GENETICS OF SHOOT FLY RESISTANCE IN SORGHUM HYBRIDS OF CYTOPLASMIC MALE STERILE LINES

By
P.D. KAMALA JAYANTHI

THESIS SUBMITTED TO THE
ACHRYA N.G. RANGA AGRICULTURAL UNIVERSITY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY
IN THE FACULTY OF AGRICULTURE

DEPARTMENT OF ENTOMOLOGY
COLLEGE OF AGRICULTURE
ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY
RAJENDRANAGAR, HYDERABAD 500 030

CEREALS ENTOMOLOGY UNIT
CEREALS PROGRAM
ICRISAT, PATANCHERU
A.P. 502 324

APRIL, 1997

CERTIFICATE

Ms P D Kamala Jayanthi has satisfactorily prosecuted the course of research and that the thesis entitled **GENETICS OF SHOOT FLY RESISTANCE IN SORGHUM HYBRIDS OF CYTOPLASMIC MALE STERILE LINES** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any University

Date April 3 1997

Major Advisor Tajbahadur

Dr Taj Bahadur Gour
Associate Professor
Department of Entomology
College of Agriculture
Rajendranagar
Hyderabad 500 030

CERTIFICATE

This is to certify that the thesis entitled "**GENETICS OF SHOOT FLY RESISTANCE IN SORGHUM HYBRIDS OF CYTOPLASMIC MALE STERILE LINES** " submitted in partial fulfilment of the requirements for the degree of **'Doctor of Philosophy'** of the Acharya N. G. Ranga Agricultural University, Hyderabad, is a record of the bonafide research work carried out by **Ms. P.D. Kamala Jayanthi** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of the investigations have been duly acknowledged by the author of the thesis.

Dr. Taj Bahadur Gour
Chairman of the Advisory Committee

Thesis approved by the Student's Advisory Committee:

Chairman: **Dr. Taj Bahadur Gour**
Associate Professor
Dept. of Entomology
College of Agriculture
Rajendranagar
Hyderabad 500 030

Members:

1. **Dr. Belum V.S. Reddy**
Senior Plant Breeder
ICRISAT, Patancheru
Andhra Pradesh 502 324

2. **Dr. D. D. R. Reddy**
Senior Scientist & Univ. Head
Maize Research Station
Amberpet, Hyderabad

3. **Dr. J.W. Stenhouse**
Principal Scientist (Breeding)
ICRISAT, Patancheru
Andhra Pradesh 502 324

4. **Dr. Y.N. Reddy**
Professor & Head
Dept. of Horticulture
College of Agriculture
Rajendranagar
Hyderabad 500 030

5. **Dr. T. Vittal Reddy**
Associate Professor
Dept. of Plant Pathology
College of Agriculture
Rajendranagar
Hyderabad 500 030

Acknowledgements

It is by the lavish love and blessing of the Almighty, that I have been able to complete my studies successfully hitherto and present this piece of work for which I am eternally indebted.

I am pleased to place my profound etiquette to my major advisor Dr. T.B. Gour, Associate Professor, Department of Entomology, College of Agriculture, Rajendra nagar, for his benign attitude and geniability extended to me during the course of investigation. Ineffable is my gratitude and sincere thanks to him for his transcendent suggestions and sedulous efforts to embellish the study.

I deem it my privilege in expressing my fidelity to an ultroneous academician Dr. **Belum V.S. Reddy**, Senior Scientist, Sorghum Breeding, GED, ICRISAT, Patancheru member of my advisory committee for his distinguished exemplary guidance, patient hearing, unstained personal interest, continuous care, well timed suggestions and high scholarly diligence all through my research endeavor. I have immense pleasure in registering my profound regard, glorious appreciation and heartfelt acknowledgements for his munificent acquiescence and meticulous reasoning to refine this dissertation most explicitly to reckon with set standards. His untiring interest have instilled me the spirit of confidence to successfully complete this task.

My deepest admiration and heartful thanks to Dr. D.D.R. **Reddy**, Professor and University Head, and member of my advisory committee for his worthy counsel, unstinted attention, meticulous and indefatigable guidance on the work in all of its stages. I am greatly indebted to him for his active interest, constructive criticism, constant encouragement and whole hearted cooperation from the very initiation of the investigation to the final embodiment of the research work.

It is a privilege to me to thank Dr. J.W. **Stenhouse**, Principal Scientist, Sorghum Breeding, GED, ICRISAT, Patancheru member of my advisory committee for his transcendent suggestions, valuable guidance and whole hearted help which have greatly facilitated the production of this dissertation.

Fervently and modestly I am pleased to place my deep sense of gratitude to Dr. K.F. **Nwanze**, Director General, WAARDA, member of my advisory committee for his sumptuous suggestions, timely help and encouragement during the course of investigation.

I thank with immense pleasure Dr. Y. N. Reddy. Professor & Head. Department of Horticulture and Dr T. Vittal Reddy. Associate Professor. Department of Plant Pathology. College of Agriculture. Rajendra nagar members of my advisory committee for their cooperation and precious suggestions during the course of work.

I owe my flow of thanks to Dr. B. Diwakar. Program Leader. HRDP. ICRISAT for providing facilities for conducting the present study.

I am grateful to the staff of the Department of Entomology. College of Agriculture. Rajendranagar. for their unstinted cooperation.

I place on record my very special thanks to Dr. Subhash Chandra. Senior Statistician and staff of Statistics Unit Mr. Prabhakar and Miss. Rukmini for their cooperation and precious suggestions during the analysis of research work.

It is but incomplete if I do not pen here my special thanks to Mr. Prakash. Mr. B.B. Singh. Mr. Ranga Reddy. Mr. Devendram. Mr. Ashok Kumar. Mr. Raju. Mr. Ali. Mr. Sangaiah. Mr. venkateswarlu. Mr. Chandra Sekhar. Mr. Gnaneswar and Mr. Chari for their technical contribution. hard work in recording observations and ready help in carrying out the experiments. I also express my sincere thanks to all staff of Sorghum Breeding and Cereal Entomology for fostering a friendly and positive interaction through out my collaborative research at ICRISAT.

I render my special thanks to Mr. A. K. Murthy and Mr. Venkateswarlu for their help in taking the electron micro photographs. My thanks are also due to Mr. Y. V. R. Reddy. Mr. Sarma and Mr. Vidya Sagar who have helped me in their own spheres in many ways

I am in dearth of words to express my unboundful gratitude and love to my beloved venerable parents Mrs. Parvathi and Mr. Damodaram. aunt. Sulochana Devi who sparkled the spirit of enthusiasm. constantly inspired. educated. guided and molded me into the present position and whose encouragement brings out the best in every one of endeavors. It remains less even if I say a lot about them.

No words are enough to express my grateful regards to my uncle Mr. Padmanabhan and aunt Mrs. Satyavathi for their inspiration. unbounding affection and extensive help. I am indeed indebted to them a lot.

Diction is not enough to express my love from the inner core of my heart to my miracle makers, my child hood friends, my endearing sister, Baby and brothers, Babu and Lokesh who sparkled my life with happiness, enthusiasm, excitement, ambitions, aspirations and who gave wings to my ideas and made me fly high.

I find no words to express my love and affection to my comrades, my endearing pals who shared my anxieties, agonies and joys Sekhar and Ravi who could construct a niche in my heart, and whose wit always kept me in a good humor. With overwhelming adoration I record with gratitude their pure and abundant love and ever ready services rendered to me throughout my studies.

The lack of vocabulary utterly fails me to express the stupendous weight of heartfelt gratitude to my beloved colleagues Mr. Loka Reddy, Mrs. Vardhini and Mrs Anitha, friends, Madhu, Lakshmi, Jyothi, Durga, Srinivas, Gopal, Subramanyam and Madhuri for their endearment, encouragement, valuable moral support and pleasant cooperation rendered to me in numerous ways from time to time.

I greatfully acknowledge the CSIR, New Delhi for granting financial assistance during the period of my reserch work.

(P.D.KAMALA JAYANTHI)

DECLARATION

I, Ms. P. D. Kamala Jayanthi, hereby declare that the thesis entitled " **GENETICS OF SHOOT FLY RESISTANCE IN SORGHUM HYBRIDS OF CYTOPLASMIC MALE STERILE LINES**" submitted to Acharya N.G. Ranga Agricultural University, Hyderabad for the degree of **DOCTOR OF PHILOSOPHY** is the result of original research work done by me. I also declare that the material contained in this thesis has not been published earlier.

Date: 3.4.91

(P.D. KAMALA JAYANTHI)

TABLE OF CONTENTS

List of Tables

List of Illustrations

List of Illustrations

List of Illustrations

'igure/ 'late No.	Title	Page No.

Author	:	P.D. Kamala Jayanthi
Title of the thesis	:	Genetics of shoot fly resistance in sorghum hybrids of cytoplasmic male sterile lines
Degree to which it is submitted	:	Doctor of Philosophy
Faculty	:	Agriculture
Department	:	Entomology
Major Advisor	:	Dr. Taj Bahadur Gour Associate Professor Department of Entomology College of Agriculture Rajendranagar Hyderabad-500030
University	:	Acharya N.G. Ranga Agricultural University
Year of submission	:	1997

Abstract

The investigations were undertaken to study the genetics of shoot fly resistance in sorghum hybrids of cytoplasmic male sterile lines with special emphasis on the inheritance of different characters associated with shoot fly resistance in different seasons and to estimate the average degree of dominance for such characters besides information on the heterosis and nature of combining ability.

A line x tester experiments using a total of 12 cytoplasmic male sterile lines and 12 diverse restorers in nine sets (each set containing 4 x 4 combinations) were undertaken for this investigation. The resulting 144 hybrids and 24 parents along with eight standard checks were evaluated at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India in the rainy and postrainy (1995-96) seasons under natural and artificial environments with varying levels of shoot fly infestation. Observations were recorded on early seedling vigour, glossiness, egg count, deadheart %, 5^{th} leaf length, 5^{th} leaf width, 5^{th} leaf droopiness, trichome density, uniformity in recovery, total tillers, productive tillers, yield-UNI, yield-I, plant height and days to 50% flowering.

On the basis of overall performance for different characters, the resistant parental lines and hybrids involving them were superior compared to the susceptible parental lines and their corresponding hybrids. The susceptible parental lines had significantly more egg laying and higher percentage of deadhearts compared to resistant parental lines indicating the breeding method employed to develop the resistant parental lines was effective. The genotypes with primary resistance were found to be highly vigorous, more glossy with maximum 5^{th} leaf length, 5^{th} leaf width, 5^{th} leaf droopiness and high trichome density during rainy season compared to postrainy season. Resistant parental lines and hybrids showed maximum uniformity in recovery compared to susceptible parental lines and corresponding hybrids indicating that the tillers of resistant cultivars are less preferred by the shoot fly for egg laying and hence recovered fast compared to susceptible cultivars. As expected, the susceptible parental lines recorded higher grain yield plant^{-1} compared to resistant parental lines indicating the need to improve the yield potential of the resistant parental lines through further breeding.

Correlation studies revealed that the seedling characters, leaf parameters, leaf characters, recovery traits, grain yield and adaptation characters were correlated with shoot fly resistance parameters (egg count and deadheart %) but their interrelationships and the magnitude of association in the parents and hybrids varied in rainy and postrainy seasons.

Inheritance and gene action studies based on hybrid group means in relation to parental line group means indicated dominance/ intermediate/ overdominance for susceptibility (as measured by egg count and deadheart %) in various hybrid and parent groups. Dominant gene action was observed for low seedling vigour and non-glossiness in low temperature conditions. Season specificity for trichome density was reflected in the hybrid groups depending upon the type of parents involved and low density (associated with susceptibility) appeared to be additive. In the hybrids of PRBR cms (postrainy season-bred resistant female lines) group the trichome expression during rainy season was lower than post-rainy season. On the other hand, it was reverse in the hybrids of RBR cms (rainy season-bred resistant cms lines) which supported low density in the postrainy season, and high density in the rainy season. Same was observed in the parents *per se* also. Considering gene action for leaf parameters it was clear that short leaf dominates over the long leaf. Similar results were recorded for leaf width and leaf droopiness. In respect to uniformity in recovery among the hybrid groups, the hybrid groups involving rainy season-bred females recovered well in rainy season and postrainy season-bred female hybrid groups recovered well in postrainy season demonstrating again the effectiveness of season-specific breeding that had been used in developing these resistant female groups or this might have also be due to existence of the different biotypes with time or due to both. This however, needs to be further confirmed, especially in no-choice conditions.

A critical evaluation of hybrid combinations with high *per se* performance for low deadheart % with high heterosis over better parent and combining ability revealed the following superior hybrids having high grain yield in postrainy season: SPSFR 94001A x ICSV 88088 with grain yield of 77.50 (UNI) and 99.25 (I) g plant^{-1}, SPSFR 94002A x ICSV 712 with grain yield 46.03 (UNI) and 55.97 (I) g plant^{-1}, SPSFR 94002A x ICSV 88088 with grain yield 55.25 (UNI) and 67.33 (I) g plant^{-1}, SPSFR 94002A x ICSV 89015 with 57.39 (UNI) and 64.97 (I) g plant^{-1}, SPSFR 94003A x ICSV 88088 with 63.75 (UNI) and 54.42 (I) g plant^{-1}, SPSFR 94003A x ICSV 89030 with 56.26 (UNI) and 67.98 (I) g plant^{-1}, SPSFR 94001A x ICSV 89030 with 72.88 (UNI) and 55.18 (I) g plant^{-1} belonging to RBR cms x RBR group, SPSFR 94001A x ICSR 93009 with grain yield 62.33 (UNI) and 56.00 (I) g plant^{-1} belonging to RBR cms x PRLR group, SPSFPR 94002A x ICSV 712 with 43.33 (UNI) and 73.67 (I) g plant^{-1} belonging to PRBR cms x RBR group and SPSFPR 94002A x ICSR 93010 with 47.88 (UNI) and 56.72 (I) g plant^{-1} belonging to PRBR cms x PRLR group compared to check M 35-1 that recorded 41.89 and 53.39 g plant^{-1} in UNI and I samples respectively. Further the hybrids SPSFR 94001A x ICSV 88088 and SPSFR 94001A x ICSR 93009 were selected during both rainy and postrainy seasons indicating their potentiality during both the seasons and may be recommended for wide cultivation after further confirmatory trials.

Introduction

CHAPTER I

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the most important cereal crop in the semi-arid tropics (SAT). India is a major producer of sorghum internationally with some 13 M ha producing in excess of 12 M t annually (FAO,1994). Generally grain yields in farmer's fields are low, ranging from 500-800 kg ha^{-1} due to biotic and abiotic stresses. Most production (about 70%) occurs in the rainy (kharif) season, but substantial potential exists for the enhancement of postrainy (rabi) season production.

Worldwide, insect pests are the major biotic stress faced by the sorghum producers. There are over 150 insect species which damage sorghum plants from sowing to crop harvest (Seshu Reddy and Davies, 1979). Of these, the sorghum shoot fly, *Atherigona soccata* Rondani is one of the major pests that destabilize the performance of sorghum cultivars and ultimately reduce sorghum production in many parts of the world (Seshu Reddy and Davies, 1978). In India, sorghum crop losses are estimated at about US $ 30 million per annum directly attributed to shoot fly. The real losses are considerably higher because the management practice for avoidance of shoot fly in postrainy season dictates delayed planting, which leads to depletion of soil water content and consequently low yields. Conventional methods for the control of shoot fly are not practical or cost effective for subsistence farmers. Resistant cultivars are a realistic alternative to chemical control, if they are able to compete economically with the commonly used hybrids and varieties and can bring stability of production under low-input conditions. During the past two decades sorghum production has considerably increased, especially in rainy season, by exploiting hybrid vigour through the use of cytoplasmic male sterility. However, high yielding hybrids are highly susceptible to shoot fly infestation which often results in severe damage (Rao and Rao, 1956; Jotwani and Srivastava, 1970).

Blum (1967) and Jotwani *et al.* (1971) suggested that resistance to shoot fly in sorghum was due to ovipositional non-preference. But the efficacy of this mechanism was reduced under heavy shoot fly population pressure (Singh and Jotwani, 1980a). Silica deposition and abundance of sclerenchymatous cells in the leaf sheath (Ponnaiya, 1951b), trichomes on the abaxial surface (Maiti and Bidinger, 1979) and glossy leaves - pale green, smooth and shining leaves (Agarwal and House, 1982) -are reported to be the factors responsible for primary mechanisms of shoot fly resistance. Singh and Jotwani (1980b) and Raina *et al.* (1981) presented direct evidence of antibiosis in some selected cultivars and Doggett *et al.* (1970) identified recovery resistance/tolerance which is also promising. Limited information is available on the genetic mechanism and nature of gene action for shoot fly resistance, where separate sets of parents are used to develop hybrids. Hence, an understanding of the genetics of resistance in relation to varying levels of shoot fly infestation through the study of combining ability for shoot fly resistance and an assessment of the utility of different parental lines are of paramount importance.

Several factors associated with resistance are generally found in the rainy season-adapted landraces that have been selected over a period of time for shoot fly resistance, but in general, landraces are not high yielding. These landraces are tall, susceptible to lodging, photosensitive, late maturing and low yielding. These have been utilized in breeding programs in an attempt to transfer resistance to new high-yielding cytoplasmic male-sterile lines (hereafter referred to as cms lines) and restorer lines. On the other hand, the postrainy season-adapted lines have been known to possess desirable attributes for grain quality besides the photoperiod sensitivity and these are known to inherit into F_1 hybrids either as complete or partially dominant traits. Postrainy season-adapted landraces are generally moderately resistant to shoot fly. Results in preliminary studies also showed that the resistant factors interact with the seasons (ICRISAT, 1992). It has been established that there is considerable heterosis for grain yield even under postrainy season conditions (ICRISAT, 1993). In order to exploit heterosis for grain yield, it is therefore important that one should aim at F_1 hybrids as target materials. However, it is known that shoot fly resistance, measured as deadheart (%), behaved as a recessive trait in F_1 (meaning-the F_1s of landraces crossed on susceptible male-sterile lines are susceptible). Therefore, the present study was an effort to understand genetics of resistance in relation to varying levels of shoot fly infestation in hybrids of cytoplasmic male sterile (cms) lines. More specifically, it has the following objectives:

1. To assess the levels of resistance (% deadhearts) and other factors of resistance (seedling vigour, glossiness and leaf parameters-length, width, curvature, drooping depth and trichomes) in different seasons.
2. To assess the effects of seasons on the inter-relationship of various factors of resistance in different types of F_1s.
3. To assess the general combining ability (GCA) of resistance (% deadhearts) and various factors of resistance.
4. To identify the cms lines and restorer lines with high GCA effects for resistance (% deadhearts) and various factors of resistance.
5. To select highly heterotic hybrids for grain yield with shoot fly resistance.

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

The development and release of new sorghum hybrids and varieties marked a genetic break through in the otherwise stagnant yield levels in India. Within a short period, it was realized that one of the important constraints in popularizing these hybrids was their high susceptibility to shoot fly. In view of the seriousness of the shoot fly problem in sorghum and owing to the limitations (like high costs and toxicity hazards) to use of chemical control, it is necessary to develop new varieties or hybrids which possess resistance to this pest. Extensive reviews of various aspects of sorghum host-plant resistance to shoot fly and the progress made in various areas namely, screening techniques (natural and artificial methods), mechanisms and stability of resistance, bio-physical and biochemical factors of resistance, larval establishment in the plant whorl and factors associated with resistance (volatiles, seedling vigour, glossiness, leaf surface wetness, etc.) are well documented (Ponnaiya, 1951a and 1951b; Blum, 1967 and 1972; Doggett, 1972; Sharma *et al.*, 1977; Singh *et al.*, 1978; Sukhani and Jotwani, 1979; Jotwani and Davies, 1980; Maiti *et al.*, 1980; Raina *et al.*, 1981; Agarwal and House, 1982; Khurana and Verma, 1982; Raina, 1985; Nwanze *et al.*, 1990). Several resistant varieties have been identified and sources of resistance were utilized in the breeding programs to transfer resistance into high yielding background (Singh, 1986).

2.1 MECHANISMS OF RESISTANCE

The major mechanisms of shoot fly resistance so far known are ovipositional non-preference (Oviposition antixenosis), antibiosis (Painter,1951) and recovery resistance (Doggett *et al.*, 1970). Rana *et al.* (1981) attributed resistance to a cumulative effect of non-preference, due to some morphological factors and antibiosis.

2.1.1 Non-preference for Oviposition

This refers to the situation in which the plant possesses factors that render it unattractive to insect pests for their oviposition, feeding and shelter. Non-preference by insects is often projected as a property of the plant. Ovipositional non-preference by the shoot fly in resistant cultivars was first detected by Jain and Bhatnagar (1962). They found significantly less oviposition (0.8 eggs $plant^{-1}$) on resistant varieties compared to susceptible ones (2.0 eggs $plant^{-1}$). Later Blum (1969b), Klaipongpan (1973), Soto (1974) and Maiti and Bidinger (1979) have confirmed that non-preference for oviposition under low shoot fly population is a major factor in resistance to the shoot fly.

Singh and Jotwani (1980a) and Borikar *et al.* (1982) indicated that the efficiency of this mechanism is not stable and tends to break down under no choice conditions and heavy shoot fly population. On the other hand under cage conditions, in the absence of preferred host, oviposition was equal on resistant and susceptible varieties (Jotwani and Srivastava, 1970; Singh and Narayana,1978). Sometimes, ovipositional non-preference was also operative in the absence of preferred host(s) (Jotwani *et al.*, 1974; Wangtong and Palanakamjorn, 1975; Raina *et al.*, 1984). Blum (1969b) concluded that ovipositional non-preference was apparent in the progenies of susceptible and resistant sorghum and was most influenced by shoot fly density.

Ogwaro (1978) reported high ovipositional preference for the second leaf followed by third, first and fourth leaves in the laboratory, while the third leaf was highly preferred to oviposition followed by second, fourth, fifth, sixth, first and seventh leaves in the field. But in India, Davies and Seshu Reddy (1980) found fifth and fourth leaves were preferred in this order for oviposition in the field. On the contrary, Sukhani and Jotwani (1979) reported that oviposition on the fourth followed by the fifth leaf in CSH-1 seedling was more likely to cause 'deadhearts', while oviposition on third, second and first leaf resulted in significant reduction in deadhearts. There is also an inverse correlation between the distance of deposition of eggs from the base of the leaf blade and production of deadheart in the infested seedling (Mowafi, 1967) while the number of eggs deposited showed significant and positive correlation with deadhearts (Sharma *et al.*, 1977). Group difference between susceptible and resistant varieties for deadhearts percentage was established by Rana *et al.* (1975). These studies indicated that varieties preferred for oviposition showed a high degree of deadheart percentage.

Studies on behavioural resistance showed that the initial choice of susceptible cultivars such as CSH-1 for oviposition was random although the time spent by female shoot flies on IS 2146, IS 3962 and IS 5613 (resistant cultivars) was brief (Raina *et al.*, 1984). In addition, adult females laid eggs on non-preferred cultivars only after laying several eggs on alternate susceptible CSH-1 seedlings. Non-preference appears to be a relative term since none of the known resistant cultivars were completely non-preferred for egg laying (Sharma and Rana, 1983).

Soto (1974) and Mote *et al.* (1986) studied the oviposition behaviour of shoot fly and reported that leaves of some of the sorghum cultivars resistant to shoot fly were pale green compared to the dark green colour of susceptible cultivars. Raina (1982) studied the oviposition behaviour of shoot fly and reported that colour, texture and width of the sorghum leaf were important factors in selection of the oviposition substrate by the female fly. Narrowness and erectness of leaves reduced both deadhearts and egg laying as shoot fly had less area for egg laying compared to broad leaved plants (Mote *et al.*, 1986). Bapat and Mote (1982) reported leaf colour and hairiness (with trichomes) as non-preference mechanisms.

2.1.1.1 Morphological Characters Associated with Shoot Fly Resistance. Various authors have suggested morphological characters such as seedling vigour, glossiness of leaves, presence of trichomes on the leaves, leaf length, leaf droopiness, leaf breadth, leaf sheath hardness, stem thickness and seedling height are reported to resistance of sorghum to shoot fly.

2.1.1.1.1 Seedling vigour. Rapid seedling growth might retard the first instar larva from reaching the growing point. Incidence of shoot fly was higher in sorghum lines that were less vigorous at seedling stage, and conditions such as low temperature, low fertility, drought etc. which reduce seedling vigour increased the susceptibility to shoot fly (Taneja and Leuschner, 1985; Sukhani and Jotwani, 1979). Mate *et al.* (1979) indicated that most resistant types grew taller and had higher growth rate than susceptible ones. Vijayalakshmi (1993) found statistically significant correlations between seedling vigour and percentage plants with eggs, number of eggs/100 plants and deadhearts in rainy season in respect of dwarf genotypes.

2.1.1.1.2 Glossiness. It has been found that varieties resistant to shoot fly usually have narrow upright leaves with yellow-green glossy appearance at the seedling stage which is termed "glossy leaf". Glossy leaves might possibly affect the quality of light reflected from leaves and influence the orientation of shoot flies towards their host plants. Glossy leaves might also influence host selection due to chemicals present in the surface waxes and/or leaves (Jotwani *et al.*, 1971; Maiti and Bidinger, 1979; Maiti *et al.*, 1980; Bapat and Mote, 1982; Omori *et al.*, 1988; and Taneja and Leuschner, 1985).

The association of both the glossy leaf type and trichomes with shoot fly resistance in sorghum has been supported by Maiti and Bidinger (1979). A study of four combinations, glossy leaf and trichomes, glossy leaf only, trichomes only and neither, revealed that the mean deadheart percentages were 60.7, 70.9, 83.5 and 91.3 respectively. These results suggested that each of the two traits contributed to the resistance, that the glossy leaf characters contributed more than did trichomes, and that the combination of the two traits was more effective than either of the traits alone.

Expression of glossiness in seedlings is an important trait for identifying shoot fly resistance in sorghum and it is easily identifiable (Agarwal and House, 1982). Maiti and Gibson (1983) suggested that glossy expression in sorghum seedlings can be utilized as a simple and reliable selection criterion for shoot fly resistance. Agarwal and Abraham (1985) reported that glossiness is highly correlated with shoot fly resistance.

Jadhav *et al.* (1986) estimated the correlation between deadhearts and glossiness (-0.77) and found it negative and highly significant. Vijayalakshmi (1993) also reported that glossiness was negatively correlated in general with percentage plants with eggs, number of eggs/100 plants and deadheart percentage in tall as well as dwarf genotypes.

2.1.1.1.3 Trichomes. Prickle hairs on the leaf sheath were noted to be numerous on resistant varieties and absent on susceptible ones (Blum, 1968; Langham, 1968). Maiti and Bidinger (1979) identified 32 lines from 8000 germplasm lines with trichomes on the abaxial surface of the leaf blade. These had fewer plants with eggs, fewer plants with deadhearts and a lower ratio of plants with deadhearts to plants with eggs than 35 lines without trichomes. Maiti *et al.* (1980) observed that the presence of trichomes on the leaf surface resulted in a lower frequency both of oviposition by shoot fly and of subsequent larval damage. The resistant cultivars IS 2146, IS 3962 and IS 5613 had high density of trichomes on the abaxial leaf surface while susceptible hybrid CSH-1 lacked these.

Wild species of sorghum, immune to shoot fly had a high trichome density on the lower surface of the leaves (Bapat and Mote, 1982). Trichomes on the leaf surface was preferred to a lesser frequency for oviposition of shoot fly and subsequent larval damage was less (Blum, 1968; Maiti and Bidinger 1979; Maiti *et al.*, 1980; and Taneja and Leuchner, 1985). The trichomes on the lower leaf surfaces might have more effect on the behaviour of the adult flies during oviposition (since eggs are laid on lower leaf surface) than on larval movement. However, the trichomes on the upper surface may interfere with larval movement and survival since larvae move on to the upper surface immediately after hatching and then towards the growing point.

Trichomes have high correlation with oviposition non-preference (genotypic correlation coefficient (r) = -0.75) (Agarwal and Abraham, 1985). When these correlations were partitioned into direct and indirect effects through path coefficient analysis, direct effect of trichomes was low and thus contributed to shoot fly resistance mainly through other traits. Jadhav *et al.* (1986) reported similar results. Moholkar (1981), Omori *et al.* (1983) and Patel and Sukhani (1990) observed positive correlation for trichome density in plants resistant to shoot fly. Agarwal and House (1982) found that the level of resistance was greater when both the glossy and trichome traits occurred together.

2.1.1.1.4 Leaf and Stem Characters. The leaf breadth and leaf length are different among susceptible and resistant lines of the same age. The differences in leaf width of susceptible and resistant varieties, though not statistically significant, indicate that leaves of resistant varieties are somewhat narrower than that of the susceptible hybrid CSH-1 (Singh and Jotwani, 1980b). Khurana (1980) reported negative correlation of shoot fly infestation with leaf breadth and leaf length whereas Sandhu *et al.* (1986) showed positive correlation of leaf breadth and leaf length with deadheart percentage in different varieties. Khurana and Verma (1985) found that plant height, tassel percentage, stem thickness, number of leaves plant^{-1}, leaf length, leaf width, leaf thickness and leaf strength were negatively correlated with susceptibility as measured by only formation of deadhearts. However thickness of vein did not show any correlation with insect resistance. Singh and Jotwani (1980c) showed that the extent of hardness of leaf sheath was high only in IS 5490 compared to other resistant and susceptible varieties to shoot fly.

Singh (1986) and Patel, and Sukhani (1990) showed that stem length, ratio of stem length to stem width, and length of internode were significantly negatively correlated with shoot fly oviposition and deadheart formation. Long and thin but sweet stem with longer internodes and short peduncle length can be taken as resistant sorghum genotypes. Vijayalakshmi (1993) found correlation coefficients of shoot fly parameters with some traits (leaf length, width, drooping depth and curvature vs shoot fly egg laying and deadhearts) to be in reverse direction between tall and dwarf genotypes, but the direct effects estimated through path analysis were in the same direction in both groups.

2.1.2.Tolerance/ Recovery Resistance

Early attack on the main shoot induces the production of the tillers many of which are able to escape further attack and produce harvestable earheads, so that yield is not much reduced. This type of resistance was referred to as tiller survival (Blum, 1969a) or recovery resistance (Doggett *et al.*, 1970). This type of reaction was found in two East African varieties namely Serena and Namatare which recovered well even when more than 90% of the main culms had been killed (Doggett and Majisu, 1965, 1966; Doggett *et al.*, 1970). Resistant cultivars of sorghum had a very high rate of tiller survival compared with susceptible cultivars. Tiller survival was related to the rate of growth. The faster the tiller grew the greater were its chance of avoiding infestation (Blum, 1972).

However, tolerance can be greatly influenced by the growth conditions of the plant and thus may not always be predicted at various locations, particularly those with irregular patterns of rainfall. Under Indian conditions, the tillers of susceptible varieties are repeatedly attacked and significant differences between resistant and susceptible varieties for tiller survival are maintained.

Among 14 hybrids, Mote *et al.* (1985) observed that SPH 196 and SPH 325 were least susceptible to *A. soccata* at the initial stage and had high recovery resistance resulting in the highest grain yield. Tiller development consequent to "deadheart" formation in the main shoot and subsequent survival and recovery depend on the level of primary resistance. Varieties with high recovery resistance appear to yield more under shoot fly infestation (Rana *et al.*, 1985). Recovery resistance does not appear to be an useful mechanism particularly when shoot fly populations progressively increase as the rainy season continues (Singh *et al.*, 1981).

2.2 BASIS OF RESISTANCE

2.2.1 Trichomes and Glossiness

Most resistant varieties have also been found to have glossy (pale green smooth and shining leaves) expression in the seedling stage (Jotwani *et al.*, 1971; Maiti *et al.*, 1980). A large proportion (84%) of the glossy lines (accounting for less than 1% of sorghum germplasm) are of peninsular Indian origin, but some are from Nigeria, Sudan, Ethiopia, North Cameroon, Kenya, Uganda, South Africa and Mexico. Most of these belong to durra group and some others to taxonomic groups such as guinea, caudatum and bicolor (Maiti *et al.*, 1984). The long and narrow leaves and faster seedling growth as indicated by the length of leaf sheaths and seedling height, coupled with toughness of leaf sheaths are also reported to contribute towards resistance to shoot fly (Singh and Jotwani, 1980b).

The majority of shoot fly resistant cultivars have a high density of leaf trichomes. Based on the report that trichome-less cultivars of pearl millet accumulate more dew and stay wet longer (Burton *et al.*, 1977). Raina *et al.* (1981) suggested that a similar situation in sorghum would facilitate the movement of freshly hatched larvae to the base of the central shoot. Maiti and Bidinger (1979) noticed that trichomes on the abaxial surface of the leaf deferred egg laying. In addition, Maiti *et al.* (1980) did not observe any differences in cuticle thickness or in the degree of lignification of leaves between trichomed and trichome-less lines. The resistant cultivars IS 2146, IS 3962 and IS 5613 had a high density of trichomes on the abaxial leaf surface while susceptible hybrid CSH-1 was found to lack trichomes. However, under heavy infestation, the density of trichomes appeared not to make any difference for preference or non-preference of a cultivar. Omori *et al.* (1983) suggested that glossy expression in seedling sorghum can be utilized as a simple and reliable selection criterion for shoot fly resistance.

2.2.2 Epicuticular waxes

The role of epicuticular wax content in impeding cuticular water loss is very complex. Not only does the quality of the wax play a role but the chemical composition and physical structure of the surface wax influence cuticular water loss as well (Hadley, 1981). The cutin-wax complex affects leaf wettability and causes considerable differences from species to species in the ease with which they are wetted. Variation in wettability achieved is often found between leaves of different ages and between the upper and lower leaf surfaces (Martin and Batt, 1958; Silva fernandes, 1965). Wax can physically impede the movement of an insect across the leaf surface. The movement of the first instar larvae of the spotted stem borer, *Chilo partellus* Swinhoe, may considerably be impeded by wax on the culms of sorghum (Bernays *et al.*, 1983) due to accumulation of wax around their prolegs during their movement over the plant surface.

In addition to the effect of thick surface wax on larval movement, there is a disorientation effect on some resistant genotypes which has been attributed to the chemical composition of epicuticular wax (Woodhead, 1987). The surface wax of sorghum clearly has considerable influence on larval behaviour and the evidence suggests that differences must exist in the chemistry of waxes from different cultivars of the same species.

2.3 INFLUENCE OF SEASONS AND STABILITY OF SHOOT FLY RESISTANCE IN SORGHUM

2.3.1 Environmental Factors Affecting Shoot Fly Resistance

Blum, as early as 1963, observed that when freshly hatched shoot fly larvae were placed on sorghum leaves in the laboratory, they repeatedly fell down unless the plants were moistened with a fine spray of water. This indicated the role of moisture which is influenced by the environmental conditions/seasons.

Farah (1992) reported that resistance of sorghum entries to shoot fly (egg laying, deadheart formation and recovery) was highly associated with seasonal variation. The seasonal variation in resistance to shoot fly was related to the prevailing environmental conditions. The late postrainy season had the highest maximum temperature and this seemed to be favourable for the recovery of plants damaged by the shoot fly. Singh *et al.* (1978) found that the damage in resistant varieties changed over seasons but the deadheart per cent was never beyond 42.64 per cent. Since the varieties under test represented the best available resistant sources from the world collection of sorghum, it can be concluded that absolute resistance to shoot fly is not available and there is marginal gradation among resistant varieties under high infestation.

Shoot fly infestation varies with locations and seasons but some varieties show considerably low susceptibility (Rana *et al.*, 1984). Environmental conditions (temperature, relative humidity and rainfall) tend to influence shoot fly damage. The most significant factor responsible for egg laying appears to be the temperature (maximum and minimum) and variation in deadheart formation also mostly influenced by temperature and evening humidity (Taneja and Leuschner, 1985).

Raina (1981) also showed that if the time of egg hatching coincides with the presence of moisture on the leaf, it creates a condition favourable for the movement of the larva to the base of the leaf. Shoot fly incidence is affected by seasonal conditions and meteorological factors such a humidity and temperature (Usman, 1968; Jotwani *et al.*, 1970).

2.3.2 Stability of Shoot Fly Resistance

Singh *et al.* (1978) observed unidirectional varietal reaction to changing environments due to non-significance of variety x season interaction. Rao *et al.* (1977) also reported relatively more stability in IS 5469, IS 5490 and IS 1054 for shoot fly resistance. Borikar and Chopde (1982) observed high degree of phenotypic stability and greater resistance to changing shoot fly population in IS 5490 and IS 5604. In general, resistant parents, resistant x susceptible hybrids and susceptible parents registered <1, 1 and >1 regression co-efficient respectively. Taneja and Leuschner (1985) stated that IS 1054, IS 1071, IS 2394, IS 5484 and IS 18368 were quite stable across locations for shoot fly resistance.

Chundurwar *et al.* (1992) studied the stability parameters for percentage of plants with eggs, trichome density on abaxial surface of fourth leaf from base and deadheart percentage. Results indicated that though the genotypes varied significantly in the different environments, genotypes like IS 2146 and IS 5566 exhibited high degree of stability for shoot fly resistance.

2.4 GENETICS OF SHOOT FLY RESISTANCE

Genetical studies of shoot fly resistance are limited in number. Non-preference for oviposition (Blum, 1967; Rana *et al.*, 1975), seedling resistance due to silica deposition and abundance of sclerenchymatous cells in leaf sheath (Ponnaiya, 1951b) are reported to be the primary mechanisms of shoot fly resistance. Limited information is available on the genetic mechanism and nature of gene action for shoot fly resistance, where separate sets of parents are used to develop resistant varieties.

Blum (1969a) suggested that any genetic information about reaction of sorghum to shoot fly must be interpreted according to insect population factors. As the resistance is primarily due to ovipositional non-preference and is governed by additive genes (Rana *et al.*, 1975), females and males with good combining ability can be used in conventional breeding programs for incorporating shoot fly resistance in to agronomically good cultivars. Rana *et al.* (1975) also reported low genetic advance for primary resistance in sorghum.

Kulkarni *et al.* (1978) stated that hybrids involving resistant or moderately resistant parents were highly resistant. Therefore, while breeding for shoot fly resistance, dwarf female parents having some degree of resistance should be combined with Indian tall local resistant parents. The relatively different reaction of pollinators to shoot fly indicated that the lines vary for resistance genes. Hence, resistance level can be increased by accumulating favorable resistance genes in a line. Borikar and Chopde (1980) studied the genetics of shoot fly resistance under three levels of infestation and indicated that variation between and within genotypic groups became more apparent under high shoot fly population. Borikar *et al.* (1982) reported adequate variation for all 8 characters (deadheart %, eggs plant^{-1}, effective tillers %, plant recovery %, yield plant^{-1} and yield productive plant^{-1}) in both F_1 and F_2 generations. The values of genotypic coefficients of variability (GCV) were low for yield plant^{-1} and deadheart %. The estimates of phenotypic and genotypic coefficients of variability were generally close for most of the characters.

Sharma and Rana (1983) examined shoot fly resistance in relation to egg laying and deadheart formation in F_2s of resistant x high yielding (susceptible) crosses. They indicated that there is segregation for egg laying and deadheart formation in F_2 and some plants may survive in spite of egg laying on them. Borikar *et al.* (1982) assessed genetic variability for shoot fly resistance under three levels of shoot fly infestation in F_1 and F_2 generations of inter-varietal crosses of sorghum. The seedling mortality and oviposition increased with increase in shoot fly population. The estimation of genotypic coefficients of variability, heritability and genetic advance were higher for both the traits when material was tested under optimum shoot fly population. Paul *et al.* (1984) registered significant variability among F_3s of 7 crosses of sorghum out of 52 selections even when the incidence of shoot fly was high on the 28^{th} day. Heritability estimates increased with an increase in infestation. When infestation was high, heritability for shoot fly resistance was about 24% and the variability got reduced, but it was possible to recover resistant F_3s equal to mid-parental value. General and specific combining ability (GCA and SCA) effects were estimated by Patel *et al.* (1984) in 28 F_1s from an 8 x 8 diallel. SCA effects in the desired direction were shown by 19 combinations with the best combinations being 296 B x M 51 and M 35 x M 51 in normal and late sowing respectively.

2.5 INHERITANCE OF SHOOT FLY RESISTANCE

Studies on the inheritance of shoot fly resistance have generally concentrated on either the resistance as a whole or on a particular trait.

2.5.1 Deadhearts (%)

Veda Moorthy (1967), Langham (1968), Khaipongpan (1973) and Borikar and Chopde (1980) studied the inheritance of resistance in crossings of resistant parents with susceptible ones. The hybrids were susceptible under high infestation, indicating dominance or nearly complete dominance of susceptibility. But these relationships were reversed under low shoot fly infestation. In this case, resistance exhibited partial dominance. Agarwal and House (1982) reported that resistance was found to be polygenic in nature and governed by genes with predominantly additive effects. Maiti and Gibson (1983) concluded from their study of the F_3 and F_4 generations segregating from a cross of trichomed and trichome-less lines, that there were at least two additional loci involved in resistance that interact with each other.

Studies of Balakotaiah *et al.* (1975) conducted on a large F_2 population revealed that the frequency distribution of different mortality classes closely fits the normal curve and that the inheritance of shoot fly resistance is predominantly additive.

2.5.2 Non-Preference Mechanism

The genetics of ovipositional non-preference and deadheart formation as components of shoot fly resistance in sorghum were investigated by Sharma *et al.* (1977) through examination of the pattern of segregation of resistant genes in F_2 generations of susceptible and resistant crosses. They concluded that one single recessive gene (npo) governed the non-preference to oviposition while two duplicate recessive genes, dh1dh1 dh2dh2, governed the resistance to deadheart formation. Rana *et al.* (1981) observed ovipositional non-preference mechanism under the influence of partially dominant genes under low to moderate shoot fly pressure, and the reverse under heavy infestation. Borikar and Chopde (1982) observed both additive and non-additive gene action to be important under low pressure and additive gene action under moderate to high pressure.

According to Sharma and Rana (1985) one single recessive gene (npo npo) governs the non-preference to oviposition while npo npo or Npo Npo governs preference to oviposition. Two duplicate recessive genes dh1dh1 dh2dh2 govern the resistance to deadheart formation. Susceptibility is governed when either of the genes DH1 or DH2 is in homozygous or heterozygous condition.

Both additive and non-additive gene effects were equally important under high shoot fly pressure (Agarwal and Abraham, 1985). Nimbalkar and Bapat (1992) studied the inheritance of shoot fly resistance in sorghum by evaluating an eight by eight diallel set in three different environments. General combining ability (GCA) variances were higher than specific combining ability (SCA) variances in all the three environments for deadheart (%), indicating additive gene action for shoot fly resistance. The nature of gene action for eggs plant^{-1} in EI and EII environments was predominantly non-additive, while it was additive in EIII. All the resistant parents recorded significant negative GCA effects for eggs plant^{-1} and deadheart (%).

2.5.3 Trichomes and Glossiness

Omori *et al.* (1988) assessed the genetic diversity of 20 sorghum cultivars with resistance to *A.soccata* originating from different geographic regions. They concluded that trichome density contributed mainly towards genetic divergence in resistance followed by glossiness. Gibson and Maiti (1983) reported that the presence of trichomes on the abaxial surface was under the control of a single recessive gene.

Glossiness plays a significant role in shoot fly resistance in sorghum and it is a simply inherited character (Agarwal and House, 1982). Tarumoto (1980) indicated that the presence of glossiness is controlled by a single recessive gene. Glossiness is highly correlated with shoot fly resistance and path analysis suggests the linkages of glossiness with some unknown inherent antibiotic factors; its intensity is quantitatively governed and is controlled by both additive and non-additive genes (Agarwal and Abraham, 1985).

2.5.4 Recovery Resistance

Doggett *et al.* (1970) identified the varieties 'Serena' and 'Nematare' and derivatives as shoot fly tolerant genotypes which recovered well even when more than 90 per cent of the main culms had been killed. The broad sense heritabilities were high for recovery. Starks *et al.* (1970) discovered that additive effects and general heterosis accounted for most of the variance in the percentage of recovered plants.

The SCA component of variance in crosses of resistant sorghum parents and susceptible ones was larger than the GCA component for recovery traits in the F_1 but less than the GCA component in the F_2 (Sharma *et al.*, 1977). Borikar and Chopde (1982) studied the gene action of plant recovery and related traits of F_1 and F_2 diallels involving shoot fly resistant and susceptible lines. Additive gene action was predominant for seedling height and plant recovery. No correlation between shoot fly resistance and recovery was found, indicating independent genetic control. Some entries showed high susceptibility in the initial stages but possessed high recovery resistance which was reflected in grain yield.

2.6 Transfer of Resistance

Efforts have been made to incorporate genes responsible for resistance into elite cultivars by making crosses between available resistant sources and the elite susceptible lines, then evaluating their derivative generations using pedigree methods and screening for shoot fly resistance, agronomic traits and grain quality (Agarwal and Abraham, 1985).

Many shoot fly resistant lines with moderate levels of resistance and reasonable yield potential have been developed at ICRISAT. The levels of their resistance are comparable with Maldandi, a local standard shoot fly resistant cultivar. Some of these lines PS 21171, PS 21271 and PS 21318 have been found promising even under no choice conditions. PS 14093, PS 14103, PS 14454 and PS 21318 have shown good promise against shoot fly both within and outside India. The segregating populations of resistant x susceptible crosses can be exploited for isolating resistant lines with desirable agronomic attributes (Borikar *et al.*, 1982).

Mote and Bapat (1988) tested the F_1 generation derived from a cross between resistant sorghum varieties and other ones. The derivatives of RSV 8R and RSV 9R are consistently more resistant than their parents. Blum (1972) crossed resistant lines with some adapted R and B lines and found the seedling infestation in F_1 was equal to or higher than in the susceptible parents and the proportion of non-infested seedling in F_2 ranged between 4.9 and 9.8%. These studies revealed that resistance would have to be built into all the three parents if a resistant hybrid were to be developed.

Bapat and Mote (1982) tested promising selections from Indian x Indian crosses for their reaction to shoot fly in F_3 and F_5 generations and identified the highly promising derivatives against shoot fly. Lal *et al.* (1986) identified SPV 346 and 22198 and PS 14413 and E 602 as desirable cross combinations, and indicated that the parents PS 14413, PPS 14454 and E602 tended to transmit genes for relatively less deadheart formation.

Mote *et al.* (1983) tested advanced breeding materials for their reaction to shoot fly. PS 18527, PS 14533, SPV 491 and RHR 5 were highly resistant showing less than 20% deadhearts. In F_2 generation of resistant x resistant and susceptible x resistant crosses the percentage of healthy plants with eggs was 16.8 and 6.3 respectively. Such plants can be selected in segregating generations. The character, no deadheart formation in spite of oviposition may provide a criterion for transferring/strengthening antibiosis in resistance breeding programs (Sharma and Rana, 1983). The progenies of the following three crosses NCL 3 x CSV 5, CSV 4 x IS 2123, and CSV 5 x IS 4533 showed significant variability for resistance to *A. soccata* and selection could be made among these progenies (Paul *et al.*, 1984).

2.7 Heritability

Based on back crosses, F_3s and advanced generation progenies, Rana *et al.* (1975) and Halalli *et al.* (1983) found the heritability of shoot fly resistance to be around 25% and 30% respectively. Sharma *et al.* (1977) reported 49.7% and 82.1% heritability for deadheart percentage in F_1 and F_2 generations respectively. Under selection, narrow sense heritability for deadheart counts were 14.07%, 52.07%, 76.31% on 14, 21 and 28 days respectively (Borikar and Chopde, 1980).

The heritability studies also revealed that the genetics of deadhearts and eggs plant^{-1} is influenced by the level of shoot fly population pressure. Sharma and Rana (1983) found that the character, no deadheart formation in spite of oviposition was found to be heritable in F_1 and F_2 generations of high yielding x resistant varietal crosses. As per Borikar and Chopde (1981) the heritability for deadheart (%), eggs plant^{-1} and plant recovery in 8 -parent F_1 and F_2 diallels was observed to be 75 to 77%, 80 to 93%, and 48 to 70% respectively. The heritability for shoot fly resistance, therefore appears to be around 23 to 25 per cent. Borikar *et al.* (1982) found that the heritability estimates were high for all characters like deadheart (%), eggs plant^{-1}, seedling height (cm), tillers/100 plants, effective tillers (%), plant recovery (%), yield plant^{-1} except yield productive plant^{-1}. According to Paul *et al.* (1984) heritability estimates increased with an increase in infestation. When infestation was high, heritability for shoot fly resistance was about 24% and the variability got reduced, but it was possible to recover resistant F_3s equal to mid-parental value.

2.8 Correlations between Various Traits of Resistance

The resistance to sorghum shoot fly in sorghum appears to be a complex character and depends upon the interplay of a number of component characters, which finally sum up on the expression of shoot fly resistance. In obtaining a clear picture of the contribution of each of such componential characters in building up the total genetic architecture of the resistance, it would be necessary to discriminate them and study their correlation and causation.

Studies by Jain and Bhatnagar (1962), Sharma *et al.* (1977) and Patel and Sukhani (1990) showed significant positive correlation between percentage deadhearts and egg laying, indicating that deadheart formation depends on the extent of egg laying, and concluded that deadheart damage was entirely due to ovipositional non-preference in sorghum.

The study of Omori *et al.* (1983) conducted at IAC included number of eggs plant^{-1} along with glossiness and trichome density as independent variables affecting deadhearts, and investigated their effects on deadhearts. They showed that the effects of trichomes and glossiness were marginal on deadhearts, as the number of eggs had accounted for most of the variability in deadhearts.

Inheritance studies by Biradar and Borikar (1983) showed that seedlings with long basal internodes had high seedling vigour. Mate *et al.* (1979) also indicated that the most resistant types grew taller and had higher growth rate than susceptible ones even though the difference in growth rate was not significant.

High trichome density on the abaxial surface of the leaf leads to lower preference for oviposition by shoot fly and high density on the adaxial surface may interfere with larval movement and survival leading to reduced deadhearts. Glossy leaves may possibly affect the quality of reflected light which in turn may influence the host preference leading to less egg laying and deadhearts. Several studies in sorghum have supported this view (Maiti and Bidinger, 1979; Taneja and Leuschner, 1985).

Khurana (1980) showed negative correlation of shoot fly infestation with leaf breadth and leaf length where as Sandhu *et al.* (1986) showed positive relationship in different varieties.

Maiti *et al.* (1980) stated that when the correlations were partitioned into direct and indirect effects it was noticed that although the trichomes were closely associated with shoot fly resistance they did not contribute directly to it but through other traits like ovipositional non-preference.

Karanjkar *et al.* (1992) conducted a field experiment to study the relation of different plant characters and shoot fly resistance in sorghum. The percentage of plants with shoot fly eggs on 14th day after seedling emergence, exhibited significant positive correlations with deadhearts. While leaf trichome density and plant height showed a significant negative correlation. The leaf trichome density exhibited higher magnitude for resistance, indirectly due to non-preference for oviposition.

Vijayalakshmi (1993) was the opinion that the combination of traits, glossiness, trichomes on adaxial surface, leaf length and drooping depth reduced deadheart formation. Omori *et al.* (1983) commented that the shoot fly resistance traits are highly and significantly associated with each other, indicating that all are important for shoot fly resistance. Thus, although these are highly significant and negative correlations between the trichome intensity and shoot fly infestation (deadheart formation), it seems that the trichomes do not play any direct role in reducing the deadhearts but help indirectly in reducing oviposition.

2.9 Heterosis for Shoot Fly Resistance

Rao *et al.* (1974), and Borikar and Chopde (1981) on the basis of significance of parents vs hybrids indicated the possibilities of heterosis for shoot fly resistance. Halalli *et al.* (1982) studied heterosis over better parent for lower deadheart (%) and found that it was present only in few crosses but most of the heterotic effects were non-significant. A better parent is one which is more tolerant or resistant to shoot fly infestation.

Heterotic effects exhibited by resistant x susceptible crosses would be useful for obtaining tolerant/resistant genotypes with better agronomic base (Nimbalkar and Bapat, 1987). Omori *et al.* (1988) found that trichome density contributed mainly toward genetic divergence in shoot fly resistance followed by glossiness and heterosis for shoot fly resistance associated with genetic divergence but not with geographic or taxonomic divergence.

Heterosis for eggs plant^{-1} and deadheart (%) in an 8 x 8 diallel mating system was studied by Nimbalkar and Bapat (1992) in three different environments. Most hybrids for eggs plant^{-1} and more than 50% hybrids for deadheart (%) showed significant (either positive or negative) heterosis over mid and better parent. The range of heterosis over better parent for eggs plant^{-1} in F_1, F_2 and F_3 was -90.87 to 30.06, -40.25 to 42.79 and -31.23 to 42.68 respectively and for deadheart (%) it was -60.90 to 53.22, -68.79 to 52.51 and -50.41 to 37.54 respectively. EI environment showed more significant negative heterosis. Negative and significant heterosis for characters related to shoot fly resistance exhibited by resistant x susceptible crosses would be useful for obtaining tolerance/resistance genotype with better agronomic base.

Materials and Methods

CHAPTER III

MATERIALS AND METHODS

Studies on the genetics of shoot fly resistance in sorghum hybrids of cytoplasmic male sterile (cms) lines were conducted in four experimental sowings in two seasons during rainy and postrainy seasons of 1995-96, at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh.

3.1. EXPERIMENTAL MATERIAL

One hundred and forty-four F_1 sorghum hybrids were produced at ICRISAT Asia Centre (IAC) during the 1994-95 postrainy season by crossing 12 restorer lines (four resistant bred lines; four susceptible bred lines and four postrainy season-adapted landraces) with 12 cms lines (four rainy season-bred resistant cms lines; four postrainy season-bred resistant cms lines and four susceptible cms lines) (Table 1). The male and female parents were crossed in the combinations shown in Table 2. The resulting 144 F_1 hybrids comprising nine sets (4 lines x 4 testers) have been used in the studies.

3.2. EXPERIMENTAL DESIGN

The 144 sorghum hybrids along with parents and checks were evaluated in Randomized Complete Block Design (RCBD) with three replications under two environments both in the rainy and postrainy seasons. Different levels of infestation were created by adjusting the sowing dates and by enhancing the shoot fly populations through the use of infestor rows. Natural environment-I in the rainy season (EIK) and in the postrainy season (EIR) was created just by allowing the shoot fly population to develop naturally to represent farmers field. Whereas artificial environment-II in the rainy season (EIIK) and in the postrainy season

Table 1 . Characteristic features of lines and testers

S.No.	Genotype	Pedigree	Days to 50% flowering	Height (mt)
I.	Lines			
a)	Rainy season-bred resistant cms lines (RBR cms)			
1.	SPSFR 94002A	(ICSB 51 x ICSV 705) PS 19349B)8-2-1-1-2	80	1.30
2.	SPSFR 94003A	(PS 21303 x SPV 386)-1-3-2-2-1	76	1.70
3.	SPSFR 94001A	(ICSB 37 x ICSV 705)13-5-2-1	74	1.00
4.	SPSFR 94031A	(ICSB 102 x PS 280603) 4-2-2-2-2	74	1.90
b)	Postrainy season-bred resistant cms lines (PRBR cms)			
5.	SPSFPR 94001A	[ICSB 11 x (S 35 x Fara Fara)]-1-1-1-1	80	1.50
6.	SPSFPR 94002A	(ICSB 37 x ICSV 705) 13-3-2-2	76	1.25
7.	SPSFPR 94005A	(ICSB 101 x ICSV 705) 7-2-3-1	78	1.75
8.	SPSFPR 94007A	(PS x 1349-2-2-1)	79	1.10
c)	Susceptible cms lines (SB cms)			
9.	ICSA 20	[(BTU 623 x CSV 4)B-Bulk]-4-2-5	71(K) 73(R)	1.40(K) 1.30(R)
10.	ICSA 89001	(BTU 623 x CSV 4)x B-Bulk)x ICSR 23 x(BTU 623 x B-Bulk) x (296B x SPV 105)x(2077B x M 35-1)-1-3-2-2-2-1-4-4	70(K) 76(R)	1.50(K) 1.10(R)
11.	ICSA 89004	(ICSB 3 x ICSR 72) x ICSB 11)-9-4-2	70(K) 80(R)	1.40(K) 1.20(R)
12.	ICSA 90002	[ICSB x (BTU 678 x Uchv2)B LINES Bulk)-3-4 x ICSR 7]	68(K) 68(R)	1.40(K) 1.20(R)
II.	Testers			
a)	Resistant bred restorer lines (RBR)			
1.	ICSV 712	(PS 21303 x ISPYT 2/E#20)-2-2-1-1-2	73	2.00
2.	ICSV 88088	(PS 14454 x SPV 351)-1-2-1-1	76	1.70
3.	ICSV 89015	(PS 19230 x SPV 351) -9-1-1-1	57	2.10
4.	ICSV 89030	(PS 28062 x R 11952)-12-2-2-3	69	2.10
b)	Susceptible bred restorer lines (SBR)			
5.	ICSR 89076	[(ICSB 22 x ICSR 35) x (BT x 623) B Bulk]-3-1-6-1-4-2	71(K) 70(R)	1.60(K) 1.40(R)
6.	ICSR 90002	(C 85-2 x ICSV 1) x MR 929)-1-3	78(K) 71(R)	1.50(K) 1.60(R)
7.	ICSR 90005	(C 138 x ICSV 112) x SPL 7R)-5-3-1	69(K) 69(R)	1.90(K) 1.40(R)
8.	ICSR 90014	(PM 14403 x MR 855)-5-3-1-1	65(K) 72(R)	1.70(R) 1.40(R)
c)	Postrainy season-adapted land races (PRLR)			
9.	ICSR 93031	M 35-1-36	65	2.80
10.	ICSR 93011	IS 18372	67	3.00
11.	ICSR 93009	IS 33843	70	3.00
12.	ICSR 93010	IS 33844	70	3.25

K = Kharif; R = Rabi

Table 2. CROSS COMBINATIONS EVALUATED FOR SHOOT FLY RESISTANCE DURING RAINY AND POST-RAINY SEASONS 1995-96, IAC, PATANCHERU.

S.NO.	HYBRID	GROUP	S.NO.	HYBRID	GROUP
1.	SPSFR 94002A x ICSV 712	RBR cms x RBR	30.	SPSFPR 94007A x ICSV 88088	PRBR cms x RBR
2.	SPSFR 94002A x ICSV 88088	RBR cms x RBR	31.	SPSFPR 94007A x ICSV 89015	PRBR cms x RBR
3.	SPSFR 94002A x ICSV 89015	RBR cms x RBR	32.	SPSFPR 94007A x ICSV 89030	PRBR cms x RBR
4.	SPSFR 94002A x ICSV 89030	RBR cms x RBR	33.	ICSA 20 x ICSV 712	SB cms x RBR
5.	SPSFR 94003A x ICSV 712	RBR cms x RBR	34.	ICSA 20 x ICSV 88088	SB cms x RBR
6.	SPSFR 94003A x ICSV 88088	RBR cms x RBR	35.	ICSA 20 x ICSV 89015	SB cms x RBR
7.	SPSFR 94003A x ICSV 89015	RBR cms x RBR	36.	ICSA 20 x ICSV 89030	SB cms x RBR
8.	SPSFR 94003A x ICSV 89030	RBR cms x RBR	37.	ICSA 89001 x ICSV 712	SB cms x RBR
9.	SPSFR 94001A x ICSV 712	RBR cms x RBR	38.	ICSA 89001 x ICSV 88088	SB cms x RBR
10.	SPSFR 94001A x ICSV 88088	RBR cms x RBR	39.	ICSA 89001 x ICSV 89015	SB cms x RBR
11.	SPSFR 94001A x ICSV 89015	RBR cms x RBR	40.	ICSA 89001 x ICSV 89030	SB cms x RBR
12.	SPSFR 94001A x ICSV 89030	RBR cms x RBR	41.	ICSA 89004 x ICSV 712	SB cms x RBR
13.	SPSFR 94031A x ICSV 712	RBR cms x RBR	42.	ICSA 89004 x ICSV 88088	SB cms x RBR
14.	SPSFR 94031A x ICSV 88088	RBR cms x RBR	43.	ICSA 89004 x ICSV 89015	SB cms x RBR
15.	SPSFR 94031A x ICSV 89015	RBR cms x RBR	44.	ICSA 89004 x ICSV 89030	SB cms x RBR
16.	SPSFR 94031A x ICSV 89030	RBR cms x RBR	45.	ICSA 90002 x ICSV 712	SB cms x RBR
17.	SPSFPR 94001A x ICSV 712	PRBR cms x RBR	46.	ICSA 90002 x ICSV 88088	SB cms x RBR
18.	SPSFPR 94001A x ICSV 88088	PRBR cms x RBR	47.	ICSA 89002 x ICSV 89015	SB cms x RBR
19.	SPSFPR 94001A x ICSV 89015	PRBR cms x RBR	48.	ICSA 89002 x ICSV 89030	SB cms x RBR
20.	SPSFPR 94001A x ICSV 89030	PRBR cms x RBR	49.	SPSFR 94002A x ICSR 89076	RBR cms x SBR.
21.	SPSFPR 94002A x ICSV 712	PRBR cms x RBR	50.	SPSFR 94002A x ICSR 90002	RBR cms x SBR
22.	SPSFPR 94002A x ICSV 88088	PRBR cms x RBR	51.	SPSFR 94002A x ICSR90005	RBR cms x SBR
23.	SPSFPR 94002A x ICSV 89015	PRBR cms x RBR	52.	SPSFR 94002A x ICSR 90014	RBR cms x SBR
24.	SPSFPR 94002A x ICSV 89030	PRBR cms x RBR	53.	SPSFR94003A x ICSR 89076	RBR cms x SBR
25.	SPSFPR 94005A x ICSV 712	PRBR cms x RBR	54.	SPSFR 94003A x ICSR 90002	RBR cms x SBR
26.	SPSFPR 94005A x ICSV 88088	PRBR cms x RBR	55.	SPSFR 94003A x ICSR 90005	RBR cms x SBR
27.	SPSFPR 94005A x ICSV 89015	PRBR cms x RBR	56.	SPSFR 94003A x ICSR 90014	RBR cms x SBR
28.	SPSFPR 94007A x ICSV 89030	PRBR cms x RBR	57.	SPSFR 94001A x ICSR 89076	RBR cms x SBR
29.	SPSFPR 94007A x ICSV 712	PRBR cms x RBR	58.	SPSFR 94001A x ICSR 90002	RBR cms x SBR

59.	SPSFR 94001A	x ICSR 90005	RBR cms	x SBR
60.	SPSFR 94001A	x ICSR 90014	RBR cms	x SBR
61.	SPSFR 94031A	x ICSR 89076	RBR cms	x SBR
62.	SPSFR 94031A	x ICSR 90002	RBR cms	x SBR
63.	SPSFR 94031A	x ICSR 90005	RBR cms	x SBR
64.	SPSFR 94031A	x ICSR 90014	RBR cms	x SBR
65.	SPSFPR 94001A	x ICSR 89076	RBR cms	x SBR
66.	SPSFPR 94001A	x ICSR 90002	RBR cms	x SBR
67.	SPSFPR 94001A	x ICSR 90005	RBR cms	x SBR
68.	SPSFPR 94001A	x ICSR 90014	RBR cms	x SBR
69.	SPSFPR 94002A	x ICSR 89076	RBR cms	x SBR
70.	SPSFPR 94002A	x ICSR 90002	RBR cms	x SBR
71.	SPSFPR 94002A	x ICSR 90005	RBR cms	x SBR
72.	SPSFPR 94002A	x ICSR 90014	RBR cms	x SBR
73.	SPSFPR 94005A	x ICSR 89076	RBR cms	x SBR
74.	SPSFPR 94005A	x ICSR 90002	RBR cms	x SBR
75.	SPSFPR 94005A	x ICSR 90005	RBR cms	x SBR
76.	SPSFPR 94005A	x ICSR 90014	RBR cms	x SBR
77.	SPSFPR 94007A	x ICSR 89076	RBR cms	x SBR
78.	SPSFPR 94007A	x ICSR 90002	RBR cms	x SBR
79.	SPSFPR 94007A	x ICSR 90005	RBR cms	x SBR
80.	SPSFPR 94007A	x ICSR 90014	RBR cms	x SBR
81.	ICSA 20	x ICSR 89076	SB cms	x SBR
82.	ICSA 20	x ICSR 90002	SB cms	x SBR
83.	ICSA 20	x ICSR 90005	SB cms	x SBR
84.	ICSA 20	x ICSR 90014	SB cms	x SBR
85.	ICSA 89001	x ICSR 89076	SB cms	x SBR
86.	ICSA 89001	x ICSR 90002	SB cms	x SBR
87.	ICSA 89001	x ICSR 90005	SB cms	x SBR
88.	ICSA 89001	x ICSR 90014	SB cms	x SBR
89.	ICSA 89004	x ICSR 89076	SB cms	x SBR
90.	ICSA 89004	x ICSR 90002	SB cms	x SBR
91.	ICSA 89004	x ICSR 90005	SB cms	x SBR
92.	ICSA 89004	x ICSR 90014	SB cms	x SBR
93.	ICSA 90002	x ICSR 89076	SB cms	x SBR
94.	ICSA 90002	x ICSR 90002	SB cms	x SBR
95.	ICSA 90002	x ICSR 90005	SB cms	x SBR
96.	ICSA 90002	x ICSR 90014	SB cms	x SBR
97.	SPSFR 94002A	x ICSR 93031	RBR cms	x PRLR
98.	SPSFR 94002A	x ICSR 93011	RBR cms	x PRLR
99.	SPSFR 94002A	x ICSR 93009	RBR cms	x PRLR
100.	SPSFR 94002A	x ICSR 93010	RBR cms	x PRLR
101.	SPSFR 94003A	x ICSR 93031	RBR cms	x PRLR
102.	SPSFR 94003A	x ICSR 93011	RBR cms	x PRLR
103.	SPSFR 94003A	x ICSR 93009	RBR cms	x PRLR
104.	SPSFR 94003A	x ICSR 93010	RBR cms	x PRLR
105.	SPSFR 94001A	x ICSR 93031	RBR cms	x PRLR
106.	SPSFR 94001A	x ICSR 93011	RBR cms	x PRLR
107.	SPSFR 94001A	x ICSR 93009	RBR cms	x PRLR
108.	SPSFR 94001A	x ICSR 93010	RBR cms	x PRLR
109.	SPSFR 94031A	x ICSR 93031	RBR cms	x PRLR
110.	SPSFR 94031A	x ICSR 93011	RBR cms	x PRLR
111.	SPSFR 94031A	x ICSR 93009	RBR cms	x PRLR
112.	SPSFR 94031A	x ICSR 93010	RBR cms	x PRLR
113.	SPSFPR 94001A	x ICSR 93031	PRBR cms	xPRLR
114.	SPSFPR 94001A	x ICSR 93011	PRBR cms	xPRLR
115.	SPSFPR 94001A	x ICSR 93009	PRBR cms	xPRLR
116.	SPSFPR 94001A	x ICSR 93010	PRBR cms	xPRLR
117.	SPSFPR 94002A	x ICSR 93031	PRBR cms	xPRLR
118.	SPSFPR 94002A	x ICSR 93011	PRBR cms	xPRLR
119.	SPSFPR 94002A	x ICSR 93009	PRBR cms	xPRLR
120.	SPSFPR 94002A	x ICSR 93010	PRBR cms	xPRLR
121.	SPSFPR 94005A	x ICSR 93031	PRBR cms	xPRLR
122.	SPSFPR 94005A	x ICSR 93011	PRBR cms	xPRLR
123.	SPSFPR 94005A	x ICSR 93009	PRBR cms	xPRLR
124.	SPSFPR 94005A	x ICSR93010	PRBR cms	xPRLR
125.	SPSFPR 94007A	x ICSR 93031	PRBR cms	xPRLR
126.	SPSFPR 94007A	x ICSR 93011	PRBR cms	xPRLR
127.	SPSFPR 94007A	x ICSR 93009	PRBR cms	xPRLR
128.	SPSFPR 94007A	x ICSR 93010	PRBR cms	xPRLR

129.	ICSA 20	x ICSR 93031	SB cms	x PRLR
130.	ICSA 20	x ICSR 93011	SB cms	x PRLR
131.	ICSA 20	x ICSR 93009	SB cms	x PRLR
132.	ICSA 20	x ICSR 93010	SB cms	x PRLR
133.	ICSA 89001	x ICSR 93031	SB cms	x PRLR
134.	ICSA 89001	x ICSR 93011	SB cms	x PRLR
135.	ICSA 89001	x ICSR 93009	SB cms	x PRLR
136.	ICSA 89001	x ICSR 93010	SB cms	x PRLR
137.	ICSA 89004	x ICSR 93031	SB cms	x PRLR
138.	ICSA 89004	x ICSR 93011	SB cms	x PRLR
139.	ICSA 89004	x ICSR 93009	SB cms	x PRLR
140.	ICSA 89004	x ICSR 93010	SB cms	x PRLR
141.	ICSA 90002	x ICSR 93031	SB cms	x PRLR
142.	ICSA 90002	x ICSR 93011	SB cms	x PRLR
143.	ICSA 90002	x ICSR 93009	SB cms	x PRLR
144.	ICSA 90002	x ICSR 93010	SB cms	x PRLR

RBR cms: Rainy season-bred resistant cms lines; PRBR cms: Post rainy season-bred resistant cms lines ; SB cms: Susceptible bred cms lines; RBR: Resistant bred restorers; SBR: Susceptible bred restorers; PRLR: Post rainy season-adapted land races.

(EIIR) was created by enhancing shoot fly populations by sowing CSH-1 (a susceptible hybrid) in four rows, 21 days prior to the planting of the test material. Moist fish meal packets of 500g each were placed within the infestor rows to attract shoot flies (Starks, 1970). Sowings were taken four to six weeks later than the normal planting period to have sufficient shoot fly pressure.

Each entry was planted in 2-row plots of 2 m x 0.75 m (i.e., 2 rows of 2 m length, ridges 75 cm apart). Plots were thinned at 10 days after emergence (hereafter referred as DAE) to spacing of 5 cm between plants within rows. Deadhearts due to shoot fly damage did not appear prior to thinning; however care was taken to thin the seedlings on the basis of their position in the row irrespective of their infestation or lack of it.

All cultural practices such as interculture, irrigation (only in postrainy season) weeding etc., were carried out to maintain a weed-free crop in both the trials in rainy and postrainy seasons. The plant protection measures during rainy and postrainy seasons were avoided until the shoot fly infestation period was complete.

The crop in all the four environments was protected against stem borer by spraying endosulfan (700g a.i. ha^{-1}) twice at an interval of 10 days at 35 DAE and 45 DAE. During the grain filling stage both the trials were protected against head bugs by spraying carbaryl (1Kg a.i. ha^{-1}) twice at an interval of six days.

3.3. OBSERVATIONS

Observations on early seedling vigour, glossiness, eggs $plant^{-1}$, deadhearts $plot^{-1}$, leaf parameters (-5^{th} leaf length, 5^{th} leaf width and 5^{th} leaf droopiness), trichome density, days to 50% flowering, uniformity in recovery, total tillers $plant^{-1}$, productive tillers $plant^{-1}$, plant height and yield from uninfested (UNI) and infested plants (I) were recorded both in the rainy (kharif) and postrainy (rabi) seasons.

3.3.1. Early Seedling Vigour

Seedling vigour was scored 14 DAE on a 1-9 scale, where 1 = highly vigorous (quick growing) and 9 = least vigorous (slow growing and weak) seedlings.

3.3.2. Glossiness

Seedlings were scored for glossiness 14 DAE on a 1-9 scale, where 1 = completely glossy and 9 = completely nonglossy.

3.3.3. Trichomes

In order to study the variation in leaf trichome density, the central portion of the 5th leaf (from the base) was taken from three randomly selected seedlings. The leaf bits were processed by adopting a standard procedure (Maiti,1977) of clearing the leaves for the observation of leaf trichomes under a microscope. Leaf segments (approximately 1cm^2) were placed in 20 ml of acetic acid and alcohol solution (2:1) in small glass vials (2 cm diameter, 7.5 cm high) overnight. Thereafter, they were transferred into 20 ml lactic acid (90%) in stoppered vials. Cleared leaf segments (approximately one day later) were stored for later examination.

For microscopic examination, the segments were mounted on a slide in a drop of lactic acid and observed under a stereo-microscope at 15x and 10x magnification. The trichomes on abaxial and adaxial surfaces were counted through randomly selected microscopic fields and expressed as trichome density mm^{-2}.

3.3.4. Leaf Parameters

Maximum length (a), drooping length (b), greatest width (w) and drooping depth (c) of the leaf were recorded in all the trials. The maximum leaf length was measured with the help of a scale from the base of the leaf to the tip after straightening the leaf. The length of the droopy leaf is the straight line distance between leaf base and tip of a leaf while drooping on the plant. This was measured with the help of the scale from the leaf base to the leaf tip without straightening the leaf. The maximum perpendicular distance between the drooping leaf and the observed length (straight line connecting the leaf base and leaf tip) was considered as drooping depth. Leaf width was recorded at the centre of the leaf (Plate.1). The measurements were recorded for 3rd, 4th, and 5th leaves at 18 DAE in both the rainy and postrainy seasons for three random plants plot^{-1} of each genotype.

3.3.5. Egg Counts

Total number of shoot fly eggs on 10 randomly selected seedlings were recorded twice at an interval of 7 days in all the four experiments. In the rainy season, counts were made at 14 and 21 DAE in each entry. In the postrainy season, counts were made in each entry at 21 and 28 DAE. A seven days delay in the egg counts in the latter was given due to delayed emergence of seedlings during winter. Similarly, number of eggs on the 3rd leaf for 10 randomly selected seedlings were recorded. Average total number of eggs per plant and average number of eggs on third leaf were calculated.

3.3.6. Deadhearts

Deadheart counts were made thrice at 14 DAE, 21 DAE and 28 DAE in both rainy and postrainy seasons.Deadhearts were expressed in percentage by recording total number of plants plot^{-1}.

3.3.7. Days to 50% Flowering

When 50% of plants in the plot were at 50% anthesis, the total number of days from sowing to anthesis was considered as days to 50% flowering. This was recorded in all the four experiments.

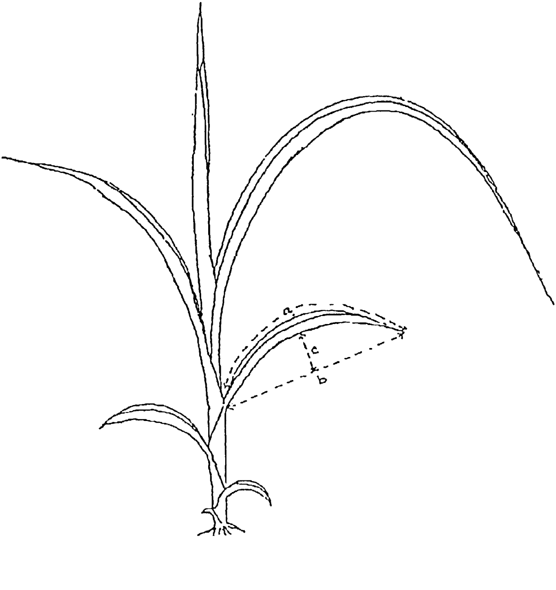


Plate 1. Methodology adapted to measure the leaf parameters.
(a) Total leaf length;
(b) Observed length of drooped leaf;
(c) Drooping depth.

3.3.8. Tiller Counts

In each plot, total tillers plant^{-1} from infested plants were recorded and number of productive tillers plant^{-1} were noted. The counts were recorded for five randomly selected infested plants plot^{-1} for each genotype. Average number of total tillers plant^{-1} and average number of productive tillers plant^{-1} were calculated.

3.3.9. Uniformity in Recovery

Recovery rating for plants was given on a 1-9 scale, where 1 was given for healthy, undamaged plants and for entries with good recovery in growth of all plants over the plot, 9 was given for heavily damaged plants with poorly recovered tillers.

3.3.10. Plant Height at Maturity

Plant height at maturity was recorded in metres (m) from the soil surface to the tip of the plant (including earhead).

3.3.11. Grain Yield

At maturity, the panicles from four uninfested (UNI) plants and from four infested (I) plants were harvested separately in each plot. Later these were threshed separately and average grain yield plant^{-1} was recorded.

3.4. STATISTICAL ANALYSIS

3.4.1. Analysis of Variance

The data for each character were analysed separately as per Randomized Complete Block Design ANOVA suggested by Panse and Sukhatme (1978) to examine the existence of differences among the genotypes. The treatment sum of squares in the ANOVA was further partitioned to examine the particular contrasts among the genotypes.

3.4.2. Correlations

Character associations for various traits of the hybrids and parents were computed using statistical procedures outlined by Singh and Chaudhary (1985) and their significance was tested by referring to the correlation coefficient tables at (n-2) degrees of freedom.

3.4.3. Combining Ability Analysis

The analysis of combining ability was based on the method of Kempthorne (1957). The covariance of half-sibs and full-sibs was used to obtain estimates of general and specific combining ability. The lines used as male and female parents were crossed in accordance with the pattern described for Design II by Comstock and Robinson (1952).

3.4.4. Heterosis

The performance of the F_1 hybrid over the mid parent value, standard check (M 35-1, the most popular variety) and that of the better parent for each cross expressed as a percentage was calculated using the formula suggested by Liang *et al.* (1972). The significance of heterosis was tested using t-test as suggested by Snedecor and Cochran (1967) and Paschal and Wilcox (1975).

Results

CHAPTER IV
RESULTS

4.1 SUMMARY STATISTICS

The range, standard error (SE), mean and coefficient of variation (CV) for early seedling vigour, glossiness, I total egg count, I third leaf egg count, II total egg count, II third leaf egg count, trichomes in abaxial (AB) and adaxial (AD) surfaces for both uninfested (UNI) and infested (I) plants, I deadheart %, II deadheart %, III deadheart %, 3rd, 4th, and 5th leaf lengths, widths and droopiness, uniformity in recovery, total tillers plant^{-1}, productive tillers plant^{-1}, yield for both uninfested (UNI) and infested (I) plants of sorghum genotypes, plant height and days to 50% flowering which were evaluated in rainy season and postrainy season in all the four environments viz., rainy natural (EIK), rainy artificial (EIIK), postrainy natural (EIR) and postrainy artificial (EIIR) environments during 1995-96 are presented in Table 3.

Shoot fly resistance is usually measured by deadhearts. However, other traits including developmental traits are known or attributed to contribute to various resistance mechanisms (ovipositional non-preference, antibiosis and recovery resistance). The feasibility of using these traits in assessing the various aspects of shoot fly resistance is investigated hereunder.

Early seedling vigour, which is one of the reliable measures of escape from shoot fly infestation, ranged between 1.0 - 9.0 during rainy and postrainy seasons. The mean seedling vigour was relatively high in EIIK, EIK and EIR with 3.52, 3.45 and 3.36 (on 1-9 scale), whereas it was moderately low in EIIR (5.27). The CVs for these environments ranged between 26.3-42.5% (Table 3).

Glossy trait, a dependable measure of ovipositional antixenosis, ranged between 1.0 - 9.0 during rainy and postrainy seasons. The mean values were 4.47 and 4.57 in rainy season (EIK and EIIK) respectively compared to 5.14 and 5.31 in postrainy season (EIR and EIIR) respectively. The CVs ranged between 20.30 - 41.1% in both rainy and postrainy seasons. Glossy trait expressed more during rainy season compared to postrainy season (Table 3).

The shoot fly activity was more during rainy season compared to the postrainy season. During the rainy season, the I total egg count plant^{-1} was high and it ranged between 0.5 - 5.6 (EIK) and 0.3 - 4.7 (EIIK), and during postrainy season the egg count was less and it ranged between 0.0 - 1.8 (EIR) and between 0.0 - 3.0 (EIIR) respectively. The mean ovipositional values were 2.22, 1.67, 0.25 and 0.97 and the CVs were 31.32, 33.60, 97.90 and 48.50% for EIK, EIIK, EIR and EIIR respectively.

Interestingly, although initial pest population build up was more in the artificial environments, there was no significant difference between natural and artificial environments in II egg count. The oviposition ranged from 0.4 - 7.1 (EIK) and between 0.2 - 7.7 (EIIK) in rainy season and between 0.0 - 5.3 (EIR) and between 0.0 - 4.1 (EIIR) in postrainy season in the II egg count. The mean oviposition values for EIK, EIIK, EIR and EIIR were 2.53, 2.43, 1.42 and 1.49 and the CVs were 36.1, 41.4, 49.7 and 37.8% respectively. The II egg count which also includes the first egg count was taken as a measure for evaluation subsequently.

The shoot fly oviposition on third leaf in the I egg count ranged between 0.0 - 2.6 (EIK) and 0.0 - 2.0 (EIIK) in rainy season and between 0.0 - 0.9 (EIR) and 0.0 - 1.5 (EIIR) in postrainy season. The mean oviposition on third leaf was 0.42, 0.29, 0.04 and 0.20 and CVs were 102.8, 116.1, 212.0 and 112.4% for EIK, EIIK, EIR and EIIR respectively.

During rainy season, the shoot fly oviposition on third leaf in the II egg count during rainy season ranged between 0.0 - 2.1 (EIK) and 0.0 - 1.8 (EIIK) and during postrainy season between 0.0 - 1.4 (EIR) and 0.0 - 1.3 (EIIR). The mean oviposition on third leaf was 0.32, 0.32, 0.15 and 0.15 and the CVs were 133.4, 117.2, 130.3 and 138.1 for EIK, EIIK , EIR and EIIR respectively. Since the CVs were very high in both the I and II egg count, only the total II egg count was adopted for further evaluation (Table 3).

Table 3: Summary statistics for different variables of sorghum genotypes, during rainy (EIK & EIIK) and postrainy (EIR & EIIR) seasons of 1995-96

Variables	EIK				EIIK				EIR				EIIR			
	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv
1. Seedling vigour	1.0-9.0	0.62 (0.17)	3.45 (1.80)	30.90 (15.80)	1.0-9.0	0.92 (0.14)	3.52 (1.80)	26.30 (13.60)	1.0-9.0	0.83 (0.22)	3.36 (1.80)	42.49 (21.59)	1.0-9.0	0.97 (0.22)	5.27 (2.20)	31.75 (17.53)
2. Glossiness	1.0-9.0	0.71 (0.18)	4.47 (2.00)	27.70 (15.60)	1.0-9.0	1.03 (0.14)	4.57 (2.10)	22.50 (11.40)	1.0-9.0	1.22 (0.29)	5.14 (2.20)	41.05 (23.20)	1.0-9.0	0.63 (0.15)	5.31 (2.20)	20.30 (11.61)
3. I Total egg count	0.5-5.6	0.40 (0.13)	2.22 (1.50)	31.32 (15.71)	0.3-4.7	0.32 (0.12)	1.67 (1.30)	33.60 (16.80)	0.0-1.8	0.14 (0.15)	0.25 (0.40)	97.9 (63.82)	0.0-3.0	0.27 (0.14)	0.97 (0.90)	48.50 (26.07)
4. I Third leaf egg count	0.0-2.6	0.25 (0.22)	0.42 (0.50)	102.76 (76.33)	0.0-2.0	0.19 (0.18)	0.29 (0.40)	116.10 (83.60)	0.0-0.9	0.05 (0.10)	0.04 (0.10)	212.00 (178.30)	0.0-1.5	0.13 (0.17)	0.20 (0.30)	112.40 (86.80)
5. II Total egg count	0.4-7.1	0.52 (0.16)	2.53 (1.50)	36.10 (17.83)	0.2-7.7	0.57 (0.18)	2.42 (1.50)	41.40 (20.80)	0.0-5.3	0.41 (0.18)	1.42 (1.10)	49.70 (29.07)	0.0-4.1	0.32 (0.14)	1.49 (1.20)	37.80 (20.08)
6. II Third leaf egg count	0.0-2.1	0.24 (0.22)	0.32 (0.40)	133.40 (98.60)	0.0-1.8	0.22 (0.21)	0.32 (0.40)	117.20 (90.14)	0.0-1.4	0.11 (0.15)	0.15 (0.30)	130.30 (102.75)	0.0-1.3	0.12 (0.16)	0.15 (0.30)	138.10 (108.88)
7. UNI Trichomes (AD)	-	-	-	-	0.0-49.4	9.31	3.00	45.67	0.0-54.1	2.79	1.89	263.87	-	-	-	-
8. UNI Trichomes (AB)	-	-	-	-	0.0-133.8	2.69	30.58	178.02	0.0-171.1	9.86	33.60	50.87	-	-	-	-
9. I Trichomes (AD)	-	-	-	-	0.0-52.3	9.82	2.64	55.25	0.0-79.40	2.76	1.60	295.92	-	-	-	-
10. I Trichomes (AB)	-	-	-	-	0.0-133.8	3.06	38.23	199.28	0.0-161.9	9.64	28.98	57.08	-	-	-	-

Contd..

Contd..

Variables	EIK				EIIK				EIR				EIIR			
	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv
11. I deadheart %	50.0-100.0	4.35 (4.33)	89.17 (89.20)	8.50 (8.41)	0.0-100.0	4.65 (3.58)	84.17 (67.99)	9.60 (9.10)	0.0-100.0	6.06 (5.05)	17.82 (24.16)	58.90 (39.71)	0.0-100.0	5.87 (5.26)	13.95 (18.60)	72.86 (49.05)
12. II deadheart %	50.0-100.0	5.12 (2.93)	93.57 (93.60)	5.50 (5.43)	43.2-100	3.55 (3.66)	89.53 (73.68)	6.90 (8.60)	1.79-100	10.27 (7.62)	51.55 (46.00)	34.55 (25.73)	0.0-100.0	5.53 (3.62)	42.27 (40.30)	22.67 (15.55)
13. III deadheart %	58.01-100.0	2.08 (2.07)	96.04 (96.00)	3.80 (3.74)	50.0-100	3.20 (3.53)	90.86 (75.18)	6.10 (8.10)	1.79-100	7.79 (5.56)	69.79 (56.59)	19.35 (16.71)	0.0-100.0	7.93 (5.77)	70.60 (59,00)	19.46 (16.94)
14. 3rd leaf length (cm)	2.8-21.7	1.36	10.29	23.10	3.3-25.3	1.61	11.14	24.55	20.00-18.3	1.22	10.17	13.68	4.8-20.0	0.91	12.39	15.87
15. 3rd leaf width (cm)	0.3-6.1	0.23	0.81	49.90	0.2-4.8	0.27	0.85	55.13	0.2-1.5	0.20	0.67	28.04	0.1-4.0	0.11	0.76	44.46
16. 3rd leaf droopiness (cm)	1.1-8.3	0.56	3.76	26.10	0.3-10.3	0.68	3.95	29.74	1.7-7.40	0.54	3.82	17.30	1.7-8.0	0.38	4.49	20.91
17. 4th leaf length (cm)	2.3-30.0	2.53	11.76	37.70	3.3-31.7	2.48	15.26	27.95	2.7-24.0	1.60	13.82	13.42	7.3-28.0	1.22	17.31	14.76
18. 4th leaf width (cm)	0.5-3.7	0.20	1.26	27.50	0.5-13.5	0.47	1.41	56.96	0.2-2.2	0.18	1.11	21.22	0.3-4.2	0.15	1.23	24.08
19. 4th leaf droopiness (cm)	4.0-12.6	1.05	4.39	41.90	1.0-12.2	1.06	5.47	33.62	2.2-10.2	0.75	5.46	16.11	2.5-11.8	0.52	6.64	19.52
20. 5th leaf length (cm)	7.0-33.6	2.40	17.63	23.70	2.7-37.2	2.63	20.93	21.17	3.3-30.3	1.97	18.14	12.78	9.0-37.5	1.52	23.22	13.29
21. 5th leaf width (cm)	0.6-3.5	0.20	1.84	18.80	0.3-9.6	0.36	2.05	29.17	0.3-2.7	0.30	1.58	19.78	0.6-9.2	0.19	1.94	25.78
22. 5th leaf droopiness (cm)	2.1-13.9	1.06	6.59	28.20	1.1-15.3	1.12	7.32	25.89	2.8-13.8	0.85	7.44	14.66	3.9-15.3	0.63	9.17	16.01

Contd..

Contd..

Variables	EIK				EIIK				EIR				EIIR			
	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv	Range	SE	Mean	Cv
23. Uniformity in recovery	1.0-9.0	0.74 (0.21)	4.37 (2.00)	29.20 (17.65)	1.0-9.0	0.61 (0.15)	4.33 (2.00)	24.60 (12.80)	1.0-9.0	0.72 (0.19)	3.45 (1.80)	35.43 (18.30)	1.0-9.0	0.26 (0.17)	3.71 (1.90)	30.21 (15.90)
24. Total tillers ($plant^{-1}$)	1.0-5.4	0.35 (0.12)	1.89 (1.40)	32.50 (15.34)	1.0-3.8	0.25 (0.09)	1.55 (1.20)	27.60 (13.20)	1.0-9.0	0.56 (0.16)	2.82 (1.60)	34.40 (16.83)	1.2-8.8	0.45 (0.12)	2.88 (1.70)	27.30 (12.76)
25. Productive tillers ($plant^{-1}$)	0.0-3.0	0.13 (0.08)	0.91 (0.90)	25.20 (15.51)	0.0-2.0	0.12 (0.07)	0.97 (1.00)	22.60 (12.10)	0.0-6.5	0.33 (0.14)	1.36 (1.10)	42.03 (21.38)	0.0-3.0	0.26 (0.14)	1.15 (1.00)	39.40 (22.85)
26. Days to 50% flowering	62.0-77.0	1.15	72.58	2.70	60.0-89.0	2.03	69.60	5.00	62.0-91.0	1.93	71.77	4.67	71.0-95.0	1.48	84.10	3.05
27. Plant height(m)	0.70-2.7	0.14	1.62	0.15	0.8-3.0	0.15	1.72	0.16	0.8-2.1	8.61	1.39	0.11	0.8-3.0	0.10	1.46	0.12
28. Yield-UNI(g $plant^{-1}$)	0.66-76.2	2.54	42.78	59.12	0.9-47.9	2.91	12.40	40.72	0.02-135.3	8.26	47.20	30.30	0.9-90.5	5.60	25.53	38.36
29. Yield-I (g $plant^{-1}$)	0.08-42.7	2.72	62.98	48.29	0.1-61.6	3.42	10.20	57.81	5.0-132.8	10.29	51.30	34.71	0.8-86.0	5.62	22.93	43.30

SE : Standard error; Cv = Coefficient of variation;
Values in parenthesis are transformed values

Observations on trichome density (mm^{-2}) in uninfested (UNI) and infested (I) plant samples recorded on both adaxial (AD) and abaxial (AB) surfaces during rainy (EIK) and postrainy (EIR) seasons. In rainy season the trichome density was greater than in postrainy season. The trichome density was higher on abaxial (lower) surface compared to the adaxial (upper) surface. There was no significant difference in trichome density between infested and uninfested plants (Table 3). The egg laying occurs mostly on the lower surface of the leaf and the maggot has to move from lower to upper surface before it reaches the growing point, and hence only the trichome number on the abaxial surface in uninfested plant samples was considered as a measure of resistance (Table 3).

Deadheart percentage is the principal measure for evaluating shoot fly resistance and in general deadheart percentage of 70% in the susceptible check is considered as a most reliable for measurement for resistance. In the present investigations, the deadheart percentages were too high (≥90.00 %) in the II and III counts in rainy season compared to I deadheart %. Therefore, it is suspected that some of the susceptible genotypes might have completely wipedout due to heavy pressure. However in the postrainy season, the I and II deadheart percentages were too lower (≤50.00 %) than the III deadheart % which was considered to be the optimum pressure for screening against shoot fly resistance (Table 3). Hence in the rainy season I deadheart count and in the postrainy season the III deadheart count have been taken as a measure of resistance to shoot fly in the present investigations.

Leaf parameters, namely leaf length, leaf width and leaf droopiness have been taken to relate the resistance to shoot fly in the 3rd, 4th and 5th leaves (Table 3). Davies and Seshu Reddy (1980) found fifth and fourth leaves to be preferred in order for oviposition in the field. Further there is an inverse correlation between the distance of eggs from the base of the leaf blade and production of 'deadhearts' in the infested seedlings (Mowafi, 1967). Hence, among these parameters only 5th leaf length, 5th leaf width and 5th leaf droopiness were taken into account to relate the resistance to shoot fly.

Doggett (1972) and Blum (1972) have established the existence of recovery resistance as a secondary mechanism of resistance. Thus recovery traits like uniformity in recovery, total tillers and productive tillers are considered for evaluation. Plant height and days to 50% flowering were considered by the sorghum breeders of India and USA to be important determining factors for ecological adjustment and yield expression. Hence these adaptation characters were also considered for evaluation to relate shoot fly resistance.

To know the increased yielding ability along with shoot fly resistance, grain yield plant^{-1} in uninfested (UNI) and infested (I) samples was recorded. Even though the yield data was obtained for all the four environments (EIK, EIIK, EIR and EIIR) only mean yield data for EIR environment was considered for interpretations.

Depending upon high range and low CV of various traits in different environments and also depending upon their relevance to shoot fly resistance, only early seedling vigour, glossiness, II total egg count, trichomes in abaxial surface (AB) in uninfested plants (UNI), I deadheart % (EIK and EIIK), III deadheart % (EIR and EIIR), 5th leaf length, 5th leaf width, 5th leaf droopiness, days to 50% flowering, plant height, total tillers plant^{-1}, productive tillers plant^{-1}, uniformity in recovery and yield in uninfested and infested samples (UNI and I) were selected for further analysis and presentation of results hereunder. Other traits such as I total egg count, I third leaf egg count, II third leaf egg count, trichomes in adaxial (AD) surface for both uninfested (UNI) and (I) plants, trichomes in abaxial surface (AB) for infested (I) plants, II and III deadheart % (EIK and EIIK), I and II deadheart % (EIR and EIIR), 3rd and 4th leaf lengths, 3rd and 4th leaf widths, and 3rd and 4th leaf droopiness with low range and high CVs were rejected as these were not found to add any meaningful insight to the objectives of the present study.

4.2. MEAN PERFORMANCE OF SORGHUM GENOTYPES FOR VARIOUS CHARACTERS

The means for early seedling vigour, glossiness, leaf parameters(-5th leaf length, 5th leaf width and 5th leaf droopiness), trichomes, egg count, deadheart %, uniformity in recovery, total tillers plant^{-1}, productive tillers plant^{-1}, yield (UNI and I), days to 50% flowering and plant height of sorghum genotypes which are selected based on low CV and high range as indicated earlier are presented in Tables 4-7.

4.2.1 Early Seedling Vigour

The early seedling vigour (1-9 scale, where 1 is most vigorous and 9 is least vigorous), a trait related to shoot fly resistance in sorghum genotypes, ranged between 1.33-7.33 (EIK) and 1.33-7.33 (EIIK) during rainy season and 1.00-7.00 (EIR) and 1.00-9.00 (EIIR) during postrainy season. The experimental mean values were 3.47, 3.52, 3.37 and 5.30 for EIK, EIIK, EIR and EIIR environments respectively (Table 4).

Among the sorghum hybrids SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94007A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed significantly high seedling vigour (≤2.00) in all the four (EIK, EIR, EIIK, and EIIR) environments. SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94005A x ICSR 93031, SPSFPR 94007A x ICSV 89015, SPSFPR 94007A x ICSR 93009 (developed on postrainy season-bred resistant female parent) also showed high seedling vigour (≤2.00) in atleast three environments. SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 88088, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031 (developed on rainy season-bred resistant female parent), SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 90002, SPSFPR 94005A x ICSR 93010 and SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female parent) showed seedling vigour of ≤3.00 in all the four environments. The hybrids, ICSA 20 x ICSV 88088, ICSA 90002 x ICSV 88088 (developed on susceptible bred female parent), SPSFR 94031A x ICSV 712, SPSFR 94003A x ICSR 93011, SPSFR 94001A x ICSR 93011 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 93011, SPSFPR 94002A x ICSV 88088, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89015, SPSFPR 94005A x ICSR 93011 and SPSFPR 94007A x ICSR 93009 (developed on postrainy season-bred resistant female parent) exhibited seedling vigour of ≤3.00 in atleast three environments which differed significantly from other genotypes. Generally sorghum hybrids involving susceptible parental lines, observed to have significantly higher score (less vigorous) especially during late rabi (EIIR) (Table 4).

Among parents, only one male parent, ICSR 93031 (postrainy season-adapted landrace) showed high seedling vigour (≤3.00) in all the four environments, whereas SPSFPR 94002A, SPSFPR 94007A (postrainy season-bred resistant cms lines), ICSV 712, ICSV 88088 (resistant bred restorer lines), ICSR 89076, ICSR 90002 (susceptible bred restorer lines), ICSR 93011, ICSR 93009 and ICSR 93010 (postrainy season-adapted landraces) showed seedling vigour of ≤3.00 in atleast three environments, which differed significantly (P=0.05) from other genotypes. With regard to parental lines, resistant ones were found to be more vigorous than susceptible ones.

Among the checks, only IS 18551 (resistant) was more vigorous (≤3.00) in atleast three environments. Generally crosses involving resistant lines showed high seedling vigour than crosses involving susceptible lines and seedling vigour was more during rainy season than in postrainy season.

4.2.2 Glossiness

The glossy score (1-9 scale, where 1.00 = completely glossy and 9.00 = non-glossy) which is one of the most important measure for resistance ranged between 1.00 - 8.67 (EIK) and 1.17 - 8.67 (EIIK) during rainy season and 1.00 - 9.00 (EIR) and 1.00 - 9.00 (EIIR) during postrainy season. Differences were marked between seasons for this character and the genotypes were less glossy (with higher score) during postrainy season (5.15 and 5.36) compared to rainy season (4.47 and 4.58) for both natural and artificial environments respectively (Table 4).

Among hybrids, SPSFR 94002A x ICSR 93011 (developed on rainy season-bred resistant female parent), SPSFPR 94007A x ICSV 88088, SPSFPR 94002A x ICSR 93010 and SPSFPR 94007A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed significantly (P=0.05) high glossiness (≤2.00) in all the four environments. SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent) and SPSFPR 94005A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed significantly high glossiness (≤2.00) in atleast three environments. SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 88088, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93031, SPSFR 94005A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94005A x ICSV 89030, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSV 89030,SPSFPR 94007A x ICSR 93011 and SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent) showed significantly (P=0.05) high glossiness (≤3.00) in all the four environments. Whereas a significantly (P=0.05) high glossiness (≤3.00) in atleast three environments was shown by SPSFR 94031A x ICSV 712, SPSFR 94003A x ICSR 93011, SPSFR 94001A x ICSR 93011, SPSFR 94002A x ICSR 93011, SPSFR 94005A x ICSR 93011 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 88088, SPSFPR 94007A x ICSV 89015, and SPSFPR 94007A x ICSR 93009 (developed on postrainy season-bred resistant female parent). Most of the hybrids involving resistant parental lines were significantly more glossy than hybrids developed from susceptible parental lines (Table 4).

Parents were statistically different from each other in glossiness. Shoot fly resistant parental lines were glossy, whereas susceptible ones were non-glossy in both the seasons. Among parents SPSFR 94002A (rainy season-bred esistant cms line) and SPSFPR 94007A (postrainy season-bred resistant cms line) showed significantly (P=0.05) high glossiness with a score of ≤2.00 in all the four environments (Table 4). ICSV 712, ICSV 88088 (resistant bred restorer lines), ICSR 93011 and ICSR 93010 (postrainy season-adapted landraces) showed significantly (P=0.05) high glossiness (≤2.00) in atleast three environments. SPSFR 94031A (rainy season-bred resistant cms line) showed high glossiness of ≤3.00 in all the environments. Whereas SPSFR 94003A, SPSFR 94001A (rainy season-bred resistant cms lines), SPSFPR 94002A (postrainy season-bred resistant cms line), ICSV 89015 (resistant bred restorer line) and ICSR 93031 (postrainy season-adapted landrace) showed a high glossiness score of ≤3.00 in atleast three environments (Table 4).

Table 4: Mean performance of genotypes for early seedling vigour and leaf characters associated with shoot fly resistance in rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons 1995-96

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	RBR cms x RBR hybrids																				
1	SPSFR 94002A x ICSV 712	3.00	3.50	3.00	8.33	2.67	2.53	7.67	9.00	19.60	23.67	15.47	22.43	1.77	2.60	1.53	2.13	7.47	8.40	6.10	9.03
2	SPSFR 94002A x ICSV 88088	3.00	2.67	4.00	4.33	2.00	2.33	8.00	8.33	14.40	22.63	17.93	23.30	1.73	1.80	1.53	2.10	5.13	8.07	7.33	9.10
3	SPSFR 94002A x ICSV 89015	3.33	4.00	2.67	4.33	3.67	2.83	6.67	8.00	17.40	23.00	16.67	21.00	1.67	2.07	1.63	1.93	6.63	7.93	6.80	8.70
4	SPSFR 94002A x ICSV 89030	3.67	4.33	5.00	4.67	2.50	2.33	6.33	2.33	18.57	24.47	15.13	18.83	1.53	2.07	1.43	1.70	6.77	9.30	6.13	7.77
5	SPSFR 94003A x ICSV 712	3.33	3.00	5.00	3.67	2.33	3.33	3.00	2.00	15.77	19.70	14.83	19.23	1.67	2.00	1.47	1.77	6.13	7.67	5.88	6.93
6	SPSFR 94003A x ICSV 88088	2.67	4.67	3.33	1.33	2.17	2.17	6.00	1.33	16.33	23.10	20.63	24.33	1.53	2.03	2.00	2.30	6.07	8.47	8.27	8.77
7	SPSFR 94003A x ICSV 89015	4.00	3.67	4.00	4.00	3.83	3.50	3.00	2.33	14.43	23.50	17.00	20.90	1.93	1.73	1.57	1.80	5.50	9.10	7.00	8.57
8	SPSFR 94003A x ICSV 89030	3.67	4.00	5.33	5.67	4.00	2.83	4.00	3.00	15.33	19.67	14.60	19.07	1.83	1.80	1.50	1.77	5.70	7.00	5.87	7.23
9	SPSFR 94001A x ICSV 712	3.67	3.67	4.00	2.33	3.17	3.00	4.33	2.00	19.30	21.07	17.20	14.90	2.40	2.17	1.77	1.30	7.53	6.53	6.67	7.70
10	SPSFR 94001A x ICSV 88088	2.00	2.33	3.00	3.00	2.17	2.67	2.00	3.00	18.33	28.50	17.67	21.80	2.13	2.93	1.73	1.67	6.77	10.80	7.13	8.17
11	SPSFR 94001A x ICSV 89015	4.67	4.67	5.60	3.00	3.33	3.67	6.38	1.00	15.37	20.43	18.50	13.17	1.67	1.87	1.73	0.30	5.50	7.67	7.53	4.86
12	SPSFR 94001A x ICSV 89030	3.67	4.33	4.33	4.00	3.17	2.67	4.00	4.67	17.00	23.60	16.13	17.60	1.77	2.17	1.40	1.77	6.47	8.60	6.23	6.67
13	SPSFR 94031A x ICSV 712	2.67	3.00	3.00	4.33	2.50	1.50	2.67	1.33	17.77	26.87	19.20	21.10	1.87	2.27	1.50	1.80	6.40	9.73	7.57	8.53
14	SPSFR 94031A x ICSV 88088	3.00	1.67	3.00	1.33	1.67	1.33	3.00	1.00	22.87	28.93	19.50	28.60	1.83	2.17	1.77	2.07	8.27	9.73	7.63	10.93
15	SPSFR 94031A x ICSV 89015	3.67	4.33	2.00	2.67	1.67	2.67	2.33	1.67	23.87	26.23	19.17	23.83	2.23	2.30	1.43	1.97	9.17	9.87	7.93	9.30
16	SPSFR 94031A x ICSV 89030	3.67	3.33	3.67	5.00	2.67	2.33	4.00	2.33	18.23	25.53	15.87	18.80	1.83	2.00	1.33	1.63	7.20	9.17	6.30	7.80
	PRBR cms x RBR hybrids																				
17	SPSFPR 94001A x ICSV 712	5.00	5.67	6.07	6.33	6.67	5.67	8.02	9.00	16.20	14.77	10.97	13.23	1.67	1.77	1.43	1.53	5.87	5.30	4.30	6.83
18	SPSFPR 94001A x ICSV 88088	3.67	5.33	2.67	4.67	6.83	7.00	6.67	7.00	13.90	16.00	15.00	20.63	1.70	1.63	1.63	2.10	5.00	5.93	6.30	8.03
19	SPSFPR 94001A x ICSV 89015	5.33	5.33	4.33	4.00	7.17	7.67	8.00	8.00	13.17	14.47	13.90	16.97	1.70	1.60	1.40	1.83	4.50	4.93	5.57	6.93
20	SPSFPR 94001A x ICSV 89030	5.67	6.33	5.33	7.33	6.50	6.50	7.00	8.33	14.07	14.73	14.90	13.37	1.53	1.97	1.83	1.37	5.23	5.40	6.00	5.07
21	SPSFPR 94002A x ICSV 712	2.67	3.67	3.67	3.67	3.00	3.00	3.67	3.00	15.57	24.20	18.53	22.17	1.60	2.20	1.90	2.00	5.90	7.80	7.83	8.73

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
22	SPSFPR 94002A x ICSV 88088	1.67	2.67	4.00	3.00	2.50	2.00	4.67	1.67	17.37	26.33	19.67	24.33	1.73	2.23	1.57	2.10	6.57	8.53	8.23	9.20
23	SPSFPR 94002A x ICSV 89015	3.00	3.33	4.00	4.33	3.00	2.83	3.33	1.67	19.47	23.80	17.73	21.17	1.80	2.20	1.73	1.90	7.47	8.53	7.10	8.30
24	SPSFPR 94002A x ICSV 89030	3.33	3.33	5.00	5.00	2.50	3.17	3.00	2.33	22.33	25.20	17.90	21.03	2.00	2.13	1.67	1.97	8.73	8.73	7.47	8.47
25	SPSFPR 94005A x ICSV 712	2.67	4.00	3.00	5.00	2.67	2.83	3.67	1.67	19.03	19.90	16.77	22.33	1.70	1.80	1.50	2.00	7.40	7.07	6.83	8.73
26	SPSFPR 94005A x ICSV 88088	2.67	3.00	3.33	5.33	2.50	1.83	2.67	4.67	19.77	23.53	18.50	22.43	1.90	2.00	1.43	1.77	7.20	7.80	7.53	9.20
27	SPSFPR 94005A x ICSV 89015	4.33	3.67	4.00	4.05	3.33	2.83	2.67	2.96	19.67	24.87	7.87	19.73	2.20	2.87	0.67	1.93	8.17	9.00	7.04	7.40
28	SPSFPR 94005A x ICSV 89030	3.33	3.00	5.00	5.33	2.83	2.17	3.00	2.00	16.97	21.63	17.57	17.23	1.67	2.33	1.50	1.33	6.30	7.77	7.07	7.20
29	SPSFPR 94007A x ICSV 712	4.00	3.00	2.67	2.00	2.33	2.00	1.67	1.00	21.20	23.43	20.67	25.57	2.23	2.07	1.77	2.07	7.89	9.17	7.73	10.00
30	SPSFPR 94007A x ICSV 88088	2.00	3.67	2.33	2.00	1.67	1.33	1.33	1.32	28.43	24.67	19.87	25.07	2.27	1.87	1.73	1.97	10.80	6.80	8.50	9.87
31	SPSFPR 94007A x ICSV 89015	2.33	2.67	2.00	3.33	2.50	3.00	2.33	2.67	21.80	19.83	19.63	23.93	2.03	1.97	1.77	2.10	8.47	6.00	8.37	9.30
32	SPSFPR 94007A x ICSV 89030	2.67	1.67	3.00	2.33	2.00	1.83	3.33	1.67	25.53	27.13	21.00	25.17	2.23	2.30	2.00	2.17	9.80	8.90	8.33	9.93
	SB cms x RBR hybrids																				
33	ICSA 20 x ICSV 712	4.00	3.67	5.33	4.00	5.67	7.00	6.33	6.33	15.13	15.30	19.80	21.37	1.83	1.60	1.63	1.93	5.60	6.10	8.33	8.33
34	ICSA 20 x ICSV 88088	3.33	3.00	2.00	2.67	4.67	5.50	5.00	5.33	15.07	15.27	22.33	26.27	1.87	1.87	1.87	1.97	5.53	4.37	8.93	9.97
35	ICSA 20 x ICSV 89015	4.33	4.67	2.67	5.00	6.00	7.83	7.00	7.33	17.63	15.47	18.83	25.50	1.67	1.70	1.73	1.87	6.70	1.70	6.97	10.43
36	ICSA 20 x ICSV 89030	3.33	4.00	1.67	4.00	6.33	6.00	7.00	8.00	17.20	16.40	16.00	24.70	1.83	1.77	1.37	1.83	6.03	1.77	6.53	10.23
37	ICSA 89001 x ICSV 712	3.33	4.33	4.00	4.33	5.50	7.83	8.33	9.00	13.57	14.07	15.33	21.00	1.37	1.50	1.17	2.03	5.20	1.50	6.03	7.60
38	ICSA 89001 x ICSV 88088	3.67	3.33	4.33	4.95	6.17	6.83	7.33	8.33	19.57	20.40	8.67	20.67	2.27	2.03	0.83	1.87	6.53	2.03	5.33	7.83
39	ICSA 89001 x ICSV 89015	4.00	4.67	2.00	8.67	6.00	7.33	8.33	9.00	15.90	13.47	16.10	21.80	1.83	1.80	1.67	1.97	5.87	1.80	6.47	8.50
40	ICSA 89001 x ICSV 89030	6.00	3.67	4.00	8.67	8.67	6.33	8.67	9.00	9.95	16.13	14.93	20.43	1.27	2.00	1.57	1.87	3.35	2.00	5.87	7.27
41	ICSA 89004 x ICSV 712	3.00	3.67	4.00	7.00	6.50	6.83	7.67	9.00	13.10	17.33	15.43	19.67	1.60	1.67	1.70	1.80	4.67	1.67	6.00	7.63
42	ICSA 89004 x ICSV 88088	4.33	4.00	2.33	6.33	7.17	7.17	5.67	8.33	13.90	12.50	15.20	19.67	1.87	1.63	1.43	1.60	5.10	1.63	6.17	7.97
43	ICSA 89004 x ICSV 89015	4.00	3.33	3.67	6.00	5.50	5.33	5.67	9.00	16.63	20.53	18.10	20.90	1.97	1.97	1.67	1.67	6.33	1.97	6.90	7.80
44	ICSA 89004 x ICSV 89030	3.67	3.67	4.67	8.33	5.50	6.50	5.00	8.33	12.67	18.60	14.97	20.13	1.50	2.40	1.40	1.60	4.33	2.40	5.70	3.17
45	ICSA 90002 x ICSV 712	3.33	4.00	1.67	7.00	5.83	5.17	6.33	8.00	14.40	18.10	17.23	24.70	1.57	1.77	1.60	1.87	5.27	1.77	6.90	10.23

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
46	ICSA 90002 x ICSV 88088	2.67	2.33	1.67	4.67	3.50	5.83	6.33	8.33	19.33	20.57	18.33	27.23	1.77	1.97	1.50	1.90	6.97	1.97	7.50	10.67
47	ICSA 90002 x ICSV 89015	3.33	3.00	4.67	8.67	5.67	6.83	8.00	9.00	15.13	17.83	18.37	19.90	1.83	1.87	1.60	1.90	5.27	1.87	7.80	7.67
48	ICSA 90002 x ICSV 89030	3.33	2.67	4.33	5.67	6.00	5.50	7.67	7.00	15.13	15.93	19.03	11.43	1.93	2.00	1.50	0.90	5.43	2.00	7.83	6.63
	RBR cms x SBR hybrids																				
49	SPSFR 94002A x ICSR 89076	4.00	4.33	3.33	4.67	6.83	6.17	6.33	8.67	18.07	21.63	18.00	22.57	2.10	2.27	1.57	2.00	6.53	2.27	7.17	9.20
50	SPSFR 94002A x ICSR 90002	3.67	5.33	4.33	7.00	6.17	7.50	6.00	9.00	14.47	14.27	10.13	18.43	1.77	1.57	0.93	1.63	4.87	1.57	6.17	7.43
51	SPSFR 94002A x ICSR 90005	4.67	4.67	7.00	8.33	6.00	7.83	7.33	9.00	13.33	16.67	16.20	16.90	1.57	1.63	1.43	1.40	5.07	1.63	6.83	6.53
52	SPSFR 94002A x ICSR 90014	3.67	4.67	2.33	7.33	7.17	7.17	6.33	7.67	16.20	16.20	18.00	27.90	1.70	1.73	1.70	2.47	6.27	1.73	7.50	11.93
53	SPSFR 94003A x ICSR 89076	4.33	5.00	3.67	8.33	5.00	4.17	5.67	3.33	13.33	20.00	14.50	19.60	1.40	1.87	1.30	1.90	3.80	1.87	5.73	7.57
54	SPSFR 94003A x ICSR 90002	4.33	4.33	4.33	3.67	7.17	5.67	5.33	1.67	15.10	22.33	15.00	15.27	1.83	2.27	1.60	1.47	5.67	2.27	6.00	5.57
55	SPSFR 94003A x ICSR 90005	4.00	3.67	3.67	7.33	6.17	6.00	7.67	8.33	15.13	20.23	15.82	20.63	1.87	2.27	1.50	2.07	5.67	2.27	6.03	7.93
56	SPSFR 94003A x ICSR 90014	3.33	4.67	4.00	6.00	4.83	4.67	6.33	8.33	14.03	19.63	15.23	19.23	1.40	1.90	1.60	1.93	4.93	1.90	6.20	7.40
57	SPSFR 94001A x ICSR 89076	2.01	3.04	4.67	8.67	8.50	6.89	8.33	9.00	11.35	15.83	13.37	16.37	1.76	0.63	1.67	1.20	4.00	6.04	5.40	7.20
58	SPSFR 94001A x ICSR 90002	5.18	4.00	7.00	5.29	5.50	7.83	9.00	8.90	17.59	9.17	17.00	17.30	1.84	1.00	1.00	1.67	6.58	4.80	6.00	6.77
59	SPSFR 94001A x ICSR 90005	4.00	4.00	4.33	5.30	7.17	7.00	7.00	5.35	14.27	20.33	20.00	21.10	1.83	2.53	2.00	2.20	5.53	6.43	6.00	7.67
60	SPSFR 94001A x ICSR 90014	4.67	3.67	3.33	7.00	7.33	6.67	4.33	7.33	16.53	14.93	14.43	21.33	1.93	1.73	1.57	1.90	6.00	4.97	5.53	8.47
61	SPSFR 94031A x ICSR 89076	3.33	3.33	3.33	8.95	4.67	4.33	6.33	9.00	16.47	25.23	8.30	18.87	1.77	2.37	0.70	1.80	6.30	9.30	5.93	7.13
62	SPSFR 94031A x ICSR 90002	3.67	4.00	4.67	4.67	3.67	2.50	6.33	4.00	18.27	22.53	17.77	22.07	1.57	2.33	1.50	1.63	7.13	7.40	7.23	8.70
63	SPSFR 94031A x ICSR 90005	2.67	3.67	2.67	7.00	5.17	5.67	6.00	8.00	17.00	18.57	18.70	24.40	1.47	2.13	1.60	2.20	6.30	6.80	7.83	9.63
64	SPSFR 94031A x ICSR 90014	3.00	3.00	3.00	6.33	3.83	3.50	5.33	4.33	21.83	24.20	19.33	19.63	2.20	2.23	1.93	1.73	8.93	8.33	7.87	7.53
	PRBR cms x SBR hybrids																				
65	SPSFPR 94001A x ICSR 89076	4.67	4.67	5.33	9.00	7.17	7.17	5.67	7.33	14.77	15.27	10.77	17.50	1.53	1.87	1.17	1.83	5.60	5.27	3.67	5.67
66	SPSFPR 94001A x ICSR 90002	4.33	5.33	3.67	9.00	7.50	6.33	7.67	7.33	15.33	20.43	12.83	18.97	1.53	2.17	1.33	1.97	5.17	7.30	4.97	7.50
67	SPSFPR 94001A x ICSR 90005	5.67	4.67	5.33	8.33	7.17	6.67	6.67	9.00	12.00	14.27	13.33	17.80	1.43	1.63	1.57	1.70	4.30	4.60	5.57	6.77
68	SPSFPR 94001A x ICSR 90014	5.67	5.67	5.00	4.67	6.33	7.83	4.67	7.00	13.03	17.70	16.10	18.50	1.37	1.93	1.73	2.00	4.90	5.87	6.47	7.00

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
69	SPSFPR 94002A x ICSR 89076	5.33	5.00	6.00	5.33	8.50	6.00	4.67	5.67	16.83	11.10	17.33	22.07	2.07	2.27	1.70	1.97	6.50	3.23	6.93	8.67
70	SPSFPR 94002A x ICSR 90002	3.00	2.67	1.00	2.00	6.50	4.50	3.67	3.33	14.07	22.00	24.13	30.23	1.83	2.33	2.00	2.10	5.43	7.43	10.07	11.37
71	SPSFPR 94002A x ICSR 90005	2.67	4.00	2.33	6.33	5.33	6.17	6.67	7.00	15.50	18.07	18.13	20.40	1.80	1.70	1.57	1.80	5.47	6.60	7.53	7.57
72	SPSFPR 94002A x ICSR 90014	4.67	4.67	4.00	6.00	6.67	7.00	7.67	9.00	16.53	13.80	15.67	22.37	2.07	1.47	1.50	2.37	6.43	4.53	6.47	8.33
73	SPSFPR 94005A x ICSR 89076	3.67	3.33	2.67	4.67	5.83	5.17	7.67	8.67	15.60	24.17	18.30	24.17	2.03	2.30	1.57	1.80	6.00	8.90	7.40	10.37
74	SPSFPR 94005A x ICSR 90002	3.67	4.33	3.00	5.00	6.00	6.83	7.67	8.33	13.43	16.93	17.80	23.87	1.87	1.97	1.67	2.20	5.53	5.50	7.50	9.77
75	SPSFPR 94005A x ICSR 90005	3.67	4.67	2.00	8.00	7.17	7.00	8.00	6.00	13.73	14.97	17.10	25.33	1.77	1.53	1.43	1.63	5.17	4.80	6.87	10.27
76	SPSFPR 94005A x ICSR 90014	4.33	3.67	4.00	8.67	6.33	5.50	6.00	5.33	19.10	16.03	17.27	22.90	1.93	2.17	1.67	1.63	7.03	4.83	7.03	9.43
77	SPSFPR 94007A x ICSR 89076	2.67	3.33	4.67	8.33	4.67	5.00	3.67	8.33	19.57	22.03	6.80	19.80	1.90	2.03	0.63	1.57	7.20	7.67	4.73	6.87
78	SPSFPR 94007A x ICSR 90002	3.33	3.33	4.00	4.33	5.83	6.50	1.33	1.33	15.83	18.40	19.97	24.53	1.67	1.67	1.67	2.17	5.60	7.70	7.90	9.90
79	SPSFPR 94007A x ICSR 90005	3.33	2.67	4.67	5.67	5.50	4.50	5.00	6.00	15.27	21.43	18.17	25.33	1.83	2.23	1.50	2.03	5.70	6.97	7.53	10.00
80	SPSFPR 94007A x ICSR 90014	3.67	2.33	2.33	2.67	4.17	4.83	2.67	1.67	17.17	19.27	19.53	22.97	1.73	1.90	1.63	1.40	5.97	5.60	8.23	8.77
	SB cms x SBR hybrids																				
81	ICSA 20 x ICSR 89076	3.00	3.67	2.00	6.00	6.67	7.67	8.00	9.00	20.60	16.93	19.90	26.03	2.03	2.00	1.60	2.13	8.10	5.10	7.70	9.93
82	ICSA 20 x ICSR 90002	4.00	2.67	3.00	7.33	6.50	7.50	6.00	9.00	21.93	17.20	14.87	26.53	1.97	1.63	1.40	2.23	8.37	6.07	6.23	10.80
83	ICSA 20 x ICSR 90005	3.00	4.67	1.00	9.00	6.67	8.00	6.00	8.33	21.23	17.67	17.07	29.07	2.07	1.73	1.43	1.97	8.43	6.73	6.73	11.57
84	ICSA 20 x ICSR 90014	3.00	4.00	2.33	7.33	6.17	6.83	7.00	6.67	13.70	16.40	20.33	24.60	1.43	1.70	1.80	2.07	4.43	5.47	8.23	9.03
85	ICSA 89001 x ICSR 89076	5.67	3.33	5.67	6.45	7.67	7.67	9.00	9.00	11.23	17.43	11.83	17.73	1.43	2.00	1.30	1.87	3.73	5.37	4.90	6.47
86	ICSA 89001 x ICSR 90002	7.33	3.05	3.33	7.67	8.17	8.67	8.67	9.00	15.06	5.23	16.20	23.30	1.57	0.60	1.53	2.27	7.43	4.59	6.30	9.27
87	ICSA 89001 x ICSR 90005	4.67	6.00	4.67	7.00	6.83	8.33	9.00	9.00	12.50	16.00	17.80	15.60	1.43	1.43	1.77	1.70	4.43	5.87	7.17	5.73
88	ICSA 89001 x ICSR 90014	5.67	6.00	4.33	8.00	6.17	6.50	7.00	9.00	15.63	16.17	14.77	22.80	1.67	1.67	1.43	1.83	5.77	6.60	6.03	9.53
89	ICSA 89004 x ICSR 89076	4.00	3.00	2.00	6.67	8.00	7.67	8.00	8.33	16.83	16.67	18.90	25.00	1.67	1.97	1.77	2.10	6.27	5.33	8.00	10.23
90	ICSA 89004 x ICSR 90002	3.00	3.67	2.00	7.67	6.50	7.33	9.00	8.33	16.40	17.27	15.60	25.23	1.70	2.07	1.57	2.07	6.47	5.23	6.20	10.63

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
91	ICSA 89004 x ICSR 90005	3.67	3.67	5.33	8.67	6.83	5.33	9.00	9.00	14.77	19.40	16.40	23.27	1.73	2.00	1.60	1.97	5.60	6.30	6.47	9.17
92	ICSA 89004 x ICSR 90014	3.67	4.00	3.33	6.33	7.33	6.17	9.00	9.00	14.13	17.70	15.33	21.17	1.73	1.77	1.40	1.83	5.53	6.43	5.83	7.47
93	ICSA 90002 x ICSR 89076	4.67	4.67	5.67	8.67	6.83	7.33	9.00	8.67	16.00	16.70	15.17	13.90	1.40	1.77	1.23	1.23	6.30	6.23	7.03	6.13
94	ICSA 90002 x ICSR 90002	4.00	3.00	2.33	9.00	5.83	6.50	9.00	8.33	20.17	16.33	17.53	22.00	1.93	1.67	1.40	1.67	7.30	4.80	7.33	8.63
95	ICSA 90002 x ICSR 90005	3.67	2.67	2.00	6.33	6.67	7.00	7.00	9.00	15.17	18.93	17.43	25.67	1.67	2.03	1.53	2.07	5.73	7.90	7.30	10.57
96	ICSA 90002 x ICSR 90014	3.33	4.33	4.67	9.00	6.00	6.83	6.00	8.00	17.00	19.67	15.67	19.67	1.97	1.77	1.60	1.70	6.23	7.43	6.70	7.87
	RBR cms x PRLR hybrids																				
97	SPSFR 94002A x ICSR 93031	1.33	2.33	2.33	8.33	2.00	1.50	5.00	7.00	22.77	24.77	13.43	23.30	2.47	1.97	1.23	2.27	8.40	9.63	5.47	9.43
98	SPSFR 94002A x ICSR 93011	1.67	2.00	3.00	1.67	1.33	1.67	1.33	1.00	20.50	32.67	23.77	27.23	2.23	3.10	1.83	1.63	7.53	11.31	9.57	10.40
99	SPSFR 94002A x ICSR 93009	2.33	1.67	4.67	4.67	3.33	1.83	6.67	1.33	17.60	28.20	15.77	23.40	1.60	2.50	1.33	1.93	6.40	9.53	6.00	9.27
100	SPSFR 94002A x ICSR 93010	1.33	7.33	3.00	8.33	2.00	7.83	6.33	8.00	24.47	15.63	13.00	23.67	2.30	1.67	1.10	2.13	9.23	5.40	5.03	9.20
101	SPSFR 94003A x ICSR 93031	4.00	5.00	3.33	3.67	3.33	3.50	2.67	2.33	23.03	23.87	16.67	24.60	2.07	2.50	1.60	1.80	8.57	8.57	6.63	9.43
102	SPSFR 94003A x ICSR 93011	3.00	3.33	2.33	1.00	1.67	1.67	2.33	1.67	19.50	28.50	23.87	24.57	1.73	2.53	1.93	1.77	7.40	9.40	9.93	9.73
103	SPSFR 94003A x ICSR 93009	3.67	3.33	2.00	3.67	2.33	3.17	3.00	2.33	25.00	20.57	20.20	26.10	2.23	2.37	1.63	2.17	10.13	6.93	7.97	11.07
104	SPSFR 94003A x ICSR 93010	2.00	2.33	2.33	2.00	2.00	2.17	2.00	1.67	21.40	21.47	19.53	26.97	2.13	2.00	1.50	2.07	8.53	7.43	8.20	11.17
105	SPSFR 94001A x ICSR 93031	2.33	2.00	2.33	1.67	2.67	2.17	2.33	2.00	22.07	24.33	25.43	25.03	2.13	2.47	2.23	2.37	8.73	9.50	10.67	9.87
106	SPSFR 94001A x ICSR 93011	2.00	2.00	2.33	3.67	2.83	2.33	3.00	3.33	21.37	24.90	19.17	24.67	2.23	2.63	1.73	2.27	9.00	7.70	7.93	9.97
107	SPSFR 94001A x ICSR 93009	2.00	1.33	2.33	1.00	2.00	2.00	3.33	1.67	22.27	25.10	25.77	30.27	2.17	2.43	1.97	2.33	8.67	9.63	10.77	12.38
108	SPSFR 94001A x ICSR 93010	1.67	1.33	1.67	1.67	2.17	1.50	2.67	2.00	25.90	28.30	27.57	28.50	2.73	2.40	2.13	2.27	9.83	9.43	11.67	11.57
109	SPSFR 94031A x ICSR 93031	1.67	2.00	2.33	1.33	2.00	1.83	5.00	1.33	20.77	27.33	23.23	26.33	2.87	2.30	1.83	2.07	8.03	9.80	10.07	10.87
110	SPSFR 94031A x ICSR 93011	1.33	1.33	2.67	2.00	1.33	1.83	3.67	1.33	19.07	25.57	23.00	25.00	2.03	2.40	1.50	1.57	6.70	8.97	9.37	9.57
111	SPSFR 94031A x ICSR 93009	3.33	2.00	3.00	4.67	1.83	1.83	5.00	2.00	21.93	29.13	21.57	20.40	1.87	2.20	1.73	2.30	8.77	10.97	9.27	10.80
112	SPSFR 94031A x ICSR 93010	2.00	1.67	2.00	2.33	2.00	1.67	4.00	1.67	18.50	27.83	23.10	27.63	1.67	2.20	1.77	2.00	7.10	9.80	9.77	10.57

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRBR cms x PRLR hybrids																				
113	SPSFPR 94001A x ICSR 93031	4.33	4.00	2.67	5.33	5.50	6.33	4.33	5.33	13.60	20.23	20.27	25.83	1.50	1.93	1.57	2.27	5.20	7.23	8.20	10.63
114	SPSFPR 94001A x ICSR 93011	4.00	3.67	6.33	5.00	5.17	4.33	4.67	6.00	20.43	18.20	15.00	23.40	1.90	1.97	1.53	2.03	8.23	6.50	6.20	9.00
115	SPSFPR 94001A x ICSR 93009	4.33	4.00	5.00	4.00	5.00	4.33	3.67	6.33	13.73	22.07	20.77	20.07	1.37	1.67	1.83	1.67	4.70	8.37	8.60	8.00
116	SPSFPR 94001A x ICSR 93010	4.00	4.00	3.31	7.67	4.50	5.00	6.67	5.35	16.20	21.77	14.90	6.77	1.53	2.13	0.43	0.53	6.40	7.93	4.24	7.12
117	SPSFPR 94002A x ICSR 93031	2.33	3.33	3.67	2.67	2.50	2.50	5.00	2.00	15.90	22.73	22.03	30.07	1.87	2.23	1.90	2.53	5.97	8.30	9.57	10.83
118	SPSFPR 94002A x ICSR 93011	2.00	1.33	3.33	2.33	1.83	1.50	2.00	1.67	15.57	26.67	21.53	25.10	2.23	1.90	1.77	2.10	5.77	9.43	8.80	9.40
119	SPSFPR 94002A x ICSR 93009	2.33	2.67	4.00	5.29	2.83	3.00	4.00	5.35	21.00	24.67	20.00	22.53	1.93	2.07	2.00	2.03	8.40	8.10	8.00	9.93
120	SPSFPR 94002A x ICSR 93010	1.33	1.67	1.67	8.00	1.83	1.83	1.33	1.67	20.83	29.33	27.00	29.00	2.43	2.83	2.13	2.13	8.30	10.33	11.37	12.27
121	SPSFPR 94005A x ICSR 93031	2.00	1.67	2.00	3.00	2.17	1.83	2.00	1.33	26.57	29.00	22.80	28.47	2.53	2.73	1.80	2.33	10.00	9.63	9.43	11.47
122	SPSFPR 94005A x ICSR 93011	2.03	2.67	1.33	3.67	1.00	1.67	1.67	1.00	16.80	22.60	22.23	31.67	1.77	1.97	1.37	1.90	6.23	8.10	9.43	12.10
123	SPSFPR 94005A x ICSR 93009	3.33	2.00	3.33	3.00	3.33	2.33	3.33	2.33	18.53	26.67	23.90	26.77	2.20	2.20	1.83	1.87	6.97	9.27	9.87	10.37
124	SPSFPR 94005A x ICSR 93010	2.33	2.00	2.00	2.00	2.50	2.17	5.33	1.67	24.33	29.27	25.13	31.00	2.70	2.33	1.93	2.03	8.67	10.87	10.60	12.63
125	SPSFPR 94007A x ICSR 93031	1.67	2.00	1.67	1.67	1.33	1.67	1.33	1.33	21.77	28.90	26.30	25.97	2.20	2.70	1.90	2.07	7.93	9.83	11.27	10.00
126	SPSFPR 94007A x ICSR 93011	3.00	2.33	1.67	2.33	2.51	2.33	1.67	1.33	20.23	25.60	25.00	30.00	1.73	2.17	1.53	2.20	7.70	8.07	10.40	12.20
127	SPSFPR 94007A x ICSR 93009	3.33	2.67	1.67	1.33	2.33	2.17	1.67	1.67	13.10	26.93	28.23	28.00	2.07	1.87	2.03	1.83	5.10	10.00	11.97	12.27
128	SPSFPR 94007A x ICSR 93010	2.00	1.67	2.67	2.00	2.17	1.83	2.33	2.00	21.43	27.30	22.17	26.20	1.97	2.60	1.80	2.10	7.90	9.83	9.13	9.90
	SB cms x PRLR hybrids																				
129	ICSA 20 x ICSR 93031	3.67	3.00	4.67	6.00	4.50	4.5	7.67	8.00	15.00	23.37	22.13	32.77	1.50	2.43	1.67	2.43	5.33	7.97	9.23	13.33
130	ICSA 20 x ICSR 93011	2.67	3.33	1.67	3.33	5.17	4.83	2.00	3.67	18.70	19.47	23.00	29.43	1.87	1.87	1.90	1.77	7.10	5.90	9.63	11.63
131	ICSA 20 x ICSR 93009	3.33	2.00	2.00	5.00	5.33	6.00	3.67	6.00	16.30	20.80	25.23	20.37	2.07	1.53	2.07	1.93	5.60	7.03	10.40	11.03
132	ICSA 20 x ICSR 93010	3.33	4.00	1.67	5.29	7.17	7.50	5.67	5.35	12.93	26.17	21.10	30.00	1.43	2.40	0.70	2.07	4.80	10.30	4.18	12.47
133	ICSA 89001 x ICSR 93031	6.33	4.00	7.33	6.67	8.50	8.00	6.33	9.00	10.83	14.37	13.83	23.23	1.67	1.83	1.33	1.90	3.33	4.50	5.10	8.83
134	ICSA 89001 x ICSR 93011	4.33	5.00	3.33	6.00	7.50	6.83	5.67	6.00	20.57	12.83	15.67	25.00	1.93	1.63	1.43	2.00	8.07	4.03	6.17	9.76

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
135	ICSA 89001 x ICSR 93009	5.33	5.33	3.00	6.67	7.57	6.00	7.33	8.00	14.10	19.50	17.63	25.97	1.63	1.87	1.60	2.20	5.10	6.60	7.07	9.97
136	ICSA 89001 x ICSR 93010	5.00	3.67	2.33	7.00	7.00	5.67	7.33	8.67	17.77	22.80	19.03	28.80	1.90	2.33	1.57	2.23	6.47	8.50	7.67	11.47
137	ICSA 89004 x ICSR 93031	3.00	2.33	1.67	9.00	4.83	5.33	4.67	7.67	19.33	17.90	20.33	25.90	1.93	1.97	1.83	2.03	7.47	6.30	8.00	11.00
138	ICSA 89004 x ICSR 93011	3.67	3.33	4.00	8.67	6.17	6.33	8.33	8.33	19.33	17.87	14.30	20.17	1.93	1.87	1.43	1.70	6.73	6.00	5.77	8.20
139	ICSA 89004 x ICSR 93009	6.00	5.33	2.00	4.67	6.50	7.00	5.33	6.67	15.60	6.73	25.33	27.23	1.70	0.63	1.90	1.93	6.10	3.37	9.80	11.17
140	ICSA 89004 x ICSR 93010	4.33	5.33	2.00	7.33	6.33	6.83	4.00	9.00	13.13	13.93	14.90	27.30	1.93	1.73	0.97	4.37	5.07	5.13	6.30	11.00
141	ICSA 90002 x ICSR 93031	2.67	2.33	4.00	5.67	4.00	3.67	8.67	8.33	16.10	18.37	17.33	22.03	1.73	2.23	1.40	1.83	6.33	6.50	7.40	8.13
142	ICSA 90002 x ICSR 93011	4.33	5.00	4.67	8.83	5.17	5.67	6.33	9.00	13.33	18.10	17.43	23.73	1.40	1.53	0.70	2.07	4.17	6.87	5.28	9.73
143	ICSA 90002 x ICSR 93009	4.00	5.00	2.67	8.33	4.33	5.50	4.33	8.33	13.87	17.30	16.07	28.33	1.93	1.90	1.23	2.17	4.80	6.20	6.90	11.43
144	ICSA 90002 x ICSR 93010	2.33	2.67	2.67	4.00	4.67	5.33	8.33	8.00	16.00	17.13	19.57	20.43	1.90	1.90	1.83	1.53	6.07	6.17	8.07	7.90
	LINES																				
	RBR cms																				
1	SPSFR 94002A	5.00	2.67	3.67	2.00	1.50	1.17	1.67	1.67	18.17	22.27	19.80	20.17	1.83	2.17	1.50	1.47	6.73	7.67	7.77	7.20
2	SPSFR 94003A	4.00	3.33	3.00	2.33	3.17	2.67	2.00	2.33	19.67	20.13	17.40	19.63	2.10	1.87	1.67	2.20	7.83	6.80	6.47	6.60
3	SPSFR 94001A	3.00	3.00	3.67	4.00	1.33	2.33	3.33	2.33	22.43	23.07	14.80	21.60	2.20	2.00	1.53	1.97	8.40	7.68	5.43	7.97
4	SPSFR 94031A	3.00	3.67	4.00	5.00	1.50	2.33	2.67	3.00	20.07	19.83	15.70	20.27	1.70	1.47	1.47	1.77	7.87	6.47	6.10	8.07
	PRBR cms																				
5	SPSFPR 94001A	4.67	5.33	5.33	7.00	3.33	5.00	7.67	8.33	14.10	23.10	11.60	17.83	1.47	2.20	1.17	1.83	5.37	8.57	4.40	6.97
6	SPSFPR 94002A	3.00	4.33	3.00	2.67	2.17	3.17	1.67	2.00	21.00	23.33	19.60	21.33	1.97	2.13	2.07	1.87	7.23	7.80	8.33	8.20
7	SPSFPR 94005A	3.00	4.67	5.00	7.00	3.17	2.00	3.00	3.67	24.13	22.40	18.00	20.67	1.97	1.77	1.37	1.70	9.00	7.30	7.67	8.13
8	SPSFPR 94007A	2.33	3.67	3.00	1.33	1.00	1.83	1.00	1.00	23.23	24.23	21.33	24.50	1.63	1.97	1.77	1.83	7.97	8.43	9.17	9.33

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	SB cms																				
9	ICSA 20	2.67	4.33	3.67	5.67	6.17	7.67	5.33	9.00	14.83	21.00	16.67	25.87	1.30	3.30	1.60	1.70	5.20	7.47	6.73	9.87
10	ICSA 89001	4.67	4.67	4.67	9.00	5.83	6.50	6.00	7.00	12.37	17.20	8.87	21.53	1.33	1.43	0.83	1.67	4.53	5.80	5.52	7.63
11	ICSA 89004	2.67	4.33	3.00	8.33	6.83	7.17	8.33	9.00	13.40	18.00	16.30	23.00	1.77	1.80	1.40	1.83	4.90	5.43	6.43	9.03
12	ICSA 90002	3.00	3.67	3.00	8.33	6.33	6.83	7.67	9.00	16.23	18.83	16.33	21.17	1.47	1.77	1.27	1.67	6.07	7.20	6.90	8.13
	TESTERS																				
	RBR																				
1	ICSV 712	3.67	1.33	2.33	2.67	3.17	1.67	1.67	1.33	14.33	22.37	19.50	24.10	1.60	2.07	1.43	1.90	5.30	7.53	8.00	9.97
2	ICSV 88088	3.67	2.67	2.67	2.00	1.67	1.83	3.00	2.00	24.80	26.90	19.47	25.43	2.07	1.90	1.70	2.10	8.97	9.07	7.97	10.00
3	ICSV 89015	3.33	3.67	1.67	4.33	1.67	3.00	4.67	2.33	16.30	21.83	15.90	26.33	1.97	2.40	1.43	2.27	6.30	7.70	5.93	10.70
4	ICSV 89030	4.00	2.67	2.67	5.67	5.50	2.50	4.33	2.67	17.57	22.83	18.17	21.33	1.50	2.03	1.50	1.63	6.77	7.30	7.70	8.17
	SBR																				
5	ICSR 89076	2.00	2.67	1.67	6.67	2.17	7.00	8.33	9.00	12.80	18.30	19.77	24.23	1.50	1.93	1.60	1.90	4.37	6.33	7.76	9.73
6	ICSR 90002	3.00	2.67	2.00	4.33	2.17	7.00	6.33	9.00	15.53	14.70	19.23	27.00	1.87	1.63	1.50	2.23	5.33	4.90	7.73	9.57
7	ICSR 90005	3.67	3.00	2.00	6.45	3.67	7.67	6.67	9.00	12.53	21.77	17.60	24.27	1.40	2.10	1.50	1.87	4.67	8.60	7.27	9.67
8	ICSR 90014	2.67	3.33	2.33	9.00	2.83	5.67	5.67	9.00	15.10	18.20	15.20	21.60	1.93	2.13	1.70	1.90	5.83	5.37	5.87	7.63
	PRLR																				
9	ICSR 93031	3.00	1.67	2.00	2.00	6.83	1.67	2.67	1.00	20.97	29.43	25.90	32.00	1.97	2.23	2.07	3.33	8.10	10.03	11.27	13.17
10	ICSR 93011	3.33	1.33	1.33	1.00	7.50	1.67	2.00	1.00	17.67	30.33	25.53	31.83	1.67	2.20	1.67	1.97	6.50	11.63	10.77	13.37
11	ICSR 93009	3.67	1.33	2.00	1.33	7.83	1.67	4.00	1.00	23.57	35.43	26.43	33.67	1.70	2.57	1.67	2.17	9.33	13.00	11.53	14.13
12	ICSR 93010	4.00	1.33	1.33	1.67	6.33	1.67	1.67	1.33	29.10	29.97	27.93	32.23	2.07	2.40	1.77	2.07	11.37	10.93	11.97	14.07

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour				Glossiness				5th Leaf Length (cm)				5th Leaf Width (cm)				Droopiness (cm)			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	CHECKS																				
1	ICSV-705B (R)	1.33	5.00	4.00	2.33	2.00	2.17	1.67	2.67	20.20	25.33	20.00	25.43	2.03	2.33	1.57	2.17	7.73	10.70	8.10	7.97
2	ICSV-708B (R)	3.33	3.00	3.67	3.67	4.17	1.50	2.33	2.00	19.57	21.87	15.80	22.73	1.83	2.20	1.60	1.93	7.37	9.17	6.40	7.20
3	PS-19349B (R)	2.00	4.33	7.00	3.33	1.50	1.83	1.67	1.67	21.03	20.70	16.20	19.03	1.80	1.67	1.07	1.37	8.13	6.13	5.83	7.10
4	296B (S)	1.67	3.67	4.33	8.00	1.67	6.83	7.67	8.33	17.40	17.50	17.10	21.43	2.10	1.90	1.57	1.67	6.17	8.97	7.23	5.53
5	CSH-9 (S)	5.33	5.00	5.33	9.00	5.83	7.50	9.00	8.67	17.57	17.83	14.00	18.87	1.87	2.10	1.00	1.63	6.53	7.23	5.27	6.87
6	IS-18551 (R)	3.00	2.67	4.67	1.00	1.33	1.33	2.33	1.33	21.27	27.40	19.73	24.67	1.87	1.97	1.40	1.97	7.93	9.63	7.97	10.23
7	ICSV-112 (S)	4.33	4.33	2.67	7.67	5.67	6.33	7.33	8.33	15.10	17.27	19.10	26.40	1.67	1.73	1.87	2.63	6.10	10.10	7.47	6.17
8	M-35-1 (R)	3.00	3.67	3.67	1.33	2.50	2.83	2.00	1.33	27.33	25.83	23.90	23.60	2.13	2.10	1.93	1.57	9.80	10.17	10.07	9.17
	Mean	3.47	3.52	3.37	5.30	4.47	4.58	5.15	5.36	17.59	20.74	22.96	17.49	1.84	2.03	1.92	1.53	6.58	7.28	9.14	7.40
	CD(P=0.05)	1.70	1.48	2.30	1.78	1.98	1.65	3.41	2.76	6.67	7.13	3.76	4.96	0.55	0.98	0.51	0.80	2.97	3.05	1.78	2.36

With regard to checks only PS-19349B (resistant) recorded ≤2.00 glossiness in all the four environments, whereas other resistant checks M 35-1 and IS 18551 recorded ≤3.00 in all the four environments. Thus, only the resistant parental lines and the hybrids involving both the resistant parents were more glossy compared to the susceptible parental lines. The hybrids involving either both or one susceptible parent were extremely non glossy. In general, the genotypes were more glossy during rainy season than during postrainy season.

4.2.3 Leaf Parameters

The mean values for leaf characters- (5[th] leaf length, 5[th] leaf width and 5[th] leaf droopiness) of all sorghum genotypes during rainy and postrainy seasons of 1995-96 are given in Table 4.

4.2.3.1 5[th] Leaf Length

The length of 5[th] leaf varied significantly (P=0.05) among the sorghum genotypes. The length of 5[th] leaf varied between 9.95 - 29.10 cm (EIK) and 5.23 - 35.43 cm (EIIK) during rainy season and between 6.80 - 28.23 cm (EIR) and 6.77 - 33.67 cm (EIIR) during postrainy season. The mean lengths for EIK, EIIK, EIR and EIIR were 17.59, 20.74, 22.96 and 17.49 cm respectively. Generally in all genotypes 5[th] leaf length was more in rainy season than in postrainy season (Table 4).

Of all hybrids, SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female parent) showed significantly (P=0.05) longer leaves (≥25.00 cm) in all the four environments compared to the checks and other genotypes in the group. SPSFR 94001A x ICSR 93009 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93011, SPSFPR 94007A x ICSR 93009 and SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89030 (developed on postrainy season-bred resistant female parent) had significantly (P=0.05) longer leaves (≥25.00 cm) in atleast three environments.

Maximum length of $\geq$20.00 cm in all the four environments was observed in SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93009 (developed on rainy season-bred resistant female parent), SPSFPR 94007A x ICSV 712, SPSFPR 94002A x ICSR 93009, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93011 and SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent). Of all genotypes SPSFR 94003A x ICSV 88088, SPSFR 94031A x ICSV 88088, SPSFR 94031A x ICSV 89015, SPSFR 94001A x ICSR 90005, SPSFR 94002A x ICSR 93031, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93011, SPSFR 94003A x ICSR 93010, SPSFR 94031A x ICSR 93011, SPSFR 94001A x ICSR 93011, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSR 93031, SPSFPR 94001A x ICSR 93009, SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSV 89030,SPSFPR 94002A x ICSR 93011, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93009, SPSFPR 94007A x ICSR 93009, SPSFPR 94007A x ICSV 88088 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSR 93031, ICSA 20 x ICSR 93009 and ICSA 20 x ICSR 93010 (developed on susceptible bred female parent) showed $\geq$20.00 cm length in atleast three environments (Table 4).

Among parents, ICSR 93010 (postrainy season-adapted landrace) showed significantly (P=0.05) longer leaves $\geq$25.00 cm in all the four environments. Whereas ICSR 93009, ICSR 93011 and ICSR 93031 (postrainy season-adapted landraces) showed $\geq$25.00 cm length in atleast three environments. SPSFPR 94007B (postrainy season-bred resistant cms line) showed significantly more length ($\geq$20.00 cm) in all the four environments while SPSFR 94001A (rainy season-bred resistant cms line), SPSFPR 94002A and SPSFPR 94005A (postrainy season-bred resistant cms lines) had longer leaves in atleast three environments (Table 4).

Of all checks, only ICSV 705B and M 35-1 (resistant) showed $\geq$20.00 cm leaf length in all the four environments. Generally among parents, resistant bred lines and landraces showed maximum leaf length compared to susceptible lines. Similarly the hybrids involving resistant parents showed maximum leaf length than hybrids involving susceptible lines.

4.2.3.2 5th Leaf Width

Among genotypes the leaf width ranged between 1.30 - 2.87 cm (EIK) and 0.60 - 3.10 cm (EIIK) during rainy season and between 0.43 - 2.23 cm (EIR) and 0.30 - 4.37 cm (EIIR) during postrainy season. The experimental mean values for EIK, EIIK, EIR and EIIR were 1.84 , 2.03 , 1.92 and 1.53 cm respectively (Table 4).

Among hybrids, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent), SPSFR 94001A x ICSR 93031 and SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female parent) showed a maximum width of ≥2.00 cm in all the four environments which differed significantly (P=0.05) from other genotypes. SPSFR 94003A x ICSV 88088, SPSFR 94002A x ICSR 89076, SPSFR 94001A x ICSR 90005, SPSFR 94003A x ICSR 93009, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93031 (developed on rainy season-bred resistant female parent), ICSA 20 x ICSR 89076 (developed on susceptible bred female parent), SPSFPR 94007A x ICSV 712, SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 93009, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x ICSR 93010 and SPSFPR 94007A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed a maximum width of ≥2.00 cm in atleast three environments (Table 4).

Among parents, ICSR 93031 and ICSR 93010 differed (postrainy season-adapted landraces) significantly (P=0.05) from other genotypes and showed a maximum width of ≥2.00 cm in atleast three environments (Table 4).

Among checks, only resistant check, ICSV 705B showed maximum width (≥2.00 cm) in atleast three environments. Thus hybrids involving resistant parental lines showed more leaf width compared to others.

4.2.3.3 5th Leaf Droopiness

Genotypes varied significantly (P=0.05) for leaf droopiness which ranged between 3.33 - 11.37 cm (EIK) and 1.5 - 13.00 cm (EIIK) during rainy season and between 4.18 - 11.97 cm (EIR) and 3.17 - 14.13 cm (EIIR) during postrainy season. Mean drooping depth for EIK, EIIK, EIR and EIIR were 6.58, 7.28, 9.14 and 7.40 cm respectively (Table 4).

Among hybrids, SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female parent) and SPSFPR 94005A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed maximum droopiness of ≥9.00 cm in all the environments. Whereas SPSFR 94031A x ICSV 89015, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93011, SPSFR 94001A x ICSR 93031, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94005A x ICSR 93009, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ISCR 93009 and SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent) showed maximum droopiness of ≥9.00 cm in atleast three environments. SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSR 93031(developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 93009, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 93010 and SPSFPR 94005A x ICSR 93010 (developed on postrainy season-bred resistant female parent) showed droopiness of ≥8.00 cm in all the four environments. SPSFR 94003A x ICSV 88088, SPSFR 94031A x ICSV 88088, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93010, SPSFR 94031A x ICSR 93011, SPSFR 94002A x ICSR 93031 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89030, SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89015, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94005A x ICSR 93011, SPSFPR 94007A x ICSR 93011, and SPSFPR 94001A x ICSR 93009 (developed on postrainy season-bred resistant female parent) showed droopiness of ≥8.00 cm in atleast three environments (Table 4).

Among parents, ICSR 93009 and ICSR 93010 (postrainy season-adapted landraces) showed ≥9.00 cm in all the four environments and ICSR 93011 (postrainy season-adapted landrace) showed ≥9.00 cm in only three environments, whereas ICSR 93031 (postrainy season-adapted landrace) showed maximum droopiness of ≥8.00 cm in all the four environments. SPSFPR 94007A (postrainy season-bred resistant cms line) and ICSV 88088 (resistant bred restorer line) showed ≥8.00 cm in only three environments. Among checks M 35-1 (resistant) only showed maximum droopiness of ≥9.00 cm in all the four environments (Table 4).

Generally, leaf droopiness is more in hybrids involving resistant lines and landrace parental lines. Similarly, among parental lines also resistant and landrace parents showed maximum droopiness compared to the susceptible lines.

4.2.4 Trichome Density

The trichome density (number mm^{-2}) on the AD surface varied between genotypes in both rainy and postrainy seasons. Among the genotypes trichome density varied between 0.00 - 109.19 (EIK) during rainy season and 0.00 - 123.36 (EIR) during postrainy season. When mean trichome density was considered in between rainy and postrainy seasons, the postrainy season trial had a higher number (44.00) than the rainy season trial (35.34) (Table 5).

Among hybrids, SPSFR 94031A x ICSR 90002 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 88088, SPSFPR 94001A x ICSV 89030, SPSFPR 94001A x ICSR 90005 and SPSFPR 94001A x ICSR 93031 (developed on postrainy season-bred resistant female parent) showed ≥100 trichomes mm^{-2} in atleast one environment. The hybrids with trichome density ≥70 in both the environments were SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94001A x ICSR 90014 (developed on postrainy season-bred resistant female parent), SPSFR 94001A x ICSV 712, SPSFR

94001A x ICSR 93009 and SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female parent), and ≥70 trichomes mm^{-2} in atleast one environment were observed in SPSFR 94002A x ICSV 88088, SPSFR 94003A x ICSV 712, SPSFR 94031A x ICSV 712, SPSFR 94001A x ICSV 88088, SPSFR 94001A x ICSR 93031, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSR 93010, SPSFR 94031A x ICSV 88088 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 712, SPSFPR 94005A x ICSV 712, SPSFPR 94005A x ICSV 89015, SPSFPR 94001A x ICSV 89015, SPSFPR 94005A X ICSV 88088, SPSFPR 94005A x ICSR 90002,SPSFPR 94001A x ICSR 93011, SPSFPR 94001A x ICSR 93009, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSV 88088 and ICSA 89004 x ICSV 712 (developed on susceptible bred female parent) (Table 5).

Among parents, ICSV 88088 (resistant bred restorer line) showed ≥100 trichomes mm^{-2} in both the environments, whereas SPSFPR 94001A (postrainy season-bred resistant cms line) and ICSV 712 (resistant bred restorer line) showed ≥100 trichomes mm^{-2} in atleast one environment. Trichome density ≥70 mm^{-2} in atleast one environment was observed among SPSFR 94031A, SPSFR 94001A (rainy season-bred resistant cms line), SPSFPR 94002A (postrainy season - bred resistant cms line) and ICSR 93031 (postrainy season - adapted landrace) (Table 5).

Among checks, only ICSV 708B (resistant) showed ≥100 trichomes mm^{-2} in atleast one environment. The resistant check, IS 18551 was observed to have ≥70 mm^{-2} in both the environments (Plate. 3).

Generally among parents, the rainy season-bred resistant lines had greater trichome density during rainy season than in postrainy season. Similarly the postrainy season-bred resistant lines had more trichomes during postrainy season rather than during rainy season. Interestingly susceptible lines had only very few to nil trichomes during postrainy season compared to rainy season. Similarly hybrids resembled their female parents for trichome density.

Table 5: Mean performance of genotypes for shoot fly parameters associated with shoot fly resistance during rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons, 1995-96

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	RBR cms x RBR hybrids										
1	SPSFR 94002A x ICSV 712	59.21	33.45	2.00	1.56	1.70	1.76	83.67 (66.22)	74.03 (60.22)	70.57 (58.36)	75.75 (61.87)
2	SPSFR 94002A x ICSV 88088	80.23	41.90	1.56	2.23	1.56	1.66	84.29 (67.41)	83.37 (65.93)	59.95 (51.00)	80.13 (63.53)
3	SPSFR 94002A x ICSV 89015	17.04	5.99	2.20	1.53	1.76	1.10	74.32 (59.97)	71.77 (58.10)	80.35 (67.06)	88.73 (70.46)
4	SPSFR 94002A x ICSV 89030	18.37	8.93	1.93	2.76	0.76	1.63	84.04 (66.87)	80.00 (63.78)	72.96 (59.18)	52.12 (46.22)
5	SPSFR 94003A x ICSV 712	36.38	74.29	2.20	1.90	0.33	0.83	93.65 (75.70)	82.67 (65.60	48.97 (44.43)	46.27 (42.78)
6	SPSFR 94003A x ICSV 88088	59.47	65.84	1.86	1.23	0.33	0.96	85.90 (69.14)	79.40 (63.05)	14.93 (22.20)	54.16 (47.41)
7	SPSFR 94003A x ICSV 89015	35.35	44.14	2.36	1.46	1.00	1.60	92.58 (75.23)	90.77 (72.69)	52.03 (46.17)	70.83 (58.25)
8	SPSFR 94003A x ICSV 89030	29.32	32.46	2.13	2.76	0.76	1.36	86.26 (68.25)	81.70 (64.80)	49.06 (44.44)	56.03 (48.54)
9	SPSFR 94001A x ICSV 712	81.30	102.17	2.46	2.03	0.73	1.36	87.57 (70.12)	84.30 (66.68)	55.56 (53.51)	61.35 (51.72)
10	SPSFR 94001A x ICSV 88088	60.43	84.28	1.80	1.56	0.26	0.66	79.79 (63.69)	84.87 (67.55)	26.48 (30.79)	55.24 (48.04)
11	SPSFR 94001A x ICSV 89015	33.51	33.45	1.96	3.06	2.26	1.40	84.43 (68.18)	83.83 (66.33)	100.00 (90.00)	63.27 (52.85)
12	SPSFR 94001A x ICSV 89030	35.20	33.45	1.73	2.43	0.90	1.76	84.40 (66.90)	82.80 (65.74)	65.08 (59.02)	70.06 (57.03)
13	SPSFR 94031A x ICSV 712	96.29	58.56	1.90	1.46	0.66	1.66	87.03 (69.69)	67.67 (55.35)	19.71 (25.96)	75.43 (60.89)
14	SPSFR 94031A x ICSV 88088	58.43	74.85	2.30	1.33	0.53	0.96	73.39 (59.58)	72.40 (58.37)	19.79 (21.89)	44.29 (41.63)
15	SPSFR 94031A x ICSV 89015	63.91	55.92	2.20	1.96	0.46	1.46	89.20 (71.04)	80.03 (63.49)	26.18 (29.98)	59.71 (50.64)
16	SPSFR 94031A x ICSV 89030	25.05	1.23	2.53	1.73	1.50	0.63	84.57 (67.91)	79.77 (63.52)	54.45 (47.70)	49.77 (44.61)
	PRBR cms x RBR hybrids										
17	SPSFPR 94001A x ICSV 712	70.45	67.66	2.20	1.46	0.89	1.26	82.27 (67.20)	75.54 (60.59)	64.38 (58.66)	65.44 (54.79)
18	SPSFPR 94001A x ICSV 88088	54.12	109.67	2.13	2.20	0.83	1.26	84.29 (66.94)	88.60 (71.33)	35.96 (36.80)	66.81 (54.87)
19	SPSFPR 94001A x ICSV 89015	15.19	90.45	2.50	1.63	0.70	1.83	95.14 (77.39)	79.63 (65.08)	33.65 (35.19)	61.70 (51.80)
20	SPSFPR 94001A x ICSV 89030	14.15	121.49	2.43	2.50	1.70	1.66	93.69 (75.97)	83.48 (66.61)	79.65 (67.92)	86.83 (68.86)
21	SPSFPR 94002A x ICSV 712	81.61	90.02	1.96	1.50	0.66	1.63	87.50 (70.16)	77.03 (61.55)	33.26 (34.23)	56.22 (48.67)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
22	SPSFPR 94002A x ICSV 88088	73.46	86.31	1.50	1.66	0.63	0.60	81.73 (65.42)	73.43 (59.07)	26.53 (30.97)	49.88 (44.92)
23	SPSFPR 94002A x ICSV 89015	63.13	52.85	2.46	3.06	1.03	0.76	86.89 (69.59)	82.93 (65.96)	58.31 (50.18)	52.23 (46.28)
24	SPSFPR 94002A x ICSV 89030	31.85	40.39	1.40	1.36	0.46	1.46	84.68 (67.16)	76.33 (60.97)	41.27 (39.80)	52.81 (46.69)
25	SPSFPR 94005A x ICSV 712	61.08	72.76	2.40	2.40	1.50	1.23	86.83 (69.36)	83.13 (65.80)	53.39 (46.95)	62.59 (52.29)
26	SPSFPR 94005A x ICSV 88088	54.55	96.19	1.73	1.80	0.83	2.10	85.80 (68.19)	71.93 (58.05)	38.82 (38.31)	69.87 (58.18)
27	SPSFPR 94005A x ICSV 89015	72.33	52.72	2.60	1.90	0.36	2.85	92.19 (74.05)	83.83 (66.89)	36.78 (37.29)	55.56 (48.25)
28	SPSFPR 94005A x ICSV 89030	23.80	15.77	1.80	2.63	1.13	1.93	87.01 (69.34)	82.43 (65.41)	51.64 (45.94)	79.57 (63.26)
29	SPSFPR 94007A x ICSV 712	63.21	68.24	2.61	1.36	0.66	1.46	91.61 (76.53)	78.60 (62.55)	30.01 (33.15)	63.76 (53.14)
30	SPSFPR 94007A x ICSV 88088	66.23	69.15	2.10	2.13	0.53	0.86	73.51 (59.44)	57.03 (49.34)	39.22 (38.61)	46.06 (42.69)
31	SPSFPR 94007A x ICSV 89015	4.22	0.00	1.40	2.13	1.10	1.76	82.40 (65.20)	75.63 (61.09)	37.71 (37.73)	69.58 (57.27)
32	SPSFPR 94007A x ICSV 89030	47.36	44.27	1.76	2.23	0.60	1.30	87.60 (69.38)	79.33 (64.03)	34.56 (35.81)	72.38 (58.67)
	SB cms x RBR hybrids										
33	ICSA 20 x ICSV 712	35.35	46.23	3.56	2.83	1.53	1.23	97.25 (80.52)	14.53 (76.52)	58.33 (55.00)	88.43 (71.62)
34	ICSA 20 x ICSV 88088	35.35	89.58	4.13	2.40	1.43	1.50	94.20 (76.13)	94.10 (76.02)	59.45 (50.48)	80.12 (63.67)
35	ICSA 20 x ICSV 89015	35.35	8.85	3.60	5.03	1.40	1.93	95.36 (78.12)	94.90 (76.96)	64.08 (53.41)	85.09 (67.78)
36	ICSA 20 x ICSV 89030	2.04	4.55	3.53	2.90	1.53	2.60	95.61 (80.30)	96.20 (79.18)	60.36 (51.07)	77.80 (62.61)
37	ICSA 89001 x ICSV 712	14.81	1.23	1.93	2.76	2.63	1.56	93.95 (76.22)	94.13 (76.51)	69.03 (56.26)	87.03 (68.93)
38	ICSA 89001 x ICSV 88088	26.76	1.23	3.26	3.03	2.60	1.00	92.95 (75.10)	92.97 (75.15)	56.88 (49.09)	83.33 (75.00)
39	ICSA 89001 x ICSV 89015	35.35	0.54	3.76	3.40	3.20	1.36	97.72 (83.19)	95.27 (77.90)	78.33 (67.10)	90.60 (72.54)
40	ICSA 89001 x ICSV 89030	35.35	0.00	2.27	3.36	3.36	1.46	95.24 (82.60)	89.53 (71.31)	54.55 (47.67)	42.25 (74.06)
41	ICSA 89004 x ICSV 712	79.96	40.08	2.47	3.10	1.26	2.06	95.44 (78.13)	96.93 (80.65)	59.69 (50.92)	87.43 (74.71)
42	ICSA 89004 x ICSV 88088	23.12	38.08	2.43	2.66	1.93	2.33	97.85 (85.10)	93.50 (75.38)	60.02 (51.36)	89.87 (74.71)
43	ICSA 89004 x ICSV 89015	35.35	8.84	3.26	2.26	1.20	1.50	95.83 (83.10)	90.93 (73.09)	54.65 (47.73)	87.83 (70.40)
44	ICSA 89004 x ICSV 89030	26.31	1.29	3.16	2.26	2.26	1.93	96.05 (78.66)	96.40 (79.41)	59.83 (51.94)	83.51 (66.27)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
45	ICSA 90002 x ICSV 712	21.35	43.90	2.83	3.86	2.76	2.30	88.39 (70.95)	90.43 (72.63)	60.73 (51.55)	91.20 (75.81)
46	ICSA 90002 x ICSV 88088	34.90	36.45	3.40	4.06	1.90	1.43	91.51 (73.33)	91.10 (72.83)	49.00 (44.27)	81.86 (64.85)
47	ICSA 90002 x ICSV 89015	0.00	3.37	2.86	4.70	1.83	1.73	98.08 (83.48)	95.67 (80.37)	63.92 (53.19)	82.14 (65.30)
48	ICSA 90002 x ICSV 89030	0.00	33.45	3.13	2.90	3.60	2.00	94.99 (77.11)	92.00 (74.24)	74.17 (64.34)	89.16 (71.08)
	RBR cms x SBR										
49	SPSFR 94002A x ICSR 89076	0.00	2.60	3.96	3.20	2.38	2.23	93.09 (77.57)	90.80 (72.69)	69.88 (61.99)	86.83 (68.83)
50	SPSFR 94002A x ICSR 90002	35.35	2.63	5.10	2.70	2.90	1.76	93.15 (77.99)	93.63 (76.01)	47.13 (43.35)	91.67 (76.20)
51	SPSFR 94002A x ICSR 90005	9.45	1.23	3.10	2.63	1.93	1.46	85.89 (69.64)	91.29 (73.09)	62.96 (53.03)	80.05 (63.56)
52	SPSFR 94002A x ICSR 90014	30.13	7.22	2.56	3.73	2.76	1.90	93.06 (77.51)	96.63 (79.59)	73.87 (59.85)	79.60 (63.62)
53	SPSFR 94003A x ICSR 89076	35.46	30.16	2.43	1.80	2.03	1.33	96.13 (79.10)	84.83 (67.11)	55.88 (48.41)	64.98 (53.76)
54	SPSFR 94003A x ICSR 90002	1.92	44.26	2.46	2.10	0.23	0.70	96.30 (79.16)	92.57 (74.36)	33.44 (34.42)	33.27 (35.01)
55	SPSFR 94003A x ICSR 90005	35.35	1.77	0.16	3.26	2.76	2.10	9.48 (73.11)	92.10 (73.70)	74.88 (64.85)	86.04 (68.13)
56	SPSFR 94003A x ICSR 90014	0.88	0.54	3.50	2.36	2.03	1.43	87.61 (69.55)	88.70 (70.65)	49.52 (44.72)	86.74 (69.37)
57	SPSFR 94001A x ICSR 89076	60.86	33.45	0.93	2.74	2.56	1.26	88.03 (70.11)	83.10 (65.67)	61.11 (56.75)	63.60 (53.16)
58	SPSFR 94001A x ICSR 90002	35.35	1.29	2.23	3.72	2.63	1.76	100.00 (90.00)	93.08 (79.13)	50.61 (45.44)	100.00 (90.00)
59	SPSFR 94001A x ICSR 90005	35.35	33.45	3.63	2.43	2.36	1.57	96.17 (78.95)	94.83 (77.31)	83.64 (66.24)	83.33 (75.00)
60	SPSFR 94001A x ICSR 90014	10.78	30.69	2.80	4.33	2.90	1.13	95.17 (79.67)	90.50 (72.48)	48.72 (44.05)	64.81 (54.57)
61	SPSFR 94031A x ICSR 89076	31.02	27.85	3.26	3.26	2.23	2.20	92.50 (74.50)	84.27 (66.84)	69.59 (57.33)	94.44 (81.97)
62	SPSFR 94031A x ICSR 90002	42.60	120.28	1.90	1.30	2.10	1.60	87.65 (73.19)	86.27 (68.83)	64.73 (53.70)	85.84 (67.98)
63	SPSFR 94031A x ICSR 90005	6.25	0.54	3.16	2.10	1.30	1.10	90.47 (72.41)	94.17 (76.49)	58.33 (50.00)	80.86 (64.73)
64	SPSFR 94031A x ICSR 90014	42.91	4.27	2.10	1.96	1.76	1.50	90.05 (71.81)	87.10 (69.67)	54.20 (47.42)	70.83 (57.39)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRBR cms x SBR hybrids										
65	SPSFPR 94001A x ICSR 89076	50.84	33.45	2.33	4.06	2.00	1.20	91.17 (74.66)	72.67 (74.36)	58.25 (49.77)	77.78 (71.75)
66	SPSFPR 94001A x ICSR 90002	63.76	40.50	3.83	2.40	1.76	1.00	94.12 (76.33)	89.28 (71.19)	74.73 (60.33)	66.83 (54.86)
67	SPSFPR 94001A x ICSR 90005	26.37	114.38	3.00	12.46	0.73	1.76	93.21 (75.14)	90.63 (72.51)	34.96 (36.23)	56.45 (49.31)
68	SPSFPR 94001A x ICSR 90014	83.72	112.55	2.63	1.93	1.36	1.53	96.40 (79.21)	89.30 (71.39)	42.14 (40.48)	57.33 (49.34)
69	SPSFPR 94002A x ICSR 89076	35.35	52.42	2.43	3.03	0.73	1.76	92.05 (74.18)	91.57 (73.36)	55.45 (48.15)	67.08 (55.19)
70	SPSFPR 94002A x ICSR 90002	0.73	66.07	3.90	2.60	0.46	1.53	95.28 (77.98)	89.37 (71.91)	35.00 (35.83)	82.95 (66.34)
71	SPSFPR 94002A x ICSR 90005	1.81	18.87	2.46	2.80	1.40	2.03	96.92 (79.98)	93.77 (75.64)	38.58 (38.15)	76.23 (60.98)
72	SPSFPR 94002A x ICSR 90014	35.35	1.77	2.90	3.23	1.86	1.60	99.07 (86.80)	94.77 (77.50)	68.81 (56.85)	83.32 (66.11)
73	SPSFPR 94005A x ICSR 89076	1.03	2.30	3.16	3.56	2.46	1.90	95.34 (77.57)	92.53 (74.17)	67.66 (55.63)	79.62 (64.45)
74	SPSFPR 94005A x ICSR 90002	93.50	3.37	3.50	3.03	1.86	2.06	96.00 (83.24)	93.47 (75.35)	90.21 (75.46)	86.60 (69.03)
75	SPSFPR 94005A x ICSR 90005	9.21	0.00	2.56	3.76	4.06	1.56	91.37 (76.28)	93.53 (75.31)	80.78 (64.95)	48.76 (44.31)
76	SPSFPR 94005A x ICSR 90014	0.93	11.15	3.03	3.00	1.60	1.90	95.14 (77.44)	86.53 (71.12)	40.21 (39.32)	78.04 (62.34)
77	SPSFPR 94007A x ICSR 89076	0.00	0.00	3.03	3.53	0.66	1.23	92.74 (74.78)	89.97 (72.36)	45.40 (42.31)	94.44 (81.97)
78	SPSFPR 94007A x ICSR 90002	5.36	0.54	2.06	2.83	0.63	0.70	86.06 (68.37)	94.53 (76.57)	24.38 (28.80)	38.77 (38.18)
79	SPSFPR 94007A x ICSR 90005	16.18	0.54	2.23	2.53	1.06	1.56	93.56 (75.32)	91.10 (72.79)	44.03 (41.45)	62.27 (52.53)
80	SPSFPR 94007A x ICSR 90014	9.93	35.14	2.46	2.13	1.10	1.16	89.32 (71.13)	92.97 (74.74)	46.28 (47.86)	54.10 (47.47)
	SB cms x SBR hybrids										
81	ICSA 20 x ICSR 89076	1.92	0.00	5.46	2.96	2.83	2.23	97.74 (81.52)	93.37 (75.14)	59.27 (50.75)	78.98 (63.56)
82	ICSA 20 x ICSR 90002	14.15	0.00	3.40	3.06	1.86	2.50	95.93 (78.38)	94.60 (76.73)	67.30 (55.61)	91.84 (76.45)
83	ICSA 20 x ICSR 90005	35.35	0.00	4.93	2.70	0.76	2.13	93.40 (75.43)	96.93 (80.20)	48.51 (44.01)	82.87 (65.57)
84	ICSA 20 x ICSR 90014	3.39	3.37	2.76	3.70	2.46	1.96	92.68 (74.34)	94.93 (77.36)	73.97 (59.97)	78.53 (63.00)
85	ICSA 89001 x ICSR 89076	12.65	1.29	2.80	3.96	3.10	1.43	94.44 (81.97)	93.97 (76.06)	73.15 (63.74)	83.25 (66.72)
86	ICSA 89001 x ICSR 90002	35.35	26.40	1.88	2.21	2.60	1.43	93.27 (77.95)	84.14 (67.97)	71.95 (63.05)	89.56 (71.16)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^2)		Egg count $plant^{-1}$				Deadheart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
87	ICSA 89001 x ICSR 90005	3.39	33.45	2.36	2.50	1.50	1.73	99.51 (87.68)	91.37 (73.51)	90.56 (72.41)	91.41 (74.41)
88	ICSA 89001 x ICSR 90014	35.35	1.77	1.99	2.00	3.10	1.83	92.46 (77.00)	46.53 (42.88)	69.40 (61.77)	96.26 (80.95)
89	ICSA 89004 x ICSR 89076	35.35	33.45	3.40	2.10	2.80	1.73	95.26 (79.69)	94.77 (77.27)	64.76 (55.03)	90.57 (72.73)
90	ICSA 89004 x ICSR 90002	35.35	0.54	2.76	3.63	1.66	1.40	92.44 (75.22)	96.03 (78.64)	78.03 (62.27)	87.66 (69.51)
91	ICSA 89004 x ICSR 90005	0.10	0.00	3.76	2.66	2.13	2.00	96.15 (78.79)	94.57 (76.66)	76.56 (62.80)	73.48 (59.53)
92	ICSA 89004 x ICSR 90014	6.27	20.43	3.50	2.50	2.20	2.03	89.81 (72.19)	93.27 (75.34)	74.05 (60.48)	93.22 (77.85)
93	ICSA 90002 x ICSR 89076	17.78	33.45	2.90	2.66	2.90	1.46	90.52 (73.92)	93.53 (75.77)	96.83 (84.01)	79.22 (65.42)
94	ICSA 90002 x ICSR 90002	5.66	0.54	4.13	3.90	1.90	1.16	95.57 (77.93)	93.67 (75.48)	70.34 (57.51)	75.96 (61.11)
95	ICSA 90002 x ICSR 90005	59.32	0.91	3.13	4.26	2.80	2.30	96.59 (83.78)	95.33 (78.02)	67.56 (55.71)	88.26 (70.22)
96	ICSA 90002 x ICSR 90014	1.92	1.23	3.90	3.60	1.90	1.83	94.35 (77.67)	95.20 (77.91)	56.59 (49.11)	83.88 (66.90)
	RBR cms x PRLR hybrids										
97	SPSFR 94002A x ICSR 93031	50.76	0.54	1.93	1.23	1.70	1.83	86.87 (68.95)	76.50 (61.06)	48.93 (44.36)	89.61 (71.22)
98	SPSFR 94002A x ICSR 93011	34.68	21.83	2.33	2.00	0.70	1.16	90.26 (72.07)	79.60 (63.17)	43.08 (40.91)	67.43 (55.36)
99	SPSFR 94002A x ICSR 93009	38.73	41.61	1.43	1.93	2.33	1.10	75.25 (60.66)	84.47 (66.83)	62.81 (53.26)	55.46 (48.14)
100	SPSFR 94002A x ICSR 93010	49.76	33.45	1.90	2.26	2.16	1.20	87.27 (69.19)	92.30 (74.26)	61.11 (51.49)	77.06 (62.19)
101	SPSFR 94003A x ICSR 93031	57.16	44.30	1.36	2.06	0.23	1.06	82.13 (65.78)	83.87 (66.34)	20.31 (25.67)	41.90 (40.24)
102	SPSFR 94003A x ICSR 93011	30.15	28.87	2.03	2.33	0.80	1.23	90.47 (73.57)	79.97 (63.73)	37.62 (37.50)	60.96 (51.44)
103	SPSFR 94003A x ICSR 93009	27.71	13.33	2.70	2.06	0.70	1.70	89.54 (71.29)	87.70 (69.56)	42.28 (40.41)	81.96 (66.19)
104	SPSFR 94003A x ICSR 93010	56.73	54.03	2.96	2.20	0.70	2.06	91.00 (72.90)	81.90 (64.86)	29.59 (32.89)	76.61 (61.18)
105	SPSFR 94001A x ICSR 93031	46.71	73.77	2.00	1.63	0.56	0.80	81.18 (64.63)	81.10 (64.40)	45.11 (42.02)	57.55 (49.61)
106	SPSFR 94001A x ICSR 93011	19.26	57.82	2.33	2.53	0.93	1.80	89.42 (71.87)	62.13 (52.43)	50.37 (45.26)	72.78 (60.01)
107	SPSFR 94001A x ICSR 93009	89.45	77.86	2.06	2.23	0.86	0.86	82.68 (65.50)	74.33 (59.85)	17.55 (24.34)	65.66 (54.33)
108	SPSFR 94001A x ICSR 93010	46.93	55.86	2.33	1.33	0.63	0.76	91.35 (72.91)	74.57 (59.77)	26.50 (30.53)	61.02 (51.44)
109	SPSFR 94031A x ICSR 93031	59.74	54.42	1.80	1.43	0.60	1.00	77.89 (62.11)	73.93 (59.67)	29.21 (32.61)	44.44 (41.69)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
110	SPSFR 94031A x ICSR 93011	54.51	31.54	1.80	1.83	0.63	1.30	86.76 (68.83)	80.63 (64.05)	26.23 (29.57)	55.99 (48.71)
111	SPSFR 94031A x ICSR 93009	42.74	74.42	1.90	1.23	0.46	1.50	80.79 (65.00)	65.60 (54.15)	25.04 (29.63)	67.19 (55.17)
112	SPSFR 94031A x ICSR 93010	71.50	59.64	2.33	1.50	0.43	1.33	85.87 (68.09)	73.07 (58.79)	25.91 (28.99)	71.42 (57.87)
	PRBR cms x PRLR										
113	SPSFPR 94001A x ICSR 93031	29.00	108.06	3.30	2.40	0.76	0.86	97.87 (85.12)	90.33 (72.11)	38.65 (38.28)	70.08 (57.23)
114	SPSFPR 94001A x ICSR 93011	44.83	85.53	1.80	2.06	0.60	1.16	81.25 (64.68)	87.97 (69.71)	43.62 (41.16)	53.33 (116.92)
115	SPSFPR 94001A x ICSR 93009	73.36	21.61	2.36	2.36	1.10	1.33	87.97 (69.75)	82.40 (65.91)	51.85 (46.06)	78.12 (62.12)
116	SPSFPR 94001A x ICSR 93010	75.55	86.89	2.46	2.26	1.33	0.45	81.38 (65.88)	88.43 (70.37)	38.20 (38.38)	66.67 (60.00)
117	SPSFPR 94002A x ICSR 93031	55.14	33.64	2.83	1.56	0.93	1.43	88.09 (69.92)	77.90 (62.04)	39.96 (38.22)	72.65 (58.62)
118	SPSFPR 94002A x ICSR 93011	55.42	60.56	1.96	2.13	0.89	1.03	89.70 (71.32)	74.50 (59.70)	46.79 (42.94)	64.45 (53.41)
119	SPSFPR 94002A x ICSR 93009	41.91	65.57	1.16	1.33	0.96	1.48	85.18 (67.38)	72.33 (58.29)	41.75 (40.18)	100.00 (90.00)
120	SPSFPR 94002A x ICSR 93010	57.08	76.77	1.53	1.56	0.20	1.26	82.65 (66.58)	84.23 (66.62)	9.23 (16.89)	58.27 (49.78)
121	SPSFPR 94005A x ICSR 93031	44.75	48.38	1.70	1.53	0.43	1.26	84.95 (67.53)	80.67 (63.94)	26.99 (30.34)	65.19 (54.02)
122	SPSFPR 94005A x ICSR 93011	54.87	51.44	2.36	1.50	0.76	2.26	86.80 (68.67)	75.30 (60.28)	26.47 (30.59)	68.60 (56.21)
123	SPSFPR 94005A x ICSR 93009	38.90	50.28	1.40	1.70	0.76	1.50	91.88 (73.45)	72.83 (59.65)	46.30 (42.87)	75.51 (60.58)
124	SPSFPR 94005A x ICSR 93010	35.50	40.07	1.80	2.00	0.36	1.36	89.82 (71.42)	85.87 (67.97)	28.03 (31.07)	65.11 (54.13)
125	SPSFPR 94007A x ICSR 93031	48.97	43.79	2.10	1.53	0.56	1.03	88.48 (70.25)	64.67 (53.69)	48.26 (43.93)	62.23 (52.20)
126	SPSFPR 94007A x ICSR 93011	6.18	12.68	2.36	1.90	0.33	1.00	86.71 (68.64)	79.27 (63.08)	30.17 (32.83)	67.42 (55.19)
127	SPSFPR 94007A x ICSR 93009	6.49	14.42	2.46	2.30	1.03	0.96	92.52 (74.13)	80.03 (63.69)	34.22 (35.39)	62.40 (52.56)
128	SPSFPR 94007A x ICSR 93010	8.01	4.62	3.16	2.16	1.10	1.26	93.01 (75.15)	82.50 (65.67)	55.66 (48.31)	45.93 (42.57)
	SB cms x PRLR hybrids										
129	ICSA 20 x ICSR 93031	6.86	3.14	2.56	2.66	1.73	1.90	92.13 (73.98)	94.83 (77.31)	75.12 (60.23)	90.90 (72.84)
130	ICSA 20 x ICSR 93011	18.29	3.22	3.10	3.13	1.70	1.36	93.67 (76.26)	84.03 (68.43)	60.77 (51.39)	80.41 (63.82)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count plant^{-1}				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
131	ICSA 20 x ICSR 93009	2.04	1.77	3.86	3.36	1.26	2.00	94.50 (76.71)	95.70 (78.09)	52.08 (46.19)	89.71 (71.35)
132	ICSA 20 x ICSR 93010	2.72	12.07	3.46	3.83	1.83	0.11	94.03 (78.39)	91.87 (74.01)	55.63 (48.30)	100.00 (90.00)
133	ICSA 89001 x ICSR 93031	2.04	2.60	2.49	3.40	2.13	1.16	83.33 (75.00)	42.18 (33.37)	83.62 (70.19)	85.43 (67.57)
134	ICSA 89001 x ICSR 93011	1.81	0.00	2.86	3.13	2.10	2.06	86.71 (69.73)	91.99 (74.12)	66.13 (55.11)	62.33 (53.00)
135	ICSA 89001 x ICSR 93009	35.35	33.45	1.83	3.56	2.53	1.76	84.60 (71.70)	85.39 (69.46)	71.56 (62.90)	88.32 (74.07)
136	ICSA 89001 x ICSR 93010	53.19	0.00	3.06	2.73	2.26	2.16	92.11 (73.79)	91.97 (74.57)	48.79 (43.95)	95.98 (78.65)
137	ICSA 89004 x ICSR 93031	12.94	22.79	3.60	3.33	1.40	2.06	98.40 (84.10)	94.67 (76.95)	67.12 (55.20)	83.13 (66.24)
138	ICSA 89004 x ICSR 93011	10.89	1.77	3.46	2.73	2.36	1.86	91.30 (73.14)	95.17 (77.64)	81.02 (64.34)	81.51 (65.11)
139	ICSA 89004 x ICSR 93009	35.35	23.70	1.54	2.57	2.93	2.60	80.00 (68.86)	69.69 (57.18)	60.35 (51.69)	91.99 (73.78)
140	ICSA 89004 x ICSR 93010	3.99	0.00	3.16	2.56	1.23	1.30	92.68 (74.64)	92.99 (74.60)	38.67 (38.09)	74.20 (59.95)
141	ICSA 90002 x ICSR 93031	2.61	1.77	3.66	2.83	1.46	1.90	93.13 (75.71)	89.90 (71.58)	80.39 (64.04)	67.29 (55.70)
142	ICSA 90002 x ICSR 93011	6.40	0.00	2.90	3.03	1.60	1.58	93.04 (74.91)	92.90 (75.28)	75.21 (60.77)	100.00 (90.00)
143	ICSA 90002 x ICSR 93009	5.03	1.29	4.93	2.30	2.26	2.03	96.68 (81.48)	85.23 (68.17)	58.14 (49.76)	89.07 (74.09)
144	ICSA 90002 x ICSR 93010	0.62	18.45	3.33	3.56	1.76	1.96	91.05 (72.76)	91.90 (74.47)	71.71 (58.44)	100.00 (90.00)
	LINES										
	RBR cms										
1	SPSFR 94002A	51.66	16.47	1.10	1.26	0.30	1.03	62.82 (52.56)	55.10 (47.97)	10.15 (16.87)	40.28 (38.85)
2	SPSFR 94003A	46.27	43.03	1.27	1.16	0.10	0.66	85.16 (67.39)	68.17 (55.72)	10.50 (17.17)	33.09 (34.95)
3	SPSFR 94001A	80.60	63.38	1.43	1.60	0.40	1.16	74.32 (60.10)	69.40 (56.44)	26.43 (30.72)	45.81 (42.49)
4	SPSFR 94031A	70.98	43.27	2.23	1.50	0.36	0.96	70.09 (57.03)	71.07 (57.59)	18.52 (24.39)	32.63 (34.26)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count plant^{-1}				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRBR cms										
5	SPSFPR 94001A	34.19	116.44	1.33	2.26	0.93	0.96	87.18 (72.73)	74.60 (60.23)	57.03 (49.17)	51.59 (45.94)
6	SPSFPR 94002A	43.83	78.73	2.03	0.93	0.23	1.30	82.50 (65.74)	74.87 (59.98)	30.06 (30.82)	47.56 (43.59)
7	SPSFPR 94005A	20.56	29.54	1.43	1.36	0.73	0.90	86.56 (68.60)	65.97 (54.78)	33.97 (35.53)	51.26 (45.73)
8	SPSFPR 94007A	18.99	0.00	1.77	1.63	0.23	0.86	72.06 (58.39)	75.20 (60.19)	31.30 (33.95)	50.63 (45.36)
	SB cms										
9	ICSA 20	7.55	0.00	3.50	4.40	1.80	1.93	96.21 (79.02)	97.80 (81.52)	54.55 (47.80)	83.01 (66.03)
10	ICSA 89001	35.35	1.23	3.53	3.46	2.00	1.13	96.23 (78.89)	91.67 (74.31)	58.89 (50.18)	63.55 (52.86)
11	ICSA 89004	2.04	0.54	3.50	2.36	2.10	1.36	96.95 (79.99)	96.47 (79.27)	60.72 (51.26)	82.85 (66.60)
12	ICSA 90002	16.51	3.37	2.50	3.10	1.70	1.96	94.90 (77.07)	88.57 (71.80)	84.83 (67.73)	76.17 (64.26)
	TESTERS										
	RBR										
1	ICSV 712	109.19	83.70	2.07	1.66	0.23	0.76	84.40 (67.28)	70.23 (57.01)	17.95 (21.64)	49.46 (44.69)
2	ICSV 88088	105.42	119.52	1.47	0.96	0.70	1.00	74.48 (59.78)	55.97 (48.42)	14.81 (20.59)	42.03 (40.36)
3	ICSV 89015	45.34	35.34	1.77	1.60	0.93	0.93	90.48 (72.66)	88.40 (70.16)	45.47 (42.35)	55.31 (48.10)
4	ICSV 89030	29.41	42.61	1.63	1.53	9.90	0.63	90.10 (72.02)	77.67 (62.49)	36.91 (37.26)	60.38 (51.77)
	SBR										
5	ICSR 89076	2.04	0.00	2.90	2.36	2.56	1.50	98.92 (85.14)	94.57 (76.81)	81.23 (64.36)	85.38 (68.05)
6	ICSR 90002	2.04	0.00	1.77	2.33	2.50	2.80	95.39 (80.02)	86.13 (69.43)	61.32 (51.80)	85.99 (72.68)
7	ICSR 90005	48.08	0.00	2.77	3.00	2.46	1.36	89.93 (74.51)	93.20 (74.95)	77.10 (62.48)	76.74 (61.23)
8	ICSR 90014	33.35	0.00	2.90	2.56	1.93	2.26	94.36 (76.26)	96.40 (79.41)	69.02 (56.32)	76.01 (60.83)

Contd...

Contd..

S.No.	Genotypes	Trichome density (mm^{-2})		Egg count $plant^{-1}$				Dead heart (%)			
		EIK	EIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRLR										
9	ICSR 93031	50.98	78.17	1.60	0.96	0.60	1.30	92.85 (74.94)	69.40 (56.59)	18.93 (25.59)	55.56 (48.23)
10	ICSR 93011	46.14	20.89	1.93	1.36	0.86	1.50	92.59 (77.14)	81.13 (64.30)	30.33 (32.68)	49.19 (44.44)
11	ICSR 93009	52.34	52.39	1.30	1.40	0.23	1.40	85.27 (67.51)	80.50 (63.85)	40.41 (39.47)	50.18 (45.12)
12	ICSR 93010	42.36	44.04	1.33	1.50	0.33	1.50	75.66 (60.67)	81.10 (64.89)	21.56 (27.34)	56.65 (48.86)
	CHECKS										
1	ICSV-705B (R)	62.61	43.90	1.40	1.10	0.36	1.26	69.52 (56.67)	52.10 (42.23)	20.17 (26.69)	48.02 (43.64)
2	ICSV-708B (R)	41.06	123.36	1.47	1.10	0.26	1.06	87.62 (69.74)	71.67 (57.91)	11.37 (19.27)	43.66 (41.29)
3	PS-19349B (R)	29.00	24.62	1.50	1.00	0.36	0.53	73.74 (59.49)	68.90 (56.26)	31.72 (34.22)	42.22 (40.52)
4	296B (S)	60.83	1.77	2.50	2.90	1.70	2.23	90.67 (72.40)	95.93 (78.48)	65.52 (54.46)	84.00 (67.74)
5	CSH-9 (S)	35.35	2.60	2.86	2.93	2.16	1.70	93.28 (75.23)	95.23 (77.63)	72.61 (63.51)	65.83 (54.34)
6	IS-18551 (R)	74.24	83.44	1.70	1.36	0.83	0.83	68.01 (85.71)	53.93 (47.27)	59.06 (51.12)	34.46 (35.93)
7	ICSV-112 (S)	23.01	0.54	3.76	3.60	2.36	1.93	92.19 (75.25)	91.73 (74.13)	66.28 (54.94)	78.04 (62.57)
8	M-35-1 (R)	42.62	58.78	1.66	1.46	1.16	1.16	73.56 (59.86)	63.57 (53.12)	54.93 (52.91)	70.36 (58.38)
	Mean	35.34	44.00	2.52	2.42	1.43	1.49	89.17	84.17	69.79	70.60
	CD(P=0.05)	90.07	92.22	1.45	1.60	1.14	0.90	12.07	6.57	28.58	21.12

Figures in parenthesis are angular transformed values

4.2.5 Egg Count

The number of shoot fly eggs varied among genotypes and also from rainy season to postrainy season (Table 5). The oviposition values varied between 0.16 - 5.46 (EIK) and 0.93 - 12.46 (EIIK) during rainy season and between 0.10 - 9.90 (EIR) and 0.11 - 2.85 (EIIR) during postrainy season. The mean oviposition values for EIK, EIIK, EIR and EIIR were 2.52, 2.42, 1.43 and 1.49 respectively.

Among hybrids, SPSFR 94002A x ICSV 712, SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 88088, SPSFR 94002A x ICSR 93031, SPSFR 94001A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSV 712 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89030, SPSFPR 94002A x ICSR 93009, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x ICSR 93009 and SPSFPR 94005A x ICSR 93010 (developed on postrainy season-bred resistant female parent) recorded ≤2.00 eggs plant^{-1} in all the four environments. Whereas ≤2.00 eggs plant^{-1} in atleast three environments were observed among SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89015, SPSFR 94002A x ICSV 89030, SPSFR 94003A x ICSV 712, SPSFR 94003A x ICSV 89015, SPSFR 94001A x ICSV 89030, SPSFR 94031A x ICSV 88088, SPSFR 94031A x ICSR 90002, SPSFR 94002A x ICSR 93011, SPSFR 94002A x ICSR 93009, SPSFR 94003A x ICSR 93031, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93010, SPSFR 94031A x ICSR 90014, SPSFR 94031A x ICSV 89015, SPSFR 94031A x ICSV 89030 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 712, SPSFPR 94001A x ICSV 89015, SPSFPR 94005A x ICSV 88088, SPSFPR 94005A x ICSV 89030, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSV 89015, SPSFPR 94007A x ICSV 89030, SPSFPR 94001A x ICSR 90014, SPSFPR 94001A x ICSR 93011, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female parent) and ICSA 89001 x ICSR 90014 (developed on susceptible bred female parent) (Table 5).

Among parents, SPSFR 94002A, SPSFR 94003A, SPSFR 94001A (rainy season-bred resistant cms lines), SPSFPR 94005A, SPSFPR 94007A (postrainy season-bred resistant cms lines), ICSV 88088, ICSV 89015, ICSV 89030 (resistant bred restorer lines), ICSR 93031, ICSR 93011, ICSR 93009 and ICSR 93010 (postrainy season-adapted landraces) recorded $\leq$2.00 eggs plant^{-1} in all the four environments. Whereas SPSFR 94031A (rainy season-bred resistant cms line), SPSFPR 94001A, SPSFPR 94002A (postrainy season-bred resistant cms lines) and ICSV 712 (resistant bred restorer line) showed $\leq$2.00 eggs plant^{-1} in atleast three environments (Table 5).

Among checks, ICSV-705B, ICSV-708B, PS-19349B, IS-18551 and M 35-1 (resistant) recorded $\leq$2.00 eggs plant^{-1} in all the four environments. The data clearly indicated that the hybrids which involved susceptible parents were in general preferred for egg laying in comparision to the hybrids which were obtained from crossing both the resistant parents and this was more evident during the postrainy season than in rainy season.

4.2.6 Deadhearts

During postrainy season, deadheart percentages significantly differed among the genotypes (Table 5) compared to the rainy season. However, in the rainy season no significant differences were observed in deadhearts among genotypes and the deadheart percentage ranged as high as 9.48 - 100.00 (EIK) and 14.53 - 97.80 (EIIK) compared to 9.23 - 100.00 (EIR) and 32.63 - 100.00 (EIIR) during postrainy season. The experimental mean values were 89.17, 84.17, 69.79 and 70.60 for EIK, EIIK, EIR and EIIR respectively.

During rainy season, among hybrids SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89015, SPSFR 94001A x ICSV 88088, SPSFR 94001A x ICSV 89030, SPSFR 94002A x ICSV 89030, SPSFR 94001A x ICSV 89015,SPSFR 94002A x ICSR 93009, SPSFR 94003A x ICSR 93031, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSV 88088, SPSFR 94031A x ICSV 89030 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89030, SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89015, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031 (developed on postrainy season-bred resistant female parent) and ICSA 89001 x ICSR 93031, ICSA 89004 x ICSR 93009(developed on susceptible bred female parent) showed ≤85.00 per cent deadhearts in both the environments (EIK and EIIK) (Table 5).

During postrainy season, the genotypes with deadheart percentages ≤60.00 in both the environments were SPSFR 94003A x ICSV 712, SPSFR 94003A x ICSV 88088, SPSFR 94003A x ICSV 89030, SPSFR 94001A x ICSV 88088,SPSFR 94003A x ICSR 93031, SPSFR 94001A x ICSR 93031, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94003A x ICSR 90002, SPSFR 94031A x ICSV 88088, SPSFR 94031A x ICSV 89015, SPSFR 94031A x ICSV 89030 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89015, SPSFPR 94002A x ICSV 89030, SPSFPR 94005A x ICSV 89015, SPSFPR 94007A x ICSV 88088, SPSFPR 94001A x ICSR 90005, SPSFPR 94001A x ICSR 90014, SPSFPR 94007A x ICSR 90002, SPSFPR 94007A x 90014, SPSFPR 94001A x ICSR 93011, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent) and ICSA 89001 x ICSV 89030 (developed on susceptible bred female parent) (Table 5).

Among parents, during rainy season SPSFR 94002A, SPSFR 94001A, SPSFR 94031A (rainy season-bred resistant cms lines), SPSFPR 94002A, SPSFPR 94007A (postrainy season-bred resistant cms lines), ICSV 712, ICSV 88088 (resistant bred restorer lines) and ICSR 93010 (postrainy season-adapted landraces) showed ≤85.00 per cent deadhearts in both the environments. SPSFR 94002A, SPSFR 94003A, SPSFR 94001B, SPSFR 94031B (rainy season-bred resistant cms lines), SPSFPR 94001A, SPSFPR 94002A, SPSFPR 94005A, SPSFPR 94007A (postrainy season-bred resistant cms lines) , ICSV 712, ICSV 88088, ICSV 89015 (resistant bred restorer lines), ICSR 93031, ICSR 93011, ICSR 93009 and ICSR 93010 (postrainy season-adapted landraces) showed ≤60.00 per cent deadhearts in both the environments during postrainy season (Table 5).

Among checks, ICSV 705B, PS-19349B, IS 18551 and M 35-1 (resistant) were observed to have ≤85.00 per cent deadhearts during rainy season, whereas during postrainy season ICSV 705B, ICSV 708B, PS-19349B and IS 18551 (resistant) showed ≤60.00 per cent deadhearts.

Thus hybrids which involved both resistant parents showed significantly low deadheart % compared to those involving susceptible parental lines. This was more pronounced during postrainy season than in rainy season.

4.2.7 Uniformity in Recovery

As an important agronomic character, visual ratings for uniform recovery were given using 1-9 scale, (1 was given for healthy, undamaged plants and for entries with good recovery in growth of all plants over the plot; while a score of 9 was given for heavily damaged plants in entries with no tillers, and also lacking uniformity in growth and recovery). The recovery rating ranged from 1.33 - 8.33 (EIK) and 1.00 - 8.67 (EIIK) during rainy season and between 1.00 - 7.00 (EIR) and 1.00 - 8.67 (EIIR) during postrainy season. The experimental mean values for EIK, EIIK, EIR, and EIIR were 4.37, 4.33, 3.50 and 3.71 respectively.

Among hybrids SPSFR 94031A x ICSR 93031 (developed on rainy season-bred resistant female parent) showed ≤2.00 recovery rate in all the four environments. SPSFR 94031A x ICSV 88088, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSV 89015 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 89015, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSV 89015, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93009 and SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent) showed recovery rate of ≤3.00 in all the four environments. SPSFR 94003A x ICSV 88088, SPSFR 94031A x ICSV 712, SPSFR 94031A x ICSV 89030, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93011, SPSFR 94003A x ICSR 93009, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR

93009, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89030, SPSFPR 94007A x ICSV 88088, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93009, SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female parent) and ICSA 90002 x ICSV 88088 (developed on susceptible bred female parent) recorded ≤3.00 recovery rate in atleast three environments (Table 6).

Among parents only ICSV 712 (resistant bred restorer line) showed ≤3.00 recovery rate in all the four environments. SPSFR 94003A (rainy season-bred resistant cms line), SPSFPR 94002A, SPSFPR 94007A (postrainy season-bred resistant cms line), ICSV 88088, ICSV 89015 (resistant bred restorer lines), ICSR 89076, ICSR 90002 (susceptible bred restorer lines), ICSR 93031, ICSR 93011 and ICSR 93010 (postrainy season-adapted landraces) showed ≤3.00 in atleast three environments (Table 6).

Among checks, ICSV-705B (resistant check) showed ≤2.00 recovery rate in all the four environments, whereas ICSV-708B, PS-19349B and IS 18551 (resistant checks) showed ≤3.00 in atleast three environments. Generally among parents, susceptible parental lines exhibited poor uniformity in recovery than resistant parental lines. Among hybrids, the crosses involving rainy season-bred resistant lines showed high uniformity in recovery during rainy season than in postrainy season. Similarly, hybrids involving postrainy season-bred resistant lines showed high uniformity in recovery during postrainy season than in rainy season. In general, recovery was more during postrainy season than in rainy season.

4.2.8 Total Tillers

Tiller count was carried out since highly susceptible varieties may respond to shoot fly attack by producing synchronous tillers, many of which may be able to escape major insect damage and give productive heads (Doggett,1972) and information on tiller production thus becomes a good measure of recovery resistance.

Total number of tillers plant^{-1} ranged between 1.07-3.47 (EIK) and 1.06-2.64 (EIIK) during rainy season and 0.80 - 6.55 (EIR) and 1.53 - 7.79 (EIIR) during postrainyseason (Table 6). The experimental means were 1.89, 1.55, 2.82 and 2.88 for EIK, EIIK, EIR and EIIR respectively.

During rainy season, among hybrids ICSA 20 x ICSR 90005, ICSA 89001 x ICSR 89076, ICSA 89004 x ICSR 89076, ICSA 20 x ICSR 93010, ICSA 89001 x ICSR 93031 and ICSA 89004 x ICSR 93010 (developed on susceptible bred female parent) produced ≥2.00 tillers plant^{-1} in both the environments (EIK and EIIK) (Table 6).

During postrainy season, SPSFR 94003A x ICSR 90014, SPSFR 94031A x ICSR 89076, SPSFR 94031A x ICSR 90005, SPSFR 94001A x ICSV 89030, SPSFR 94001A x ICSR 93011 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 90014, SPSFPR 94005A x ICSR 90002, SPSFPR 94005A x ICSR 90005, SPSFPR 94005A x ICSR 90014, SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSR 89076, ICSA 20 x ICSR 90002, ICSA 20 x ICSR 90014, ICSA 89001 x ICSR 89076, ICSA 89001 x ICSR 90002, ICSA 89001 x ICSR 90005, ICSA 89001 x ICSR 90014, ICSA 89004 x ICSR 90002, ICSA 89004 x ICSR 90005, ICSA 90002 x ICSR 89076, ICSA 20 x ICSR 93031, ICSA 89001 x ICSR 93009, ICSA 20 x ICSV 712, ICSA 89001 x ICSV 712, ICSA 89001 x ICSV 88088, ICSA 89001 x ICSV 89015, ICSA 89001 x ICSV 89030, ICSA 89004 x ICSV 712, ICSA 89004 x ICSV 88088, ICSA 89004 x ICSV 89015, ICSA 90002 x ICSR 93009 and ICSA 90002 x ICSV 89030 (developed on susceptible bred female parent) showed ≥3.00 tillers plant^{-1} in both the environments (EIR and EIIR) (Table 6).

Among parents during rainy season none of the parents produced ≥2.00 tillers plant-1 in both the environments, whereas SPSFPR 94002A (postrainy season-bred resistant cms line), ICSA 20 (susceptible bred cms line), ICSV 89015 (resistant bred restorer line) and ICSR 90014 (susceptible bred restorer line) produced ≥2.00 tillers plant-1 in only one environment (EIK). During postrainy season ICSA 20, ICSA 89001, ICSA 90002 (susceptible bred cms lines), ICSV 89015 (resistant bred restorer line) and ICSR 90005 (susceptible bred restorer line) showed ≥3.00 tillers plant^{-1} in both the environments (EIR and EIIR) (Table 6).

Table 6: Mean performance of genotypes for uniformity in recovery and tiller count associated with shoot fly resistance during rainy (EIK and EIIK) and post rainy (EIR and EIIR) seasons 1995-96

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	RBR cms x RBR hybrids												
1	SPSFR 94002A x ICSV 712	3.67	2.42	4.33	4.67	2.00	1.80	2.40	2.93	0.87	1.33	1.73	0.86
2	SPSFR 94002A x ICSV 88088	3.00	2.67	3.33	4.00	1.73	1.46	2.53	2.86	0.87	0.80	1.27	0.86
3	SPSFR 94002A x ICSV 89015	4.00	4.00	3.00	3.33	1.80	1.86	2.53	3.33	0.87	1.00	1.47	1.06
4	SPSFR 94002A x ICSV 89030	3.33	3.33	3.00	2.33	2.07	1.80	2.53	3.40	0.93	1.13	1.27	0.73
5	SPSFR 94003A x ICSV 712	3.67	3.00	3.33	2.67	1.87	1.66	1.60	2.13	0.80	1.06	1.07	1.26
6	SPSFR 94003A x ICSV 88088	3.00	4.33	2.33	2.33	1.73	1.66	2.27	1.86	1.00	0.93	1.07	1.20
7	SPSFR 94003A x ICSV 89015	5.33	5.67	5.00	6.00	1.80	1.73	3.00	2.80	1.07	0.80	1.40	1.26
8	SPSFR 94003A x ICSV 89030	4.33	3.33	3.33	4.67	2.40	1.53	2.07	3.13	0.80	1.00	1.13	0.93
9	SPSFR 94001A x ICSV 712	3.33	3.00	5.00	6.00	1.33	1.40	3.20	2.66	0.60	0.93	1.64	1.26
10	SPSFR 94001A x ICSV 88088	3.00	2.67	3.67	4.33	1.67	1.53	2.20	2.83	1.00	0.86	1.27	1.51
11	SPSFR 94001A x ICSV 89015	3.33	3.67	7.00	8.67	2.33	1.33	4.00	2.66	0.87	1.00	2.83	1.26
12	SPSFR 94001A x ICSV 89030	4.00	2.33	5.33	5.67	1.87	1.66	3.48	3.93	0.93	1.06	1.48	1.33
13	SPSFR 94031A x ICSV 712	2.67	1.67	2.33	4.67	1.67	1.40	2.93	2.40	1.00	1.00	1.33	1.26
14	SPSFR 94031A x ICSV 88088	2.00	1.67	2.33	2.33	2.00	1.66	1.60	2.53	0.86	1.06	0.80	1.20
15	SPSFR 94031A x ICSV 89015	2.00	2.67	1.67	2.00	1.33	1.66	2.53	2.20	0.93	1.00	1.53	1.06
16	SPSFR 94031A x ICSV 89030	3.67	2.67	2.00	2.67	2.27	1.63	2.67	2.53	0.80	0.76	1.00	1.06
	PRBR cms x RBR hybrids												
17	SPSFPR 94001A x ICSV 712	5.33	4.67	4.52	4.33	1.47	1.33	2.52	2.38	0.80	0.80	1.54	0.98
18	SPSFPR 94001A x ICSV 88088	5.00	4.33	3.33	1.67	1.80	1.20	2.27	3.20	0.73	0.80	0.80	1.26
19	SPSFPR 94001A x ICSV 89015	5.67	6.67	3.33	4.67	2.27	1.40	3.07	2.53	0.93	1.00	1.00	0.80
20	SPSFPR 94001A x ICSV 89030	5.67	6.67	4.00	4.67	2.07	1.46	2.87	3.06	1.00	0.93	1.13	1.33
21	SPSFPR 94002A x ICSV 712	2.33	2.33	3.00	2.67	1.87	1.73	2.33	2.93	0.93	1.13	1.40	1.73

Contd...

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
22	SPSFPR 94002A x ICSV 88088	2.33	2.33	3.00	4.33	1.73	2.00	1.93	2.26	0.93	1.20	1.13	1.13
23	SPSFPR 94002A x ICSV 89015	2.33	3.00	3.00	2.67	2.53	1.06	2.47	2.26	0.93	1.00	1.20	1.66
24	SPSFPR 94002A x ICSV 89030	2.67	3.00	3.00	3.67	1.87	1.46	3.20	2.13	0.86	0.93	1.13	1.13
25	SPSFPR 94005A x ICSV 712	2.67	4.00	3.00	3.67	1.67	1.46	2.13	2.86	0.80	0.86	1.20	1.00
26	SPSFPR 94005A x ICSV 88088	2.33	2.33	4.33	3.67	1.80	1.86	2.20	2.40	0.80	0.93	1.53	1.26
27	SPSFPR 94005A x ICSV 89015	3.67	3.33	3.67	1.67	1.80	1.46	3.20	2.95	0.86	1.00	2.13	1.49
28	SPSFPR 94005A x ICSV 89030	3.00	3.00	4.33	5.33	2.33	1.33	2.80	3.46	1.00	1.00	1.33	0.93
29	SPSFPR 94007A x ICSV 712	2.00	2.33	2.00	1.67	1.39	1.66	1.93	2.80	0.90	1.06	1.27	1.33
30	SPSFPR 94007A x ICSV 88088	2.33	3.00	1.67	3.33	2.07	1.33	2.07	3.40	1.00	1.06	1.00	1.73
31	SPSFPR 94007A x ICSV 89015	3.00	3.00	2.33	2.67	1.60	1.73	2.40	2.46	0.93	0.86	1.07	1.33
32	SPSFPR 94007A x ICSV 89030	2.67	2.00	2.67	3.00	1.47	1.33	2.20	2.73	1.00	1.00	1.27	1.33
	SB cms x RBR												
33	ICSA 20 x ICSV 712	6.00	7.00	4.67	4.67	1.80	1.40	4.93	3.40	0.86	0.86	2.15	1.40
34	ICSA 20 x ICSV 88088	5.33	5.67	3.00	3.33	1.67	1.66	2.13	2.86	0.93	1.00	0.87	1.00
35	ICSA 20 x ICSV 89015	6.00	7.00	2.00	1.67	1.93	1.60	2.93	2.66	0.80	1.00	1.00	1.06
36	ICSA 20 x ICSV 89030	5.67	6.00	4.67	2.67	1.80	1.60	2.33	2.86	1.00	1.13	1.07	0.73
37	ICSA 89001 x ICSV 712	6.00	6.67	6.00	5.33	1.80	1.33	3.60	3.13	0.80	1.00	1.93	1.46
38	ICSA 89001 x ICSV 88088	5.33	4.67	5.00	7.00	2.53	1.46	4.27	5.72	0.66	1.13	2.07	0.89
39	ICSA 89001 x ICSV 89015	5.67	7.00	3.00	3.00	1.78	1.80	3.00	3.00	0.66	1.00	1.33	1.06
40	ICSA 89001 x ICSV 89030	8.33	4.33	4.00	8.33	2.53	1.33	4.67	3.53	0.93	1.06	2.20	0.73
41	ICSA 89004 x ICSV 712	5.67	7.33	3.00	3.33	1.80	1.73	3.13	3.13	0.93	1.06	1.00	1.00
42	ICSA 89004 x ICSV 88088	5.67	6.00	4.00	4.33	2.60	1.33	3.00	3.00	0.80	0.86	1.07	1.06
43	ICSA 89004 x ICSV 89015	6.33	4.67	3.00	1.67	1.87	1.66	3.73	3.40	0.93	1.13	0.87	0.86
44	ICSA 89004 x ICSV 89030	4.67	5.00	5.00	4.33	2.00	1.40	2.27	2.66	1.00	0.93	0.73	1.00

Contd...

Contd..

S.No.	Genotypes	Uniformity in recov ry				Total Till rs Plant^{-1}				Productive Till rs Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
45	ICSA 90002 x ICSV 712	5.00	3.67	2.67	2.67	2.13	1.53	1.93	2.60	0.80	0.93	1.27	1.20
46	ICSA 90002 x ICSV 88088	2.33	3.33	2.00	3.00	1.73	1.46	2.93	2.66	0.93	0.93	1.33	1.00
47	ICSA 90002 x ICSV 89015	4.67	4.33	4.67	4.00	1.60	1.60	3.49	2.60	0.73	1.00	0.87	0.93
48	ICSA 90002 x ICSV 89030	3.67	5.33	6.00	5.67	1.73	1.73	4.13	3.53	0.53	0.86	0.80	1.06
	RBR cms x SBR hybrids												
49	SPSFR 94002A x ICSR 89076	5.33	3.67	4.00	4.33	2.53	1.80	4.20	2.33	1.00	1.46	1.80	1.40
50	SPSFR 94002A x ICSR 90002	6.67	7.33	6.33	5.00	2.00	1.40	3.00	2.57	0.73	0.93	1.23	1.12
51	SPSFR 94002A x ICSR 90005	5.33	7.33	6.00	4.00	2.20	1.66	2.60	2.93	0.93	1.00	1.27	1.00
52	SPSFR 94002A x ICSR 90014	6.33	7.00	3.67	4.00	2.13	1.40	3.53	2.13	0.93	0.80	1.60	1.00
53	SPSFR 94003A x ICSR 89076	5.33	5.00	5.00	4.67	2.13	1.53	1.95	3.06	1.00	1.06	0.87	1.26
54	SPSFR 94003A x ICSR 90002	7.00	5.00	4.00	4.00	2.00	1.46	2.60	2.20	1.00	0.80	1.27	1.06
55	SPSFR 94003A x ICSR 90005	6.33	5.33	3.00	3.33	1.53	1.66	2.13	2.80	1.06	1.13	1.27	1.00
56	SPSFR 94003A x ICSR 90014	5.00	5.33	3.33	2.67	1.47	1.93	6.55	3.26	0.93	1.06	1.27	1.53
57	SPSFR 94001A x ICSR 89076	6.67	8.08	6.00	8.67	1.24	2.33	5.18	2.53	0.98	0.99	3.59	0.80
58	SPSFR 94001A x ICSR 90002	2.67	7.67	5.33	4.00	1.31	1.54	2.67	7.79	0.95	1.10	2.37	1.92
59	SPSFR 94001A x ICSR 90005	6.00	5.67	4.67	2.33	1.93	2.53	2.67	2.90	0.86	1.00	1.27	1.14
60	SPSFR 94001A x ICSR 90014	7.33	6.00	4.00	5.00	1.87	1.93	2.93	3.20	1.00	1.06	1.20	1.20
61	SPSFR 94031A x ICSR 89076	4.33	3.33	5.33	6.67	1.80	1.26	4.27	6.56	1.06	0.93	2.20	1.08
62	SPSFR 94031A x ICSR 90002	5.33	4.67	3.67	4.00	1.87	1.40	2.53	2.66	0.93	1.06	1.33	1.35
63	SPSFR 94031A x ICSR 90005	4.00	5.00	3.00	2.33	2.13	1.46	3.00	3.00	1.06	0.93	1.13	1.06
64	SPSFR 94031A x ICSR 90014	3.33	3.67	3.67	6.67	1.73	1.46	1.87	2.66	0.93	0.93	1.13	1.13

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRBR cms x SBR hybrids												
65	SPSFPR 94001A x ICSR 89076	6.67	7.00	5.33	6.33	1.33	2.13	4.13	1.78	0.93	0.80	2.27	1.01
66	SPSFPR 94001A x ICSR 90002	6.00	7.00	4.33	7.00	1.73	1.40	3.20	2.46	0.80	0.80	1.67	0.86
67	SPSFPR 94001A x ICSR 90005	7.00	6.33	5.33	4.33	2.00	1.73	2.27	3.51	0.86	0.80	0.73	1.09
68	SPSFPR 94001A x ICSR 90014	6.00	6.33	5.67	4.67	2.47	1.20	2.60	2.66	0.80	0.60	0.93	0.80
69	SPSFPR 94002A x ICSR 89076	7.00	5.00	5.00	7.00	2.40	1.40	3.60	2.80	1.00	1.13	1.40	1.06
70	SPSFPR 94002A x ICSR 90002	5.33	3.33	1.67	2.00	1.67	1.53	3.33	3.00	0.86	1.00	1.47	1.60
71	SPSFPR 94002A x ICSR 90005	5.33	5.33	2.67	3.33	1.93	1.26	2.93	2.73	0.93	0.93	1.67	1.46
72	SPSFPR 94002A x ICSR 90014	6.67	6.00	4.00	5.33	2.67	1.53	3.58	3.26	0.93	1.00	2.13	1.20
73	SPSFPR 94005A x ICSR 89076	5.33	5.67	3.00	3.33	2.00	1.66	3.87	2.46	0.86	0.93	1.27	0.86
74	SPSFPR 94005A x ICSR 90002	6.00	5.33	5.33	5.67	1.73	1.53	3.73	3.53	0.93	1.00	1.87	1.20
75	SPSFPR 94005A x ICSR 90005	6.00	5.33	2.67	2.33	1.53	1.46	3.60	3.06	1.00	0.86	1.00	0.93
76	SPSFPR 94005A x ICSR 90014	5.67	5.67	4.67	6.33	2.27	1.26	3.07	3.26	0.86	1.13	1.53	1.06
77	SPSFPR 94007A x ICSR 89076	3.00	5.00	5.33	4.33	1.60	1.60	6.13	5.41	1.00	1.13	3.23	0.83
78	SPSFPR 94007A x ICSR 90002	4.67	4.67	4.67	4.67	1.40	1.46	1.87	2.30	0.80	1.00	1.47	0.83
79	SPSFPR 94007A x ICSR 90005	5.33	3.33	4.67	3.33	1.73	1.73	2.87	2.60	0.93	0.86	1.40	0.93
80	SPSFPR 94007A x ICSR 90014	3.67	3.67	2.67	1.33	2.00	1.26	1.93	2.40	0.86	0.93	0.93	1.13
	SB cms x SBR hybrids												
81	ICSA 20 x ICSR 89076	5.67	7.33	3.33	3.33	1.67	1.66	3.33	3.13	0.93	0.93	1.13	1.20
82	ICSA 20 x ICSR 90002	6.00	6.33	3.33	2.67	3.47	1.53	3.60	4.73	1.13	1.00	0.87	1.13
83	ICSA 20 x ICSR 90005	5.33	7.33	3.33	4.67	2.87	2.00	2.33	3.60	0.86	1.00	1.20	1.33
84	ICSA 20 x ICSR 90014	6.33	7.67	4.00	2.67	1.60	2.06	3.40	3.13	0.73	0.93	1.53	1.26
85	ICSA 89001 x ICSR 89076	6.33	5.67	6.33	7.67	2.08	2.00	3.93	4.62	1.00	1.00	1.80	1.29
86	ICSA 89001 x ICSR 90002	5.00	8.67	3.00	3.67	2.27	1.75	3.47	3.26	0.66	0.80	1.60	0.86
87	ICSA 89001 x ICSR 90005	7.33	8.33	4.67	2.67	2.07	1.73	3.87	3.46	0.80	0.80	1.13	0.86

Contd...

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers $Plant^{-1}$				Productive Tillers $Plant^{-1}$			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
88	ICSA 89001 x ICSR 90014	6.67	7.00	6.00	5.67	2.60	1.89	3.93	3.06	0.93	0.57	1.40	0.86
89	ICSA 89004 x ICSR 89076	6.33	5.67	4.33	4.33	2.13	2.33	4.00	2.33	0.73	0.93	1.40	0.80
90	ICSA 89004 x ICSR 90002	5.00	5.33	4.33	7.00	1.80	1.26	3.80	3.13	0.86	1.00	1.40	0.46
91	ICSA 89004 x ICSR 90005	5.67	5.00	3.00	4.67	3.07	1.26	3.20	3.13	0.86	1.00	0.87	0.66
92	ICSA 89004 x ICSR 90014	5.67	5.33	2.33	1.67	1.93	1.40	3.07	2.86	1.06	1.06	1.40	0.66
93	ICSA 90002 x ICSR 89076	5.33	5.00	5.67	4.67	1.87	1.40	3.20	6.03	0.93	0.93	1.82	0.73
94	ICSA 90002 x ICSR 90002	5.33	5.00	3.33	4.00	2.53	1.53	2.47	3.40	0.80	1.00	1.33	0.93
95	ICSA 90002 x ICSR 90005	4.33	3.67	2.33	2.67	1.53	1.66	2.47	2.46	0.93	1.00	0.93	1.13
96	ICSA 90002 x ICSR 90014	5.33	4.67	3.33	2.33	1.53	1.40	2.20	2.80	1.26	0.86	0.87	0.86
	R8R cms x PRLR hybrids												
97	SPSFR 94002A x ICSR 93031	1.67	1.33	4.67	7.67	1.47	1.33	2.73	3.13	1.00	1.06	1.07	1.13
98	SPSFR 94002A x ICSR 93011	1.67	2.67	2.00	3.67	1.80	1.13	2.53	2.86	1.06	0.93	1.20	1.00
99	SPSFR 94002A x ICSR 93009	3.67	1.33	5.33	4.67	2.27	1.47	3.07	2.60	1.06	1.13	2.00	0.80
100	SPSFR 94002A x ICSR 93010	3.33	7.67	5.33	4.00	1.53	1.80	2.80	3.33	1.00	0.93	1.13	1.20
101	SPSFR 94003A x ICSR 93031	3.67	2.67	3.00	3.00	1.53	1.80	2.13	2.27	1.00	1.00	1.13	1.40
102	SPSFR 94003A x ICSR 93011	3.00	2.67	3.00	3.67	1.60	1.20	2.13	2.60	0.93	0.93	1.27	1.46
103	SPSFR 94003A x ICSR 93009	3.67	2.67	3.00	3.00	2.20	1.28	2.33	2.73	1.20	1.13	1.27	1.40
104	SPSFR 94003A x ICSR 93010	2.33	2.00	2.67	4.33	1.60	1.46	2.20	2.80	0.93	1.00	1.27	1.26
105	SPSFR 94001A x ICSR 93031	2.00	1.00	3.00	3.67	1.40	1.40	2.40	2.26	0.73	1.06	1.40	1.46
106	SPSFR 94001A x ICSR 93011	3.00	2.33	3.67	3.33	1.73	1.33	3.33	3.40	0.93	0.93	2.13	1.60
107	SPSFR 94001A x ICSR 93009	2.00	1.67	2.33	3.33	1.53	1.2	2.17	2.33	1.00	1.00	1.33	1.73
108	SPSFR 94001A x ICSR 93010	2.00	1.67	1.67	2.33	1.47	1.73	2.27	2.26	0.86	0.86	1.40	2.00
109	SPSFR 94031A x ICSR 93031	1.33	1.00	2.00	2.00	1.40	1.26	2.20	2.20	0.73	1.26	1.20	1.20
110	SPSFR 94031A x ICSR 93011	1.67	1.00	2.33	4.67	1.80	1.80	2.13	2.86	1.06	1.00	1.13	1.73

Contd...

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
111	SPSFR 94031A x ICSR 93009	3.00	1.33	3.00	3.67	1.40	1.33	3.27	2.53	0.80	1.00	1.73	1.46
112	SPSFR 94031A x ICSR 93010	1.67	1.33	3.67	2.67	1.73	1.26	2.53	2.40	1.06	0.93	1.33	1.33
	PRBR cms x PRLR hybrids												
113	SPSFPR 94001A x ICSR 93031	4.67	5.00	3.00	4.67	1.60	1.26	2.60	2.73	1.06	1.00	1.47	1.53
114	SPSFPR 94001A x ICSR 93011	4.67	4.33	4.67	3.67	1.40	1.66	2.27	2.75	0.86	0.93	1.13	1.36
115	SPSFPR 94001A x ICSR 93009	4.00	4.67	3.00	4.67	1.67	1.60	2.07	1.73	0.93	0.86	1.60	0.93
116	SPSFPR 94001A x ICSR 93010	4.00	5.33	2.25	3.67	2.40	1.66	2.18	2.05	1.06	0.93	2.09	1.39
117	SPSFPR 94002A x ICSR 93031	2.33	2.33	3.33	2.67	1.53	1.66	3.07	2.53	0.93	1.13	1.60	1.46
118	SPSFPR 94002A x ICSR 93011	2.00	1.67	2.67	3.33	1.07	1.26	2.40	2.80	0.86	1.06	1.60	1.00
119	SPSFPR 94002A x ICSR 93009	3.67	4.00	4.00	1.00	2.33	1.60	3.00	2.90	1.00	1.06	2.20	1.14
120	SPSFPR 94002A x ICSR 93010	2.33	1.67	1.00	2.33	1.20	1.13	1.33	2.66	0.73	0.93	0.93	1.40
121	SPSFPR 94005A x ICSR 93031	2.33	1.67	2.67	1.33	1.93	1.40	2.67	2.60	1.06	1.13	1.33	1.53
122	SPSFPR 94005A x ICSR 93011	2.00	2.33	1.33	3.33	1.89	1.46	1.67	3.00	0.80	1.13	0.93	0.93
123	SPSFPR 94005A x ICSR 93009	2.67	2.00	3.67	2.00	1.33	1.53	2.80	2.46	0.80	0.93	1.51	1.20
124	SPSFPR 94005A x ICSR 93010	1.67	1.00	2.00	2.33	1.67	1.46	2.27	2.00	0.93	1.06	0.93	1.00
125	SPSFPR 94007A x ICSR 93031	2.33	2.00	2.00	2.00	1.47	1.33	1.80	2.33	0.86	1.13	1.00	1.46
126	SPSFPR 94007A x ICSR 93011	4.00	2.33	2.33	2.00	2.27	1.46	3.33	2.86	1.00	1.06	1.53	1.13
127	SPSFPR 94007A x ICSR 93009	2.67	2.33	2.67	1.33	2.00	1.40	1.93	2.33	0.80	1.06	1.20	1.40
128	SPSFPR 94007A x ICSR 93010	2.67	1.67	2.67	2.67	1.87	1.40	1.53	2.33	1.13	1.06	1.07	1.53
	SB cms x PRLR hybrids												
129	ICSA 20 x ICSR 93031	6.00	5.00	2.33	2.67	2.33	1.53	3.67	3.00	1.06	1.06	1.87	1.26
130	ICSA 20 x ICSR 93011	5.00	6.00	2.00	2.67	1.40	1.46	2.53	2.26	1.06	0.80	1.13	1.00
131	ICSA 20 x ICSR 93009	5.33	5.00	2.33	3.67	2.60	1.66	2.53	2.07	0.80	0.86	1.13	1.40

Contd...

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
132	ICSA 20 x ICSR 93010	5.67	6.00	3.00	6.00	2.07	2.13	2.20	3.06	0.80	1.33	1.40	1.04
133	ICSA 89001 x ICSR 93031	7.67	7.67	5.33	3.00	2.94	2.64	2.93	3.73	1.55	1.09	1.07	1.26
134	ICSA 89001 x ICSR 93011	6.00	5.33	3.00	4.00	2.07	1.66	4.33	2.93	0.73	1.13	1.40	1.40
135	ICSA 89001 x ICSR 93009	7.67	6.67	4.33	4.00	2.40	1.78	3.73	3.60	1.00	0.80	1.60	0.93
136	ICSA 89001 x ICSR 93010	6.00	5.33	4.00	2.00	2.87	1.66	2.67	2.86	0.86	0.86	1.40	1.20
137	ICSA 89004 x ICSR 93031	4.33	3.33	2.67	3.00	1.60	1.33	2.73	3.46	0.93	1.13	1.13	1.53
138	ICSA 89004 x ICSR 93011	5.67	5.67	4.33	3.00	2.53	1.80	3.53	2.80	0.73	1.06	0.80	0.53
139	ICSA 89004 x ICSR 93009	6.33	8.33	2.67	2.00	1.97	1.62	3.07	2.53	0.76	1.16	1.13	1.40
140	ICSA 89004 x ICSR 93010	6.00	6.00	2.67	5.00	2.27	2.13	2.40	3.06	0.93	1.00	1.33	1.71
141	ICSA 90002 x ICSR 93031	3.00	3.67	4.33	3.00	1.40	1.46	4.37	2.53	0.93	0.93	2.13	1.40
142	ICSA 90002 x ICSR 93011	4.00	6.00	3.67	3.00	1.53	1.60	3.07	2.57	1.00	1.00	1.47	0.52
143	ICSA 90002 x ICSR 93009	4.33	5.67	4.00	6.00	1.87	1.46	3.33	3.60	0.86	0.93	2.20	1.26
144	ICSA 90002 x ICSR 93010	3.67	3.67	6.00	3.00	1.16	2.00	2.80	4.13	0.93	1.06	0.93	2.22
	LINES												
	RBR cms												
1	SPSFR 94002A	3.33	1.67	2.00	5.00	1.47	1.33	1.69	1.69	0.60	0.86	1.42	0.86
2	SPSFR 94003A	3.67	2.33	2.67	2.00	1.67	1.40	1.67	1.67	0.86	0.86	0.53	1.13
3	SPSFR 94001A	3.33	3.33	1.67	5.00	1.73	1.26	2.13	2.13	0.93	0.93	1.73	1.13
4	SPSFR 94031A	3.33	3.33	3.00	3.00	1.53	1.26	1.80	1.80	0.80	1.06	0.80	0.80
	PRBR cms												
5	SPSFPR 94001A	5.67	4.67	3.33	3.00	1.33	1.73	1.93	1.93	0.93	0.93	1.53	0.53
6	SPSFPR 94002A	2.33	4.00	2.33	3.00	2.20	1.40	2.33	2.33	0.93	0.93	1.20	1.13

Contd...

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
7	SPSFPR 94005A	3.00	2.67	4.00	5.00	1.87	1.26	2.97	2.97	0.73	0.86	1.33	0.93
8	SPSFPR 94007A	1.67	3.00	2.67	5.00	1.53	1.20	2.80	2.80	0.86	0.93	1.27	1.20
	SB cms												
9	ICSA 20	6.67	7.33	4.67	6.00	2.60	1.46	3.13	3.13	0.53	0.66	1.33	1.00
10	ICSA 89001	7.00	6.33	5.00	5.00	1.87	1.46	4.07	4.07	0.86	0.93	1.80	1.26
11	ICSA 89004	7.00	7.00	4.33	5.00	1.93	1.53	2.33	2.33	0.73	0.60	1.33	0.73
12	ICSA 90002	5.00	6.00	4.67	2.00	1.40	1.26	4.20	4.20	1.00	0.93	1.73	1.20
	TESTERS												
	RBR												
1	ICSV 712	2.67	1.33	1.67	1.00	1.67	1.33	2.13	2.13	0.86	1.00	1.33	1.00
2	ICSV 88088	4.33	1.67	2.00	2.00	1.93	1.26	1.60	1.60	1.00	0.60	0.87	1.13
3	ICSV 89015	2.67	3.33	2.00	3.00	2.27	1.73	3.27	3.27	0.93	0.93	0.80	0.40
4	ICSV 89030	6.67	3.33	2.00	2.00	1.67	1.86	2.27	2.27	1.00	1.13	0.47	0.66
	SBR												
5	ICSR 89076	3.00	6.33	3.00	2.00	1.67	1.66	0.80	2.80	0.80	1.00	0.73	1.33
6	ICSR 90002	2.67	7.67	3.00	2.00	1.64	1.26	2.93	2.93	0.66	0.66	0.87	0.73
7	ICSR 90005	4.67	7.33	3.33	3.00	1.73	1.13	3.27	3.27	0.80	0.80	1.40	1.26
8	ICSR 90014	3.67	6.67	3.33	2.00	2.00	1.26	2.60	2.60	0.86	0.80	0.93	0.60

Contd..

S.No.	Genotypes	Uniformity in recovery				Total Tillers Plant^{-1}				Productive Tillers Plant^{-1}			
		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
	PRLR												
9	ICSR 93031	6.00	1.67	2.33	3.00	1.67	1.20	1.93	1.93	0.93	0.93	0.87	1.13
10	ICSR 93011	4.00	2.33	1.33	3.00	1.80	1.20	1.53	1.53	1.20	0.86	0.93	1.13
11	ICSR 93009	6.67	1.67	2.67	5.00	1.87	1.73	1.80	1.80	0.80	1.00	1.13	1.33
12	ICSR 93010	7.00	3.00	2.00	2.00	1.40	1.13	1.80	1.80	0.80	0.86	1.20	1.60
	CHECKS												
1	ICSV-705B (R)	3.67	2.00	1.33	1.00	2.13	1.80	1.33	2.80	1.00	1.06	1.00	1.53
2	ICSV-708B (R)	4.67	2.33	2.33	2.00	1.60	1.40	2.07	2.20	1.06	1.00	1.46	1.06
3	PS-19349B (R)	4.33	2.67	2.67	1.00	1.33	2.00	1.73	2.77	1.00	1.00	1.20	1.11
4	296B (S)	2.00	7.00	3.33	7.00	1.60	1.73	2.73	2.80	0.86	0.86	1.87	1.20
5	CSH-9 (S)	6.67	6.67	6.00	2.00	2.53	1.46	4.00	3.13	1.06	0.86	2.40	0.66
6	IS-18551 (R)	1.33	1.00	2.67	4.00	1.40	1.33	2.13	2.53	1.00	1.06	1.80	1.06
7	ICSV-112 (S)	6.00	5.67	3.00	3.00	2.47	1.53	2.40	3.60	0.80	1.06	1.47	0.66
8	M-35-1 (R)	4.00	3.67	3.00	3.00	1.60	1.60	2.78	2.26	1.00	0.93	1.78	1.66
	Mean	4.37	4.33	3.50	3.71	1.89	1.55	2.82	2.88	0.91	0.97	1.36	1.15
	CD(P=0.05)	2.04	1.71	1.99	1.79	0.98	0.69	1.86	1.27	0.37	0.34	1.05	0.72

During rainy season, none of the checks produced ≥2.00 tillers plant^{-1} in both the environments. During postrainy season, only CSH-9 (susceptible check) produced ≥3.00 tillers plant^{-1} in EIR and EIIR environments.

Thus among parental lines, the susceptible bred lines produced maximum number of tillers plant^{-1} compared to the resistant bred lines. Similarly the hybrids involving susceptible parentallines produced more number of tillers than hybrids involving resistant parental lines. In general, more number of tillers were produced during postrainy season than in rainy season.

4.2.9 Productive Tillers

Productive tillers were recorded as the number of tillers producing harvestable heads in relation to the total number of tillers after the main stem was damaged. Number of productive tillers plant^{-1} ranged from 0.53-1.55 (EIK) and 0.57-1.46 EIIK) during rainy season and 0.47-3.59 (EIR) and 0.40-2.00 (EIIR) during postrainy season. The experimental mean values for EIK, EIIK, EIR and EIIR were 0.91, 0.97, 1.36 and 1.15 respectively (Table 6).

Among hybrids, SPSFR 94031A x ICSV 712, SPSFR 94002A x ICSR 89076, SPSFR 94003A x ICSR 90005, SPSFR 94002A x ICSR 93031, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93011, SPSFR 94001A x ICSR 90014 (developed on rainy season-bred resistant female parent), SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 89076, SPSFPR 94001A x ICSR 93031, SPSFPR 94002A x ICSR 93009, SPSFPR 94005A x ICSR 93031, SPSFPR 94007A x ICSR 93011, SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSR 93031, ICSA 89001 x ICSR 89076, and ICSA 89001 x ICSR 93031 (developed on susceptible bred female parent) produced ≥1.00 productive tillers plant^{-1} in all the four environments. Whereas SPSFR 94002A x ICSV 89015, SPSFR 94003A x ICSV 712, SPSFR 94003A x ICSV 88088, SPSFR 94003A x ICSV 89015, SPSFR 94001A x ICSV 88088, SPSFR 94001A x ICSV 89015, SPSFR 94001A x ICSV 89030, SPSFR 94002A x ICSR 90005, SPSFR 94003A x ICSR 89076, SPSFR 94003A x ICSR 90002, SPSFR 94003A x ICSR 90014, SPSFR 94001A x ICSR 90002, SPSFR 94001A x 90005, SPSFR 94031A x ICSR 89076, SPSFR 94031A x ICSR 90002, SPSFR 94031A x ICSR 90005, SPSFR 94002A x ICSR 93011, SPSFR 94002A x ICSR 93009, SPSFR 94002A x ICSR 93010, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSR 93010, SPSFR 94031A x ICSV 89015 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 89030, SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89015, SPSFPR 94005A x ICSV 89015, SPSFPR 94005A x ICSV 89030, SPSFPR 94007A x ICSV 712, SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 90014, SPSFPR 94005A x ICSR 90002, SPSFPR 94005A x ICSR 90014, SPSFPR 94001A x ICSR 93010, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93009, SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSR 90002, ICSA 20 x ICSR 90005, ICSA 20 x ICSV 89015, ICSA 20 x ICSV 89030, ICSA 89001 x ICSV 712, ICSA 89001 x ICSV 89015, ICSA 89004 x ICSV 712, ICSA 89004 x ICSR 90014, ICSA 20 x ICSR 93011, ICSA 20 x ICSR 93010, ICSA 89001 x ICSR 93011, ICSA 89004 x ICSR 93031, ICSA 89004 x ICSR 93009, ICSA 89004 x ICSR 93010 and ICSA 90002 x ICSR 93011 (developed on susceptible bred female parent) produced ≥1.00 productive tiller plant^{-1} in atleast three environments (Table 6).

None of the parents produced ≥1.00 productive tiller plant^{-1} in all the environments, whereas ICSA 90002 (susceptible bred cms line), ICSV 712 (resistant bred restorer) and ICSR 93009 (postrainy season-adapted landrace) produced ≥1.00 productive tiller plant^{-1} in atleast three environments (Table 6).

Among checks ICSV 705B, ICSV 708B, PS 19349B and IS 18551 (resistant checks) produced ≥1.00 productive tiller in all the four environments, whereas M 35-1 (resistant check) produced ≥1.00 productive tiller plant^{-1} in only three environments. Generally productive tillers were more during postrainy season than during rainy season. Among parents, susceptible parental lines and postrainy season-adapted landraces produced maximum number of productive tillers. No significant difference was observed among hybrids for this trait.

4.2.10 Yield (UNI and I)

The grain yield (g plant^{-1}) from uninfested plant samples (UNI) ranged from 0.53 - 114.40 (EIK) and from 0.85 - 45.79 (EIIK) during rainy season and between 16.33 - 97.97 (EIR) and between 2.43 - 65.31 (EIIR) during postrainy season. The trial mean values for EIK, EIIK, EIR and EIIR were 10.92, 12.54, 47.27 and 25.12 g plant^{-1} respectively (Table 7).

The grain yield from infested plant samples (I) ranged between 0.18 - 27.04 g (EIK) and 1.86 - 72.82g (EIIK) during rainy season and between 22.08 - 102.42 g (EIR) and 3.36 - 67.76 g (EIIR) during postrainy season. The mean values for EIK, EIIK, EIR and EIIR were 7.56, 10.49, 51.26 and 22.41 g plant^{-1} respectively (Table 7).

The differences between the means of EIK, EIIK, EIR and EIIR were reflections of the severe ergot disease due to continuous rains during flowering period in rainy season (EIK and EIIK) and severe bird damage in postrainy season (EIIR). Hence only EIR trial is considered for interpretations.

During postrainy season (EIR), among hybrids, SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSR 90002, SPSFR 94003A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSR 90014, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSV 88088, ICSA 89004 x ICSV 712, ICSA 20 x ICSR 90002 and ICSA 89001 x ICSR 90014 (developed on susceptible bred female parent) produced $\geq$60.00 g plant^{-1} both in UNI and I samples. SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89015, SPSFR 94002A x ICSV 89030, SPSFR 94003A x ICSV 88088, SPSFR 94003A x ICSV 89030, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSV 89030, SPSFR 94031A x ICSV 89030, SPSFR 94031A x ICSR 90014, SPSFR 94002A x ICSR 93010, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSV 712, SPSFR 94002A x ICSR 90002, SPSFR 94002A x ICSR 90014, SPSFR 94003A x ICSR 90002 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSV 88088, SPSFPR 94001A x ICSV 89015, SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 89030, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSR 90002, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93011, SPSFPR 94007A x ICSR 93010, SPSFPR 94007A x ICSV 89015, SPSFPR 94007A x ICSR 89076, SPSFPR 94001A x ICSR 90005, SPSFPR 94002A x ICSR 90014 (developed on postrainy season-bred resistant female parent), ICSA 89001 x ICSR 89076, ICSA 89001 x ICSR 90002, ICSA 89004 x ICSR 89076, ICSA 89004 x ICSR 90005, ICSA 89004 x ICSR 90014, ICSA 90002 x ICSR 90002, ICSA 90002 x ICSR 90005, ICSA 90002 x ICSR 90014, ICSA 89001 x ICSR 93011, ICSA 89001 x ICSR 93009, ICSA 20 x ICSV 712, ICSA 20 x ICSV 89015, ICSA 89004 x ICSV 89015, ICSA 90002 x ICSV 89015 (developed on susceptible bred female parent) recorded $\geq$60.00 g plant^{-1} grain yield in atleast one sample (UNI or I) (Table 7).

Among parents, only ICSR 90014 (susceptible bred restorer line) produced $\geq$60.00 g plant^{-1} grain yield in both UNI and I samples. SPSFR 94002A, SPSFR 94003A, SPSFR 94001A (rainy season-bred resistant cms lines), SPSFPR 94005A, SPSFPR 94007A (postrainy season-bred resistant cms lines), ICSA 20 (susceptible bred cms line) and ICSV 89030 (resistant bred restorer line) produced $\geq$60.00 g plant^{-1} in atleast one sample (Table 7).

None of the checks produced $\geq$60.00 g plant^{-1} grain yield in both the samples. The checks, ICSV 708B (resistant), 296B (susceptible) and IS 18551 (resistant) produced $\geq$60.00 g plant^{-1} in atleast one sample. Although, among the parental lines the susceptible parentallines have yielded more compared to others, the hybrids did not differ significantly.

4.2.11 Days to 50% Flowering

The duration (number of days) for 50% flowering ranged between 65.50 - 77.55 (EIK) and between 61.00 - 86.23 (EIIK) during rainy season and between 60.00 - 83.67 (EIR) and between 74.00 - 94.33 (EIIR) during postrainy season. The experimental mean values were 72.82, 69.66, 71.78 and 84.13 days for EIK, EIIK, EIR and EIIR respectively (Table 7).

During rainy season, among the hybrids, SPSFR 94001A x ICSV 88088, SPSFR 94002A x ICSR 89076, SPSFR 94002A x ICSR 93031, SPSFR 94002A x ICSR 93011, SPSFR 94002A x ICSR 93009, SPSFR

94001A x ICSR 93031, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011 (developed on rainy season-bred resistant female parent), ICSA 90002 x ICSR 89076, ICSA 89004 x ICSR 93031, ICSA 89004 x ICSR 93011 and ICSA 9002 x ICSR 93031 (developed on susceptible bred female parent) recorded ≤70.00 days for 50% flowering in both the environments (EIK and EIIK) (Table 7).

During postrainy season, a duration of ≤80.00 days to 50% flowering in both the environments (EIR and EIIR) was recorded for SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSV 88088, SPSFR 94001A x ICSV 89015, SPSFR 94031A x ICSV 88088, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93011, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89015, SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A X ICSR 90002, SPSFPR 94001A x ICSR 93031, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93011, SPSFPR 94007A x ICSR 93009, SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 20 x ICSV 712, ICSA 20 x ICSV 88088, ICSA 20 x ICSV 89076, ICSA 20 x ICSR 93031, ICSA 20 x ICSR 93011 and ICSA 20 x ICSR 93009 (developed on susceptible bred female parent) (Table 7).

Among parents, the duration of ≤70.00 days for 50% flowering in both the environments during rainy season was recorded in only SPSFPR 94007A (postrainy season-bred resistant female parent). SPSFPR 94002A, SPSFPR 94007A (postrainy season-bred resistant female parents), ICSV 88088 (resistant bred restorer line), ICSR 93031 and ICSR 93011 (postrainy season-adapted landraces) recorded ≤80.00 days to 50% flowering in both the environments during postrainy season (Table 7).

The resistant check, ICSV 705B recorded ≥70.00 days for 50% flowering during rainy season in both the environments (EIK and EIIK), and ICSV 705B and M 35-1 (resistant checks) took ≤80.00 days to 50%

flowering in both the environments (EIR and EIIR) during postrainy season.

Thus, the period for 50% flowering was more during postrainy season compared to the rainy season and the hybrids involving susceptible parents were late compared to the others Particularly the hybrids involving postrainy season-adapted landraces as male parents were much earlier compared to others.

4.2.12 Plant Height

Differences among genotypes for plant height were significant (P=0.05) both in rainy and postrainy season (Table 7). In rainy season, plant height of the hybrids ranged from 0.87 - 2.58 m (EIK) and from 0.97 - 2.53 m (EIIK) during rainy season and between 0.83 - 1.97 m (EIR) and between 0.90 - 2.32 m (EIIR) during postrainy season. The mean plant height for EIK, EIIK, EIR and EIIR were 1.62, 1.73, 1.39 and 1.46 m respectively.

During rainy season the mean plant height of ≥2.00 m in both the environments (EIK and EIIK) was observed among the hybrids, SPSFR 94002A x ICSR 93031, SPSFR 94002A x ICSR 93009, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 930011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x 93009, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSR 93011, SPSFPR 94001A x ICSR 93010, SPSFPR 94002A x ICSR 93011, SPSFPR 94002A x ICSR 93009, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x 93009, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x 93011, SPSFPR 94007A x 93009, SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 89001 x ICSR 93011, ICSA 89001 x 93010, ICSA 89004 x ICSR 93010, ICSA 90002 x ICSR 93031, ICSA 90002 x ICSR 93009 and ICSA 90002 x ICSR 93010 (developed on susceptible bred female parent).

Table 7: Mean performance of genotypes for yield and plant characters during rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons, 1995-96

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
	RBR cms x RBR hybrids																
1	SPSFR 94002A x ICSV 712	14.21	13.54	16.92	12.28	46.03	55.97	25.13	17.97	70.67	61.00	71.33	80.33	1.35	1.52	1.23	1.42
2	SPSFR 94002A x ICSV 88088	21.69	24.77	23.27	18.71	55.25	67.33	16.94	9.76	72.33	64.00	71.67	83.67	1.33	1.47	1.17	1.52
3	SPSFR 94002A x ICSV 89015	12.44	8.31	14.18	12.24	57.39	64.97	24.23	30.29	70.58	68.33	72.00	87.33	1.42	2.08	1.37	1.27
4	SPSFR 94002A x ICSV 89030	19.20	9.07	24.52	22.24	39.30	60.94	19.98	18.80	71.33	61.67	70.33	84.67	1.33	1.62	1.28	1.38
5	SPSFR 94003A x ICSV 712	9.13	8.82	7.86	7.33	54.13	58.67	30.58	13.42	72.82	68.00	73.33	83.67	1.50	1.75	1.47	1.57
6	SPSFR 94003A x ICSV 88088	3.90	2.72	13.59	6.66	63.75	54.42	18.19	16.51	73.71	71.00	69.33	78.00	1.40	1.50	1.33	1.47
7	SPSFR 94003A x ICSV 89015	10.91	4.15	10.38	26.43	38.50	54.00	25.55	28.12	73.71	68.33	76.00	84.33	1.78	1.83	1.25	1.43
8	SPSFR 94003A x ICSV 89030	4.45	4.34	11.49	9.45	56.26	67.98	31.92	24.42	74.08	69.33	70.67	85.67	1.65	1.88	1.58	1.58
9	SPSFR 94001A x ICSV 712	14.95	11.08	13.08	8.23	33.17	62.68	17.76	26.06	73.57	69.33	70.33	78.33	1.47	1.67	1.30	1.42
10	SPSFR 94001A x ICSV 88088	9.06	5.44	10.26	7.26	77.50	99.25	29.63	22.44	68.83	63.00	69.67	79.00	2.02	1.63	1.33	1.17
11	SPSFR 94001A x ICSV 89015	4.63	6.76	18.11	13.67	50.75	54.69	16.92	15.00	71.00	65.67	81.67	79.67	1.62	1.25	1.00	1.37
12	SPSFR 94001A x ICSV 89030	17.32	10.36	6.97	16.05	72.88	55.18	31.07	31.50	72.33	66.67	77.00	82.67	1.57	1.53	1.27	1.27
13	SPSFR 94031A x ICSV 712	10.91	4.98	11.15	5.46	38.93	59.92	26.83	14.88	74.33	68.33	69.67	86.00	1.67	1.80	1.58	1.57
14	SPSFR 94031A x ICSV 88088	7.93	1.26	11.68	3.93	51.48	52.08	15.69	11.48	73.21	66.67	71.33	74.00	1.88	1.62	1.28	1.42
15	SPSFR 94031A x ICSV 89015	18.46	10.24	16.79	11.39	24.10	35.75	28.64	13.30	70.67	64.33	71.00	84.67	1.48	1.53	1.20	1.35
16	SPSFR 94031A x ICSV 89030	13.54	14.96	15.48	8.41	64.08	36.44	18.55	23.36	73.00	68.00	72.00	84.00	1.58	1.65	1.50	1.58
	PRBR cms x RBR hybrids																
17	SPSFPR 94001A x ICSV 712	10.91	2.46	5.79	11.84	49.25	43.08	25.13	22.42	72.82	78.33	77.14	90.00	1.50	1.67	1.45	1.17
18	SPSFPR 94001A x ICSV 88088	8.00	3.06	7.42	5.74	73.83	56.75	20.00	19.27	72.82	71.00	68.33	82.00	1.53	1.48	1.37	1.45
19	SPSFPR 94001A x ICSV 89015	10.91	3.87	12.04	38.47	68.75	55.80	9.25	16.04	77.55	72.00	71.67	89.33	1.97	1.98	1.27	1.43
20	SPSFPR 94001A x ICSV 89030	6.74	5.30	12.54	22.80	43.75	44.25	11.63	31.05	72.82	75.33	78.33	87.33	1.53	1.58	1.30	1.58
21	SPSFPR 94002A x ICSV 712	9.43	7.31	10.23	9.61	43.33	73.67	38.83	18.33	73.83	72.67	68.67	77.33	1.43	1.38	1.25	1.40

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
22	SPSFPR 94002A x ICSV 88088	9.68	3.72	20.83	9.34	22.51	38.00	14.33	12.36	73.83	71.67	68.33	78.00	1.20	1.28	1.20	1.17
23	SPSFPR 94002A x ICSV 89015	9.13	7.34	24.72	13.50	37.08	58.33	13.73	9.92	74.00	70.33	72.67	79.67	1.93	1.52	1.62	1.77
24	SPSFPR 94002A x ICSV 89030	14.88	2.69	7.21	10.16	35.83	63.58	30.83	23.84	74.21	67.67	70.67	81.67	1.52	1.60	1.37	1.42
25	SPSFPR 94005A x ICSV 712	10.91	3.55	12.54	3.95	55.75	51.64	21.19	12.76	72.82	78.92	70.67	86.00	1.63	1.62	1.45	1.50
26	SPSFPR 94005A x ICSV 88088	10.91	7.56	12.54	28.97	39.33	35.08	21.67	36.47	72.82	72.33	74.00	83.33	1.73	1.52	1.23	1.40
27	SPSFPR 94005A x ICSV 89015	6.18	3.10	20.75	9.22	46.30	46.08	25.13	22.42	73.67	70.67	75.67	89.69	1.52	1.42	1.40	1.34
28	SPSFPR 94005A x ICSV 89030	5.55	4.08	9.23	8.75	29.08	39.33	31.42	22.67	73.83	69.67	77.33	87.33	1.68	1.95	1.48	1.68
29	SPSFPR 94007A x ICSV 712	4.82	7.84	13.63	6.10	35.89	64.67	26.17	23.11	73.58	68.33	69.00	80.67	1.45	1.45	1.23	1.37
30	SPSFPR 94007A x ICSV 88088	10.63	2.57	12.58	8.34	41.06	43.58	8.88	10.56	72.33	70.00	70.00	78.00	1.22	1.38	1.15	1.17
31	SPSFPR 94007A x ICSV 89015	13.75	11.72	14.05	11.18	69.77	40.33	26.71	13.23	73.67	66.67	70.33	81.33	1.30	1.18	0.99	1.17
32	SPSFPR 94007A x ICSV 89030	9.99	3.96	12.18	10.87	40.47	34.86	25.06	31.88	73.33	69.67	70.67	78.67	1.63	1.72	1.42	1.43
	SB cms x RBR hybrids																
33	ICSA 20 x ICSV 712	10.91	12.85	5.19	16.81	60.67	56.17	18.75	17.92	73.71	73.67	72.00	79.33	1.55	1.78	1.62	1.75
34	ICSA 20 x ICSV 88088	0.61	9.47	8.20	9.46	69.27	75.17	18.08	22.68	74.08	70.33	67.33	77.67	1.33	1.76	1.40	1.38
35	ICSA 20 x ICSV 89015	13.94	8.68	12.54	9.72	38.93	72.48	26.44	29.67	73.67	70.33	67.33	80.67	1.63	1.67	1.32	1.62
36	ICSA 20 x ICSV 89030	6.08	11.10	22.90	15.74	32.12	47.43	17.81	26.76	73.33	70.67	68.67	84.00	1.52	1.50	1.57	1.50
37	ICSA 89001 x ICSV 712	4.74	2.36	10.67	3.71	41.36	52.50	28.28	31.92	72.59	72.33	70.33	84.33	1.47	1.60	1.30	1.60
38	ICSA 89001 x ICSV 88088	10.91	3.01	11.14	5.45	36.63	55.75	25.13	22.42	74.56	70.00	74.33	81.08	1.45	1.48	1.10	1.45
39	ICSA 89001 x ICSV 89015	10.91	3.90	12.54	13.62	59.39	46.50	25.13	15.05	74.67	72.67	68.33	85.33	1.68	1.72	1.20	1.35
40	ICSA 89001 x ICSV 89030	10.91	4.10	17.68	5.17	31.10	35.75	19.92	6.28	72.82	72.33	72.33	88.73	1.22	1.82	1.03	1.00
41	ICSA 89004 x ICSV 712	7.82	14.76	10.72	4.80	97.97	61.73	17.28	15.84	74.08	65.67	72.00	86.67	1.47	1.45	1.23	1.43
42	ICSA 89004 x ICSV 88088	6.05	4.73	23.24	6.63	58.11	58.17	25.13	22.42	73.58	70.33	77.67	88.33	1.30	1.38	1.17	1.33
43	ICSA 89004 x ICSV 89015	12.42	15.32	15.99	11.21	59.50	45.44	16.31	16.76	72.00	67.67	70.67	90.00	1.60	1.90	1.23	1.30
44	ICSA 89004 x ICSV 89030	20.83	7.67	8.87	28.36	44.52	28.23	18.75	17.96	71.67	66.00	80.33	90.33	1.60	1.83	1.10	1.50

Contd...

Contd...

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
45	ICSA 90002 x ICSV 712	7.50	3.38	7.82	17.60	31.13	31.98	15.25	20.73	74.08	69.33	67.67	85.00	1.58	1.55	1.65	1.72
46	ICSA 90002 x ICSV 88088	25.19	9.82	7.85	10.52	53.10	48.19	11.94	15.61	73.33	71.00	68.00	82.67	1.63	1.70	1.37	1.52
47	ICSA 90002 x ICSV 89015	10.91	9.25	14.41	6.28	62.27	45.33	25.13	22.42	72.00	66.67	73.67	89.67	1.73	1.82	1.25	1.10
48	ICSA 90002 x ICSV 89030	16.16	3.07	15.63	10.03	42.25	42.25	31.92	27.33	73.50	69.00	83.67	87.67	1.57	1.68	1.13	1.72
	RBR cms x SBR hybrids																
49	SPSFR 94002A x ICSR 89076	20.97	15.04	24.19	17.34	37.67	39.42	32.89	35.96	70.00	63.67	71.33	85.08	1.45	1.55	1.37	1.65
50	SPSFR 94002A x ICSR 90002	28.94	21.42	34.53	10.84	60.92	41.59	9.38	6.76	72.67	75.00	81.00	80.69	1.42	1.53	1.30	1.24
51	SPSFR 94002A x ICSR 90005	36.54	26.83	12.54	7.18	41.68	52.93	26.68	12.84	70.67	73.00	83.00	89.00	1.40	1.50	1.10	1.43
52	SPSFR 94002A x ICSR 90014	20.16	17.94	12.54	6.48	55.85	76.18	25.13	4.41	69.83	73.33	78.33	92.67	1.30	1.48	1.18	1.37
53	SPSFR 94003A x ICSR 89076	1.12	4.16	12.54	15.28	38.01	40.89	6.91	6.53	70.08	71.67	72.00	90.67	1.40	1.43	1.30	1.38
54	SPSFR 94003A x ICSR 90002	10.91	2.64	9.56	8.53	40.22	68.22	5.94	7.96	75.82	69.33	77.67	89.00	1.40	1.65	1.17	1.17
55	SPSFR 94003A x ICSR 90005	10.91	7.66	4.82	8.84	48.00	44.50	16.17	15.75	73.71	71.00	69.00	84.67	1.50	1.63	1.33	1.42
56	SPSFR 94003A x ICSR 90014	15.15	14.27	11.27	20.92	38.31	45.11	36.44	35.63	73.58	68.67	69.00	84.33	1.17	1.53	1.28	1.35
57	SPSFR 94001A x ICSR 89076	10.91	8.37	4.27	6.66	27.76	44.67	25.13	22.42	72.82	70.07	81.67	94.33	1.45	1.87	1.30	1.17
58	SPSFR 94001A x ICSR 90002	10.91	7.56	12.54	3.04	39.01	43.69	25.13	22.42	72.82	74.67	74.00	84.13	1.90	1.25	1.32	1.08
59	SPSFR 94001A x ICSR 90005	4.82	8.35	13.77	17.33	55.72	35.80	25.13	22.42	73.00	65.00	69.33	84.13	1.38	1.52	1.32	1.46
60	SPSFR 94001A x ICSR 90014	9.22	12.06	19.13	10.36	30.47	57.18	32.11	62.00	72.21	67.67	69.67	85.00	1.35	1.50	1.20	1.07
61	SPSFR 94031A x ICSR 89076	19.08	10.29	10.62	13.63	30.51	42.94	25.13	19.20	74.33	70.67	71.00	87.33	1.28	1.72	1.37	1.50
62	SPSFR 94031A x ICSR 90002	16.78	3.31	9.69	17.89	63.27	68.42	25.13	8.92	71.71	66.00	75.67	88.33	1.27	1.55	1.33	1.43
63	SPSFR 94031A x ICSR 90005	22.13	9.62	12.29	14.51	49.14	31.92	32.69	21.96	74.33	68.67	69.00	81.67	1.40	1.58	1.42	1.38
64	SPSFR 94031A x ICSR 90014	15.33	11.33	23.82	23.48	61.92	48.75	27.17	26.83	72.33	66.67	70.00	83.67	1.60	1.67	1.33	1.48

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
87	ICSA 89001 x ICSR 90005	10.91	10.59	12.03	10.52	25.47	58.08	33.00	21.83	72.82	78.67	70.33	87.67	1.20	1.28	1.00	1.30
88	ICSA 89001 x ICSR 90014	10.91	1.46	37.70	26.86	60.92	77.28	25.13	10.15	72.82	75.67	70.33	81.58	1.38	1.62	1.20	1.10
89	ICSA 89004 x ICSR 89076	15.78	10.01	15.95	11.93	44.33	80.08	24.58	21.29	74.33	70.00	73.67	87.00	1.43	1.52	1.37	1.38
90	ICSA 89004 x ICSR 90002	6.84	11.32	14.93	7.89	55.68	22.81	15.19	17.70	73.21	70.67	69.67	88.67	1.23	1.88	1.13	1.22
91	ICSA 89004 x ICSR 90005	5.83	17.69	11.51	10.33	56.77	84.00	28.46	14.51	73.08	67.00	69.00	84.69	1.35	1.52	1.27	1.23
92	ICSA 89004 x ICSR 90014	10.72	14.13	15.61	26.11	54.35	64.92	36.31	44.92	70.67	69.00	69.33	88.23	1.42	1.52	1.23	1.33
93	ICSA 90002 x ICSR 89076	10.91	7.56	12.59	12.12	32.15	46.08	39.08	24.40	73.08	69.67	79.33	87.33	1.20	1.27	1.48	1.60
94	ICSA 90002 x ICSR 90002	10.02	12.75	11.26	4.48	59.02	60.33	13.59	12.66	70.08	70.33	69.00	88.33	1.50	1.48	1.37	1.58
95	ICSA 90002 x ICSR 90005	17.99	11.88	14.23	15.61	58.40	69.83	27.45	23.38	72.00	69.33	68.67	85.00	1.50	1.48	1.50	1.33
96	ICSA 90002 x ICSR 90014	14.45	10.11	12.58	10.45	32.58	77.17	24.63	25.92	73.21	70.33	70.33	90.33	1.55	1.43	1.30	1.52
	RBR cms x PRLR hybrids																
97	SPSFR 94002A x ICSR 93031	5.77	2.12	7.43	3.29	43.97	48.14	25.13	22.42	65.50	61.00	73.00	88.67	2.13	2.32	1.17	1.38
98	SPSFR 94002A x ICSR 93011	1.20	2.37	14.16	6.19	55.01	49.33	24.30	23.63	70.33	66.00	67.67	80.00	1.93	1.97	1.60	1.77
99	SPSFR 94002A x ICSR 93009	4.29	2.20	9.03	6.76	45.78	33.03	20.74	3.36	70.50	67.33	81.00	89.33	2.08	2.37	1.35	1.27
100	SPSFR 94002A x ICSR 93010	4.18	5.14	8.83	10.52	22.47	70.97	25.13	32.61	72.00	76.33	72.00	85.00	2.00	1.73	1.50	1.48
101	SPSFR 94003A x ICSR 93031	4.88	11.46	13.67	18.08	44.84	52.67	13.97	8.54	71.83	65.67	68.67	85.00	2.03	2.10	1.80	1.08
102	SPSFR 94003A x ICSR 93011	3.53	7.47	8.11	6.06	32.08	36.92	31.17	67.76	74.71	64.67	71.33	78.67	1.95	2.45	1.73	1.87
103	SPSFR 94003A x ICSR 93009	7.55	6.08	11.72	9.77	24.45	61.00	33.19	30.90	72.21	66.00	68.67	82.00	1.95	2.13	1.60	1.93
104	SPSFR 94003A x ICSR 93010	11.79	2.46	10.77	6.10	84.75	102.42	21.80	45.08	74.00	69.33	70.67	83.33	2.18	2.25	1.78	1.92
105	SPSFR 94001A x ICSR 93031	8.78	4.68	5.38	4.76	47.50	44.17	50.95	39.30	68.00	64.33	68.00	80.00	2.32	2.22	1.58	1.80
106	SPSFR 94001A x ICSR 93011	4.80	1.93	31.75	8.69	42.83	54.08	50.39	20.52	72.00	65.00	67.33	78.33	2.28	2.18	1.77	1.77
107	SPSFR 94001A x ICSR 93009	4.18	14.43	11.91	13.56	62.33	50.00	15.92	21.40	72.67	69.33	68.00	78.67	2.33	2.43	1.63	1.88
108	SPSFR 94001A x ICSR 93010	0.53	4.91	6.71	5.66	40.17	60.17	32.08	21.78	73.67	67.33	67.67	78.67	2.00	2.40	1.80	1.80
109	SPSFR 94031A x ICSR 93031	9.77	1.79	16.31	3.15	26.01	63.43	19.41	20.71	69.17	61.67	67.67	79.67	2.50	2.53	1.83	1.85

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
110	SPSFR 94031A x ICSR 93011	5.42	3.94	11.02	4.13	35.27	49.75	16.67	31.50	68.67	65.67	69.00	80.33	2.18	2.40	1.70	1.85
111	SPSFR 94031A x ICSR 93009	10.17	2.17	7.72	4.87	48.92	46.75	29.33	16.18	72.33	70.33	70.00	82.67	2.07	2.27	1.58	1.88
112	SPSFR 94031A x ICSR 93010	6.82	6.29	8.20	7.50	45.75	29.64	21.00	15.25	73.33	65.67	70.33	82.33	2.50	2.45	1.77	1.92
	PRBR cms x PRLR hybrids																
113	SPSFPR 94001A x ICSR 93031	6.24	9.62	16.25	9.62	40.22	55.80	39.75	34.19	73.83	71.00	69.00	79.00	1.85	2.22	1.80	1.78
114	SPSFPR 94001A x ICSR 93011	5.96	4.43	7.90	6.89	20.71	32.42	26.21	36.03	73.21	74.33	73.00	86.19	2.15	2.03	1.80	1.72
115	SPSFPR 94001A x ICSR 93009	10.91	3.82	9.17	72.82	31.58	36.86	45.53	20.05	72.82	73.80	72.00	86.23	2.10	2.25	1.70	1.98
116	SPSFPR 94001A x ICSR 93010	20.51	8.91	5.11	9.80	29.64	46.67	3.81	2.18	71.50	76.67	71.32	91.67	2.15	2.13	1.90	1.85
117	SPSFPR 94002A x ICSR 93031	5.27	3.55	10.24	4.77	48.96	38.52	20.19	38.51	73.91	63.00	69.33	78.00	2.15	2.58	1.80	1.83
118	SPSFPR 94002A x ICSR 93011	9.44	4.47	13.32	8.07	31.50	40.08	30.42	27.58	73.00	69.33	68.33	79.00	2.00	2.40	1.73	1.80
119	SPSFPR 94002A x ICSR 93009	5.69	4.76	16.65	11.50	23.51	46.80	8.39	22.42	74.33	69.00	71.67	84.13	2.17	2.38	1.80	1.46
120	SPSFPR 94002A x ICSR 93010	3.49	2.91	12.43	2.79	59.76	67.75	29.53	20.91	73.67	66.00	67.33	80.67	2.38	2.15	1.93	1.87
121	SPSFPR 94005A x ICSR 93031	5.75	3.44	8.41	5.86	47.88	50.72	31.89	34.36	70.83	66.00	70.00	81.33	2.13	2.42	1.72	1.82
122	SPSFPR 94005A x ICSR 93011	4.45	2.58	10.09	6.87	81.00	44.00	26.06	28.56	73.08	69.67	67.33	81.33	2.22	1.85	1.83	1.87
123	SPSFPR 94005A x ICSR 93009	4.30	4.28	5.64	7.18	43.85	57.92	2.43	8.34	74.58	72.33	77.00	85.00	2.20	2.45	1.80	1.93
124	SPSFPR 94005A x ICSR 93010	6.47	3.30	4.55	4.40	20.27	94.94	26.19	12.88	74.58	68.33	68.67	80.67	2.22	2.39	1.97	1.97
125	SPSFPR 94007A x ICSR 93031	7.23	8.61	0.85	5.75	16.33	49.08	46.92	29.25	71.00	66.00	68.00	77.00	2.18	2.27	1.83	1.77
126	SPSFPR 94007A x ICSR 93011	14.15	4.04	11.44	8.67	55.26	60.00	51.25	43.00	71.67	65.00	67.67	78.33	2.00	2.53	1.68	1.65
127	SPSFPR 94007A x ICSR 93009	10.91	14.32	4.60	14.76	37.00	58.19	18.67	15.42	73.00	67.00	73.00	78.33	2.02	2.33	1.77	1.85
128	SPSFPR 94007A x ICSR 93010	7.67	8.50	8.38	5.80	38.30	63.58	20.92	28.50	72.57	65.67	68.67	79.33	2.06	2.50	1.63	2.32
	SB cms x PRLR hybrids																
129	ICSA 20 x ICSR 93031	4.72	7.21	9.13	16.86	49.88	22.08	38.61	16.89	72.67	67.00	66.00	78.33	1.85	2.00	1.60	1.73
130	ICSA 20 x ICSR 93011	7.31	6.87	11.95	5.15	37.50	34.42	24.25	25.08	72.33	69.00	66.33	77.33	1.88	2.07	1.68	1.87

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
131	ICSA 20 x ICSR 93009	19.36	3.49	9.27	7.69	34.51	37.17	28.46	25.82	74.00	69.33	67.33	78.33	1.92	1.97	1.73	1.67
132	ICSA 20 x ICSR 93010	16.86	10.21	8.43	9.97	44.60	47.28	25.13	22.42	71.96	69.67	66.00	84.13	2.00	1.97	1.55	1.80
133	ICSA 89001 x ICSR 93031	58.27	4.13	9.07	10.52	28.00	37.89	25.13	57.51	72.08	70.33	70.00	81.67	1.97	2.28	1.23	1.45
134	ICSA 89001 x ICSR 93011	16.62	4.82	4.12	4.95	54.25	60.05	65.19	47.04	73.21	71.33	67.33	83.33	2.17	2.20	1.60	1.93
135	ICSA 89001 x ICSR 93009	0.93	2.49	12.37	11.26	43.51	69.36	38.83	29.18	74.56	73.33	75.67	81.33	1.85	2.05	1.63	1.78
136	ICSA 89001 x ICSR 93010	11.78	14.51	8.67	8.92	38.33	47.00	34.13	40.01	72.84	73.00	69.00	83.33	2.13	2.15	1.77	1.97
137	ICSA 89004 x ICSR 93031	10.42	7.80	6.01	17.05	44.58	37.92	29.87	18.33	69.33	65.67	67.33	80.67	1.85	1.63	1.88	1.70
138	ICSA 89004 x ICSR 93011	3.56	7.66	18.84	13.78	44.42	39.67	30.03	20.26	67.86	67.00	73.00	90.67	1.77	2.28	1.23	1.32
139	ICSA 89004 x ICSR 93009	10.91	5.02	11.81	9.79	57.58	49.81	32.94	30.76	70.60	76.00	71.67	80.67	1.70	1.80	1.70	2.00
140	ICSA 89004 x ICSR 93010	5.72	5.83	8.89	14.20	40.14	47.33	11.83	30.84	74.00	68.67	60.00	85.67	2.10	2.37	1.83	1.78
141	ICSA 90002 x ICSR 93031	9.73	15.42	9.45	8.47	54.33	45.58	65.31	26.07	70.67	62.33	72.67	82.00	2.15	2.37	1.27	1.33
142	ICSA 90002 x ICSR 93011	10.91	7.56	12.54	10.52	29.83	30.86	25.13	44.26	75.08	70.33	66.33	85.59	1.43	1.43	1.67	1.52
143	ICSA 90002 x ICSR 93009	20.89	5.55	21.04	5.83	39.75	41.75	6.39	8.26	68.96	72.67	73.67	88.23	2.13	2.05	1.77	1.43
144	ICSA 90002 x ICSR 93010	12.41	11.00	13.82	7.77	41.38	37.48	61.42	64.92	71.00	66.33	77.67	80.67	2.03	2.17	1.17	2.02
	LINES																
	RBR cms																
1	SPSFR 94002A	10.91	9.01	14.01	4.35	57.77	67.58	22.50	11.50	72.89	70.33	77.00	86.67	1.05	1.08	1.00	1.20
2	SPSFR 94003A	5.16	6.66	10.52	9.17	55.27	99.97	17.83	21.36	76.55	70.33	71.33	79.00	1.18	1.77	1.15	1.30
3	SPSFR 94001A	2.36	2.81	10.69	2.61	46.04	67.33	19.33	14.42	74.33	67.33	71.00	82.00	1.52	0.97	0.83	0.90
4	SPSFR 94031A	13.58	0.40	6.74	4.29	46.04	46.19	20.92	23.66	72.67	67.00	70.33	82.67	1.28	1.32	1.13	1.13

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
	PRBR cms																
5	SPSFPR 94001A	10.91	5.24	12.59	9.24	38.25	39.98	12.38	17.29	73.58	67.67	72.67	93.64	0.87	1.02	1.05	1.10
6	SPSFPR 94002A	10.62	7.72	5.30	13.32	43.00	36.92	23.25	9.52	74.21	69.67	71.33	79.33	1.05	1.18	1.03	1.10
7	SPSFPR 94005A	13.54	8.91	12.03	14.59	57.94	66.78	25.97	19.58	73.83	76.33	75.33	93.67	1.67	1.28	1.13	1.15
8	SPSFPR 94007A	16.32	12.24	15.73	10.27	63.97	54.33	21.67	13.16	69.67	67.00	71.33	79.33	1.22	1.31	1.03	1.00
	SB cms																
9	ICSA 20	19.15	4.23	4.72	6.11	32.39	65.92	20.89	20.25	74.67	70.67	69.33	81.33	1.12	1.37	1.20	1.10
10	ICSA 89001	9.34	17.74	7.18	9.42	44.77	46.07	24.67	40.83	73.58	67.33	69.33	89.67	1.23	1.20	1.23	1.18
11	ICSA 89004	7.29	8.49	7.18	10.67	44.30	44.97	11.86	11.14	74.56	74.00	74.33	90.19	1.27	1.38	1.27	1.13
12	ICSA 90002	11.24	27.04	18.46	2.50	34.64	51.92	12.92	22.41	73.67	71.00	75.33	91.69	1.22	1.03	1.17	1.07
	TESTERS																
	RBR																
1	ICSV 712	7.12	9.68	21.47	10.52	40.44	57.08	23.67	15.00	73.59	73.00	69.67	80.67	1.47	1.57	1.27	1.57
2	ICSV 88088	4.23	2.46	10.00	8.07	52.77	50.67	25.83	14.67	73.59	71.33	69.67	77.33	1.23	1.35	1.18	1.20
3	ICSV 89015	14.18	4.23	14.34	6.09	30.25	47.33	23.17	9.69	72.71	71.33	69.67	84.67	1.15	1.30	1.13	1.07
4	ICSV 89030	7.77	1.68	8.96	6.94	60.75	44.92	21.23	9.28	72.82	70.33	73.33	87.33	1.52	2.22	1.43	1.30
	SBR																
5	ICSR 89076	6.50	7.56	10.47	7.20	30.76	47.42	42.83	37.33	73.67	74.00	70.33	83.67	1.42	1.43	1.33	1.47
6	ICSR 90002	10.91	2.00	5.58	3.94	54.63	52.25	13.94	27.13	72.82	86.00	74.00	89.00	1.23	1.09	1.27	1.30
7	ICSR 90005	10.91	11.65	14.70	1.86	49.85	53.44	26.67	23.78	73.59	82.33	72.00	87.67	1.12	1.13	1.12	1.18
8	ICSR 90014	7.95	6.08	13.49	9.73	60.17	60.92	20.92	29.23	72.82	70.67	74.00	90.67	1.05	1.25	1.03	1.13

Contd...

Contd..

S.No.	Genotypes	Yield (g plant^{-1})								Days to 50% flowering				Plant height (m)			
		EIK		EIIK		EIR		EIIR		EIK	EIIK	EIR	EIIR	EIK	EIIK	EIR	EIIR
		UNI	I	UNI	I	UNI	I	UNI	I								
	PRLR																
9	ICSR 93031	10.91	1.96	4.79	2.08	21.14	39.00	20.67	18.58	71.33	63.33	70.00	78.67	2.17	1.87	1.68	1.77
10	ICSR 93011	10.91	0.57	12.54	6.86	32.58	26.00	21.33	10.33	73.57	70.00	70.00	79.00	1.70	2.05	1.57	1.50
11	ICSR 93009	10.91	8.66	12.54	6.93	48.25	47.15	30.94	11.48	74.56	69.33	75.33	82.00	1.53	2.15	1.48	1.70
12	ICSR 93010	18.02	0.18	2.12	10.52	48.63	28.83	10.67	17.42	74.58	72.33	74.00	85.33	2.05	2.47	1.83	1.88
	CHECKS																
1	ICSV-705B (R)	11.14	5.32	15.60	11.53	47.42	47.85	22.90	22.29	69.71	64.00	67.67	78.08	1.03	1.07	0.97	1.03
2	ICSV-708B (R)	9.59	10.48	8.23	6.09	52.68	75.80	25.31	13.34	73.21	69.33	70.00	80.00	1.59	1.43	1.30	1.30
3	PS-19349B (R)	6.69	5.56	11.82	7.05	32.17	30.78	18.07	25.29	71.67	65.33	71.00	81.33	1.02	1.09	0.83	1.03
4	296B (S)	2.44	10.25	14.84	6.03	39.38	75.30	23.71	19.45	73.58	76.67	76.33	91.33	1.28	1.17	0.97	0.97
5	CSH-9 (S)	4.64	7.14	9.47	10.95	24.02	36.84	35.42	48.50	72.21	67.00	78.67	93.67	1.32	1.80	1.45	1.25
6	IS-18551 (R)	10.91	0.31	18.13	10.52	47.58	61.42	36.94	27.05	74.00	67.67	72.67	82.67	2.47	2.27	1.67	1.78
7	ICSV-112 (S)	7.11	11.96	10.16	7.66	43.14	44.17	24.42	24.25	72.71	70.33	69.67	81.33	1.33	1.32	1.33	1.25
8	M-35-1 (R)	2.36	2.67	12.54	2.17	41.89	53.39	22.00	5.90	70.50	68.92	76.67	77.33	2.33	2.15	1.67	1.70
	Mean	10.92	7.56	12.54	10.49	47.27	51.26	25.12	22.41	72.82	69.66	71.78	84.13	1.62	1.73	1.39	1.46
	CD(P=0.05)	14.22	9.95	10.85	14.66	27.30	29.96	20.71	19.80	3.18	5.62	5.38	4.28	0.39	0.43	0.24	0.27

During postrainy season, the mean plant height of $\geq$1.75 m in both the environments (EIR and EIIR) was observed among hybrids, SPSFR 94003A x ICSR 93011, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94001A x ICSR 93031, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93009, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93009, SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent), ICSA 89001 x ICSR 93010 and ICSA 89004 x ICSR 93010 (developed on susceptible bred female parent) (Table 7)

Among parents, only ICSR 93010 (postrainy season-adapted landrace) showed $\geq$2.00 m in both the environments (EIK and EIIK) during rainy season. ICSR 93010 recorded $\geq$1.75 m plant height in both the environments during postrainy season (Table 7).

The resistant checks, IS 18551 and M 35-1 recorded $\geq$2.00 m during rainy season, though none of these recorded $\geq$1.75 m during postrainy season. Generally the plant heights were more during rainy season than postrainy season and the hybrids involving postrainy season-adapted landraces as male parents were taller compared to others.

4.3 CORRELATIONS BETWEEN VARIOUS CHARACTERS

The associations between shoot fly resistance and its components, and the components themselves were computed in terms of phenotypic correlation coefficients among the hybrids and parents for 15 selected variables in rainy (EIK) and postrainy (EIR) seasons. The results are presented in Table 8.

4.3.1. Early Seedling Vigour

Among the hybrids, early seedling vigour was significantly and positively correlated with glossiness, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery and plant height both in rainy and postrainy seasons. Seedling vigour was significantly and positively correlated with trichome density in rainy season. Significant negative correlations among hybrids were observed between this trait and deadheart percentage, total tillers and days to 50% flowering (both in rainy and postrainy seasons), egg count and yield-I (only in rainy season), and productive tillers (only in postrainy season) (Table 8).

Among parents, significant positive correlations were observed between seedling vigour and uniformity in recovery, 5th leaf length, 5th leaf droopiness and plant height (both in rainy and postrainy seasons),and 5th leaf width (only in postrainy season), whereas significant negative correlations were exhibited between this trait and productive tillers (only in postrainy season) (Table 8).

The correlation between early seedling vigour and productive tillers was in the same direction in both parents and hybrids. The magnitude of association (r^2) was more in postrainy season (51 times in case of parents and 39 times in case of hybrids) than in rainy season.

4.3.2 Glossiness

In the hybrids, glossiness was positively correlated with 5th leaf length, 5th leaf droopiness, trichome density, uniformity in recovery and plant height (both in rainy and postrainy seasons), and 5th leaf width (only in rainy season). Significant negative correlations were observed with egg count, deadheart percentage, total tillers (both in rainy and postrainy seasons), yield-UNI, yield-I and days to 50% flowering (only in rainy season) and productive tillers (only in postrainy season) (Table 8).

Among the parents, significant positive correlations were observed with uniformity in recovery (both in rainy and postrainy seasons), and trichome density, 5th leaf length, 5th leaf width, 5th leaf droopiness (only in rainy season). Significant negative correlations were observed with egg count, deadheart percentage (in rainy and postrainy seasons), and total tillers, yield-UNI and yield-I (only in postrainy season) (Table 8).

The magnitude of association between glossiness and 5th leaf width, yield-UNI and yield-I varied greatly for both parents and hybrids in rainy and postrainy seasons. For 5th leaf width the magnitude of association

(r^2) was 8 times more in case of parents and 12 times in case of hybrids during rainy season; for yield-UNI, 21 times more in case of parents during postrainy season and 7 times in case of hybrids during rainy season, and for yield-I 5 times more in case of parents during postrainy season and 20 times more in hybrids during rainy season.

4.3.3 Egg Count

Among the hybrids, egg count was strongly and positively correlated with deadheart percentage, total tillers (both in rainy and postrainy seasons), productive tillers, days to 50% flowering (only in postrainy season), yield-UNI and yield-I (only in rainy season), while significant negative correlations were observed between this trait and trichome density, 5th leaf length, 5th leaf droopiness and uniformity in recovery (in rainy and postrainy seasons), 5th leaf width and plant height (only in postrainy season).

For parents, significant positive correlations were observed between this trait and deadheart percentage, total tillers (both in rainy and postrainy seasons), yield-UNI and yield-I (only in postrainy season). Egg count was significantly and negatively correlated with uniformity in recovery (both in rainy and postrainy seasons), and 5th leaf length, 5th leaf width and 5th leaf droopiness (only in rainy season) and trichome density (only in postrainy season) (Table 8).

The maximum variation in the magnitude of association (r^2) was found with 5th leaf width, yield-UNI and yield-I. For 5th leaf width r^2 was 17 times more in case of parents in rainy season and 2 times more in case of hybrids during postrainy season; for yield-UNI, 4 times more in case of parents in postrainy season and 6 times in case of hybrids in rainy season, and for yield-I, 5 times more in case of parents in postrainy season and 20 times in case of hybrids in rainy season.

4.3.4 Trichome Density

In the hybrids, this trait was strongly and positively correlated with 5th leaf length, 5th leaf width, 5th leaf droopiness (only in rainy season) and uniformity in recovery and plant height (both in rainy and postrainy seasons). Trichome density was negatively correlated with total tillers (both in rainy and postrainy seasons) and yield-UNI and yield-I (only in rainy season) (Table 8).

In the parents, trichome density was significantly and positively correlated with uniformity in recovery (both in rainy and postrainy seasons). Significant negative correlations were observed with total tillers, yield-I (only in postrainy season) and yield-UNI (only in rainy season) for parents (Table 8).

The magnitude of association varied greatly between trichome density and yield-UNI, yield-I. For yield-UNI, in case of parents r^2 was 2 times and in case of hybrids 484 times more during rainy season, and for yield-I, in case of parents 11 times more during postrainy season and 2 times more in case of hybrids during rainy season.

4.3.5 Deadheart %

Deadheart percentage is an apparent indicator for shoot fly susceptibility and it was correlated with other traits. For the hybrids, strong positive correlations were observed with total tillers and days to 50% flowering (in rainy and postrainy seasons) and yield-I (only in rainy season). Significant negative correlations were noticed with trichome density, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery and plant height (both in rainy and postrainy seasons) (Table 8).

During postrainy season, only total tillers and yield-I recorded significant positive correlations with this trait for parents. Significant negative correlations were observed with trichome density and uniformity in recovery (both in rainy and postrainy seasons), 5th leaf length, 5th leaf width and 5th leaf droopiness (in rainy season only). In postrainy season, correlation coefficients for 5th leaf length, 5th leaf width and 5th leaf droopiness were not significant among parents but these were in the same direction to rainy season correlations (Table 8).

The magnitude of association varied greatly between deadheart % and yield-I i.e., in case of parents,

r^2 was 17 times more during postrainy season and in case of hybrids 4 times more during rainy season.

4.3.6 5th Leaf Length

This trait was strongly and positively correlated with 5th leaf width, 5th leaf droopiness, uniformity in recovery and plant height for both parents and hybrids in rainy and postrainy seasons. Significant negative correlations were observed for hybrids with total tillers, days to 50% flowering (both in rainy and postrainy seasons), productive tillers (in postrainy season), and yield-UNI and yield-I (only in rainy season) (Table 8).

4.3.7 5th Leaf Width

Highly significant and positive correlations were noticed among hybrids for 5th leaf droopiness, uniformity in recovery and plant height (in rainy and postrainy seasons), whereas 5th leaf width was negatively correlated with total tillers and days to 50% flowering (both in rainy and postrainy seasons) and yield-UNI (in rainy season only) (Table 8).

The results of correlations among parents indicated that this trait was positively correlated with 5th leaf droopiness (in rainy and postrainy seasons), uniformity in recovery (only in rainy season), and plant height (in postrainy season). Significant negative correlations with this trait for parents were observed only in rainy season with yield-UNI and yield-I (Table 8).

4.3.8 5th Leaf Droopiness

No significant correlations were observed for hybrids with this trait both in rainy and postrainy seasons. Significant positive correlation with plant height was observed for parents both in rainy and postrainy seasons and with uniformity in recovery only in rainy season (Table 8).

Table 8: Correlation coefficients among 15 selected characters of sorghum parents (24) and hybrids (144) in rainy and postrainy seasons (1995-96)

			Glossiness	Egg count	DH%	Trichomes	5th leaf length	5th leaf width	5th leaf droopiness	Uniformity in recovery	Total tillers	Productive tillers	Yield (UNI)	Yield (I)	Plant height	Days to 50% flowering
Vigour	R	P	0.29	0.09	-0.02	-0.08	-0.47*	-0.15	-0.46*	0.40*	-0.04	-0.06	-0.17	0.20	-0.71**	0.20
		H	0.74**	0.17*	0.33**	-0.22**	-0.54**	-0.50**	-0.50**	0.79**	0.44**	-0.04	0.23**	0.09	-0.36**	0.25**
	PR	P	0.09	-0.11	-0.04	0.14	-0.71**	-0.45*	-0.69**	0.49*	0.16	0.43*	-0.16	-0.19	-0.56**	0.13
		H	0.31**	0.10	0.26**	0.07	-0.70**	-0.37**	-0.70**	0.60**	0.35**	0.25**	-0.07	-0.11	-0.38**	0.55**
Glossiness	R	P		0.73**	0.78**	-0.58**	-0.74**	-0.46*	-0.75**	0.88**	0.23	-0.21	0.09	0.30	-0.32	0.20
		H		0.48**	0.55**	-0.43**	-0.59**	-0.45**	-0.56**	0.92**	0.39**	-0.06	0.27**	0.20**	-0.43**	0.22**
	PR	P		0.85**	0.90**	-0.36	-0.21	-0.16	-0.22	0.64**	0.54**	0.08	0.42*	0.67**	-0.11	0.15
		H		0.69**	0.70**	-0.35**	-0.37**	-0.13	-0.37**	0.45**	0.49**	0.18**	-0.10	0.05	-0.40**	0.19
Egg count	R	P			0.61**	-0.37	-0.67**	-0.58**	-0.69**	0.73**	0.43*	-0.22	0.28	0.35	-0.28	0.02
		H			0.60**	-0.42**	-0.22**	-0.11	-0.23**	0.40**	0.23**	-0.06	0.26**	0.35**	-0.19	0.03
	PR	P			0.88**	-0.61**	-0.06	-0.14	-0.12	0.60**	0.63**	0.07	0.59**	0.77**	-0.03	0.05
		H			0.71**	-0.54**	-0.21**	-0.15*	-0.20**	0.41**	0.50**	0.16*	-0.11	0.08	-0.31**	0.22**
DH%	R	P				-0.54**	-0.63**	-0.42*	-0.61**	0.75**	0.35	0.07	0.05	0.19	0.01	0.16
		H				-0.40**	-0.40**	-0.17*	-0.40**	0.53**	0.15*	-0.06	0.03	0.21**	-0.30**	0.26**
	PR	P				-0.56**	-0.12	-0.23	-0.14	0.65**	0.73**	0.21	0.39	0.78**	-0.12	0.15
		H				-0.48**	-0.36**	-0.22**	-0.34**	0.47**	0.45**	0.14	0.01	0.10	-0.34**	0.23**
Trichomes	R	P					0.29	0.33	0.33	-0.46*	-0.09	0.34	-0.43*	-0.16	0.13	-0.03
		H					0.24**	0.17*	0.26**	-0.42**	-0.26**	-0.06	-0.22**	-0.18*	0.19*	-0.04
	PR	P					0.01	0.34	0.09	-0.50**	-0.60**	-0.20	-0.29	-0.53**	0.04	-0.27
		H					-0.09	-0.03	-0.08	-0.15*	-0.34**	-0.13	0.01	-0.12	0.18*	0.00

Contd.

Contd..

			Glossi-ness	Egg count	DH%	Tri-chomes	5th leaf length	5th leaf width	5th leaf droopi-ness	Unifor-mity in recovery	Total tillers	Productive tillers	Yield (UNI)	Yield (I)	Plant height	Days to 50% flo-wering
5th leaf length	R	P						0.65**	0.98**	-0.81**	-0.15	0.11	0.03	-0.31	0.51**	-0.01
		H						0.72**	0.97**	-0.59**	-0.17*	0.05	-0.23**	-0.17*	0.36**	-0.19*
	PR	P						0.59**	0.98**	-0.33	-0.22	-0.15	-0.04	0.15	0.79**	-0.20
		H						0.58**	0.95**	-0.61**	-0.33**	-0.21**	0.07	0.14	0.55**	-0.59**
5th leaf width	R	P							0.65**	-0.51**	0.01	0.11	-0.44*	-0.46*	0.29	0.20
		H							0.70**	-0.49**	-0.23**	-0.04	-0.19*	-0.12	0.42**	-0.16*
	PR	P							0.54**	-0.31	-0.26	-0.33	-0.08	0.02	0.47*	-0.32
		H							0.54**	-0.32**	-0.18*	-0.09	0.04	0.14	0.31**	-0.47**
5th leaf droopiness	R	P								-0.78**	-0.19	0.13	0.01	-0.31	0.55**	0.04
		H								-0.55	-0.17	0.02	-0.23	-0.14	0.35	-0.16
	PR	P								-0.35	-0.26	-0.15	-0.09	0.10	0.80**	-0.20
		H								-0.58	-0.31	-0.18	0.12	0.19	0.56	-0.55
Uniformity in recovery	R	P									0.28	-0.23	0.07	0.22	-0.37	0.17
		H									0.43	-0.01	0.23	0.18	-0.46	0.22
	PR	P									0.70**	0.40*	0.17	0.46*	-0.19	0.17
		H									0.55**	0.40**	-0.13	-0.19*	-0.47**	0.70**
Total tillers	R	P										-0.18	0.18	-0.17	-0.20	0.24
		H										0.11	0.11	0.05	-0.18*	0.08
	PR	P										0.51**	0.19	0.63**	-0.24	0.02
		H										0.64**	-0.03	-0.02	-0.29**	0.35**

Contd..

4.3.9 Uniformity in Recovery

During rainy season, no significant correlations were observed with this trait for both hybrids and parents. In postrainy season, significant positive correlations were observed between this trait and yield-I and plant height (for hybrids). Uniformity in recovery was significant and negatively correlated with total tillers and productive tillers (for both hybrids and parents), days to 50% flowering (only in hybrids) and yield-I (only for parents) (Table 8).

The magnitude of association (r^2) varied greatly with total tillers and productive tillers. It was more during post-rainy season (for total tillers-6 times in parents and 2 times in hybrids; for productive tillers - 3 times in parents and 1600 times in hybrids) compared to rainy season.

4.3.10 Total Tillers

Significant negative correlation was observed with plant height (for hybrids) during rainy and postrainy seasons. During postrainy season, significant positive correlations were noticed for productive tillers (for hybrids and parents), days to 50% flowering (only for hybrids) and yield-I (only for parents) (Table 8).

The magnitude of association (r^2) varied greatly with productive tillers and was more (9 times in case of parents and 34 times in case of hybrids) during postrainy season compared to rainy season.

4.3.11 Productive Tillers

Among the hybrids, significant positive correlations were noticed for yield-UNI (only in rainy season) and days to 50% flowering (only in postrainy season). For parents significant negative correlation was observed between this trait and yield-UNI (only in rainy season), whereas it was in the same direction but non significant during postrainy season (Table 8).

The magnitude of association (r^2) varied greatly with yield-UNI and was more (5 times in parents and 13 times in hybrids) during rainy season compared to postrainy season.

4.3.12 Yield (UNI)

Among the hybrids, significant positive correlations were observed between this trait and yield-I (in rainy and postrainy seasons) and plant height (only in postrainy season), whereas plant height (only in rainy season) and days to 50% flowering (only in postrainy season) showed significant negative correlation with this trait during rainy season. Among parents, significant positive correlation was noticed for yield-I during postrainy season (Table 8).

4.3.13 Yield (I)

Among hybrids, yield-I was negatively correlated with plant height (only in rainy season) and days to 50% flowering (only in postrainy season), while the relationship of plant height with yield-I was in opposite direction during postrainy season (only for hybrids). Among parents the estimates were small in magnitude (Table 8).

4.3.14 Plant Height

Plant height was negatively correlated with days to 50% flowering during both rainy and postrainy seasons (only for hybrids). In respect of parents the estimates were small in magnitude (Table 8).

4.4 INHERITANCE OF CHARACTERS IN VARIOUS HYBRID AND PARENT GROUPS

Nine groups of hybrids obtained by crossing three groups of cms lines [rainy season-bred resistant cms lines (RBR cms), postrainy season-bred resistant cms lines (PRBR cms) and rainy season-bred susceptible lines (SB cms)] and three groups of restorer lines [resistant bred restorers (RBR), susceptible high yielding restorers (SBR) and postrainy season-adapted landraces (PRLR)] were examined to elicit information on the type(s) of crosses needed to obtain shoot fly resistant hybrids in different seasons.

Examination of data for G (genotype) x E (environment) interaction showed significant (P=0.01) GxE interactions for various traits particularly deadhearts. Since investigation into such significant interactions, indicate the need to treat the experiments conducted in different situations separately for meaningful interpretation, investigations to envisage G x E interaction is not the objective of the present study, and these are not presented here in greater details. Therefore, the group means are presented for each season and experiment [rainy season-natural (EIK), rainy season-artificial (EIIK), postrainy season-natural (EIR) and postrainy season-artificial (E II R) environments] separately in Tables 9 -11.

4.4.1 Seedling Vigour

In general, seedling vigour was low in postrainy season compared to the rainy season, was the least (5.30) in the late planted postrainy season (EIIR) when there was low temperature during the early crop growth. This tendency did not exist in all the parental lines and hybrid groups uniformly. Among the parental line groups, the susceptible (SBR and SB cms) parental lines and their hybrid groups showed markedly poor vigour than any other groups of parental lines and hybrids in the late sown postrainy season experiment (EIIR).

In general, seedling vigour was low when susceptible parents were used as one of the parents in the hybrids across all four experiments. Unlike the susceptible parental line groups (SB cms and SBR), the other resistant parental groups, RBR cms and PRBR cms bred for shoot fly resistance behaved uniformly across

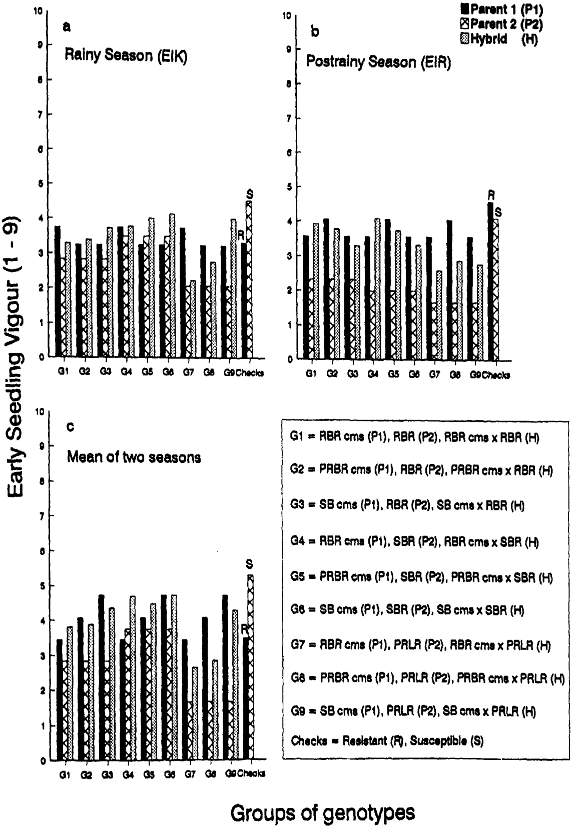


Figure 1. Mean early seedling vigour of parents and their hybrid groups(a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

all seasons. Similarly RBR and PRLR also behaved uniformly. Among all lines, PRLR group has the highest vigour across all experiments. As a result, their hybrid groups (RBR cms x PRLR and PRBR cms x PRLR) showed numerically higher vigour compared with the hybrid groups (RBR cms x RBR and PRBR x RBR) which involved bred restorers (Table 9; Fig.1).

Further examination of susceptible x resistant and their reciprocal hybrid groups (SB cms x RBR, SB cms x PRLR, RBR cms x SBR and PRBR cms x SBR) in relation to their parental groups for seedling vigour in the late planted experiment (EIIR) showed that low vigour was dominant over high seedling vigour in low temperature conditions.

4.4.2 Glossiness

Expression of glossiness was more in rainy season than in postrainy season. This tendency was not related to breeding history of the materials. In other words, there was no clear pattern among resistant parental line (RBR cms, PRBR cms and RBR) and susceptible parentalline (SB cms and SBR) groups. In other words, season specific breeding had no effect on glossiness as both RBR cms and PRBR cms parental line groups behaved similarly in both the seasons. As expected the two resistant groups, RBR cms and PRBR cms among the female lines, and RBR and PRLR among the restorers had the highest glossiness, and the other two susceptible groups (SB cms and SBR) had the lowest glossiness. In other words selection for shoot fly resistance based on deadheart damage had indirect effect on selection for glossiness. Further PRLR parental line group, which were not bred specifically, but selected by farmers, showed highest glossiness like any other bred lines (Table 9; Fig.2).

The hybrid groups involving both parent groups with glossiness (RBR cms x RBR, PRBR cms x RBR, RBR cms x PRLR and PRBR cms x PRLR) were extremely glossy. On the other hand, the other groups of hybrids which involved glossy (RBR cms, PRBR cms and PRLR) and non-glossy (SB cms and SBR) parent or both non-glossy parent groups were all non-glossy irrespective of the seasons. This indicated that non-glossy trait was dominant and the trait expression was stable across the season (Table 9a).

Table 9: *Group* means *of various* types of sorghum genotypes for different characters associated with shootfly resistance in rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons of *1995-96*

Genotype groups	Early seedling vigour					Glossiness					Egg count $plant^{-1}$					Dead heart %					Trichome density (mm^{-2})		
	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIR	Mean
Hybrids																							
RBR cms x RBR	3.292	3.573	3.933	4.500	3.82	2.719	2.606	4.586	3.333	3.31	2.073	1.942	0.985	1.304	1.58	84.69	87.83	51.26	62.70	71.62	50.30	49.85	50.06
PRBR cms x RBR	3.396	3.771	3.775	4.607	3.89	3.625	3.479	4.064	3.685	3.71	2.064	2.000	0.854	1.501	1.60	86.45	87.93	43.45	63.21	70.26	49.80	67.37	58.59
SB cms x RBR	3.729	3.625	3.313	6.747	4.35	5.917	6.490	6.896	8.830	7.03	3.102	3.288	2.154	1.748	2.57	95.03	96.84	61.44	86.10	84.85	22.93	20.76	21.85
RBR cms x SBR	3.783	4.086	4.104	6.811	4.70	5.448	5.848	6.479	7.103	6.22	2.833	2.729	2.179	1.567	2.33	92.31	96.56	59.91	78.31	81.77	22.55	11.76	17.16
PRBR cms x SBR	4.021	4.021	3.750	6.125	4.48	6.292	6.063	5.583	6.396	6.08	2.842	2.933	1.487	1.533	2.20	93.61	96.24	52.93	69.41	78.05	25.71	30.06	27.89
SB cms x SBR	4.146	3.899	3.354	7.570	4.74	6.802	7.208	7.792	8.604	7.60	3.320	3.028	2.283	1.825	2.61	94.38	96.63	71.18	85.31	86.88	10.45	3.47	6.96
RBR cms x PRLR	2.229	2.563	2.604	3.229	2.66	2.177	2.375	3.646	2.542	2.69	2.077	1.865	0.904	1.296	1.54	85.55	83.40	36.98	65.44	67.84	48.53	45.98	47.26
PRBR cms x PRLR	2.772	2.604	2.894	3.188	2.86	2.885	2.802	3.188	2.554	2.86	2.175	1.896	0.756	1.214	1.51	88.02	85.03	37.88	67.25	69.55	42.25	50.27	46.26
SB cms x PRLR	4.021	3.854	2.792	6.483	4.29	5.927	5.938	5.979	7.639	6.37	3.118	3.048	1.975	1.742	2.47	91.09	96.13	65.40	86.27	84.72	9.15	6.13	7.64
CD	0.43	0.37	0.58	0.69	0.39	0.50	0.41	0.85	0.44	0.56	0.36	0.40	0.28	0.23	0.21	3.02	3.22	7.15	7.86	3.51	8.66	8.61	5.83
Lines																							
RBR cms	3.750	3.167	3.583	3.333	3.46	1.875	2.125	2.417	2.333	2.19	1.508	1.383	0.292	0.958	1.03	73.10	80.17	16.40	37.95	51.91	62.38	41.54	51.96
PRBR cms	3.250	4.500	4.083	4.500	4.08	2.417	3.000	3.333	3.750	3.12	1.642	1.550	0.533	1.008	1.18	82.08	82.81	38.09	50.26	63.31	29.40	56.18	42.79
SB cms	3.250	4.250	3.583	7.833	4.73	6.292	7.042	6.833	8.500	5.04	3.258	3.330	1.900	1.600	2.52	96.07	98.82	64.75	76.40	84.01	8.71	1.28	5.00
CD	0.85	0.74	1.15	1.38	0.40	1.00	0.83	1.70	0.89	1.11	0.73	0.80	0.57	0.45	0.41	6.03	6.44	14.30	15.73	7.03	17.33	17.23	11.67
Testers																							
RBR	2.833	2.583	2.333	3.667	2.85	2.708	2.250	3.417	2.083	2.61	1.733	1.442	0.692	0.833	1.17	84.87	80.47	28.79	51.79	61.48	69.84	70.29	70.07
SBR	3.500	2.917	2.000	6.612	3.76	7.125	6.833	6.756	9.00	7.43	2.584	2.567	2.367	1.983	2.38	94.65	98.61	72.17	81.03	88.62	17.40	0.00	8.7
PRLR	2.083	1.417	1.669	1.500	1.67	2.333	1.417	2.583	1.083	1.85	1.542	1.308	0.508	1.425	1.20	86.59	81.99	27.81	52.89	62.32	47.95	48.87	48.41
CD	0.85	0.74	1.15	1.38	0.40	1.00	0.83	1.70	0.89	1.11	0.73	0.80	0.57	0.45	0.41	6.03	6.44	14.30	15.73	7.03	17.33	17.23	11.67
Checks																							
Resistant	3.333	3.733	4.600	2.333	3.50	1.967	1.933	2.000	1.800	1.93	1.547	1.207	0.600	0.973	1.08	74.49	77.20	35.45	47.80	58.74	59.91	66.82	63.37
Susceptible	4.556	4.333	4.111	8.222	5.31	5.667	6.889	8.000	8.444	7.25	3.044	3.144	2.078	1.956	2.56	92.05	98.13	68.14	75.96	83.57	41.91	1.28	21.60
CD	0.60	0.52	0.81	0.97	0.28	0.70	0.58	1.20	0.63	0.79	0.51	0.57	0.40	0.32	0.29	4.27	4.55	10.11	11.12	4.97	12.25	12.18	8.25
Mean (overall)	3.45	3.52	3.37	5.30		4.47	4.58	5.15	5.36		2.52	2.42	1.43	1.49		89.17	84.17	69.79	70.60		35.34	44.00	
CD	1.70	1.48	2.30	1.78		1.98	1.65	3.41	2.76		1.45	1.60	1.14	0.90		12.07	6.57	28.58	21.12		90.07	92.22	

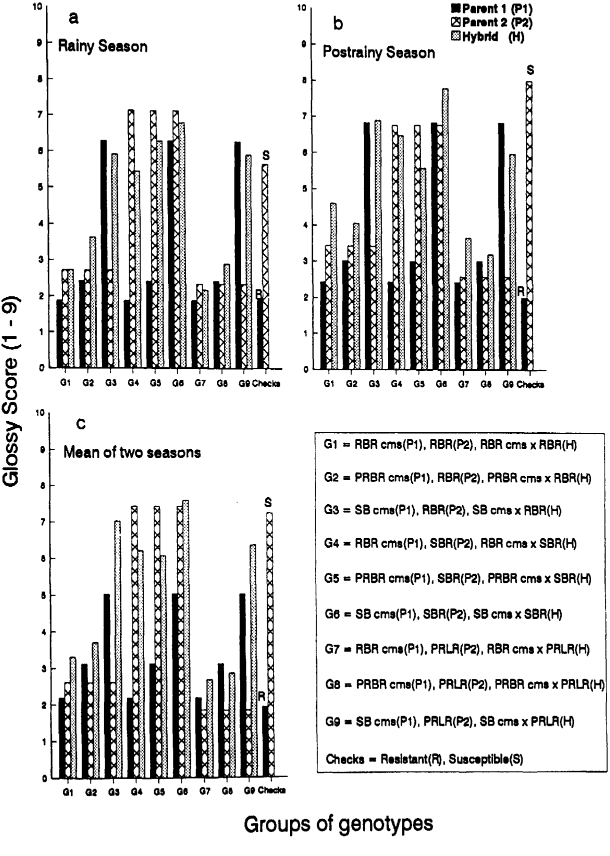


Figure 2. Mean glossy score of parents and their hybrid groups (a) Rainy season (EIK) (b) postrainy season (EIR) (c) Mean of two seasons

Table 9a: Gene action for non-glossiness in various hybrid groups

Group	Season	P_1	P_2	Mid parental Value	Hybrid	Gene action for non-glossiness
RBR cms x RBR	R	2.00	2.48	2.24	2.66	Dominant
	PR	2.38	2.75	2.57	2.57	Overdominant
RBR cms x SBR	R	2.00	6.98	4.49	5.65	Dominant
	PR	2.38	7.88	5.13	6.79	Dominant
RBR cms x PRLR	R	2.00	3.04	2.52	2.28	Partially dominant
	PR	2.38	1.83	2.11	3.09	Dominant
PRBR cms x RBR	R	2.71	2.48	2.60	3.55	Overdominant
	PR	3.54	2.75	3.15	3.87	Dominant
PRBR cms x SBR	R	2.71	6.98	4.85	6.18	Dominant
	PR	3.54	7.88	5.71	5.99	Partially dominant
PRBR cms x PRLR	R	2.71	3.04	2.88	2.84	Dominant
	PR	3.54	1.83	2.69	2.87	Dominant
SB cms x RBR	R	6.56	2.48	4.52	6.20	Dominant
	PR	7.67	2.75	5.21	7.49	Dominant
SB cms x SBR	R	6.56	6.98	6.77	7.01	Overdominant
	PR	7.67	7.88	7.78	8.20	Overdominant
SB cms x PRLR	R	6.56	3.04	4.80	5.93	Dominant
	PR	7.67	1.83	4.75	6.81	Dominant

P_1= Parent 1; P_2= Parent 2; R= Rainy season; PR= Postrainy season

4.4.3 Egg Count

In general, number of eggs plant^{-1} was more in rainy season than in postrainy season. This may be due to low pest load in the postrainy season than in the rainy season. Both bred (RBR cms, PRBR cms and RBR) and the farmer selected (PRLR) resistant parental line groups showed least egg count irrespective of the season when compared with the susceptible parent groups (SBR cms and SBR). High egg count appeared to be dominant over least count, with the result, hybrids involving both the resistant parents (RBR cms, PRBR cms, RBR, and PRLR) only showed least count while all other combinations (SB cms x RBR, RBR cms x SBR, PRBR cms x SBR, SB cms x SBR, SB cms x PRLR) supported high egg count irrespective of season/temperature (Table 9; Fig.3). In other words, high egg count pattern followed non-glossy pattern across all seasons.

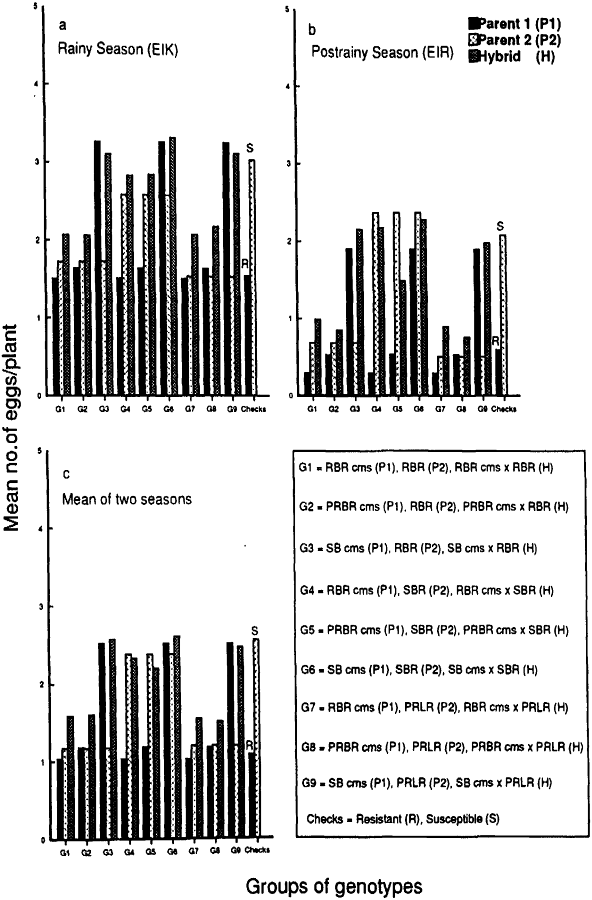


Figure 3. Mean number of eggs/plant in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

4.4.4 Deadheart %

Deadheart % ranged from 51.91 to 88.62 among all groups of hybrids, parental lines and controls (Table 9). Of all the parental lines and control groups, rainy season-bred resistant cms lines (RBR cms) had least deadheart % (51.91) and performed well in all the four environments, followed by resistant checks (58.74). Interestingly both postrainy season-adapted lines (PRBR cms and PRLR) had lower deadheart % only in postrainy season and in rainy season they were inferior to the rainy season-bred resistant cms lines (RBR cms) (Table 9; Fig.4).

Among hybrids, RBR cms x PRLR recorded least deadheart % (67.84) followed by PRBR cms x PRLR group (69.55). The highest deadheart % was recorded in SB cms x SBR group (86.88). Comparatively a low deadheart % was recorded in all the hybrid groups involving resistant female and male lines. Use of susceptible lines either as female or male increased the level of deadhearts and the deadheart % in these hybrids were comparable with that of susceptible x susceptible crosses (SB cms x SBR). This suggested that resistance to shoot fly as measured by deadheart damage was recessive and both the parents have to be resistant in order to have resistant hybrids. Further, the deadheart % was high in those hybrids where susceptible line groups were used as female parents than as pollen parent in combination with resistant parent groups.

Deadheart % was low in hybrid groups having rainy season resistant line as female and resistant/ landraces as pollen parent in both rainy and postrainy seasons. However, the crosses involving postrainy season- bred resistant lines (PRBR cms) as female parents had high level of resistance only in postrainy season. On the other hand, use of landraces (PRLR) as pollen parent with susceptible female parent did not increase the level of resistance level in the hybrid either in rainy or postrainy season. But use of landraces as pollen parent with rainy/ postrainy season bred resistant lines as females had high deadheart % in rainy season and markedly low deadheart % in postrainy season.

In crosses involving either RBR cms or PRBR cms as one of the parental lines the susceptibility was intermediate/ partially dominant/ dominant, even though the male parent was susceptible bred restorer group (SBR) (Table 9b). Interestingly, the crosses involving the susceptible bred cms females (SB cms)

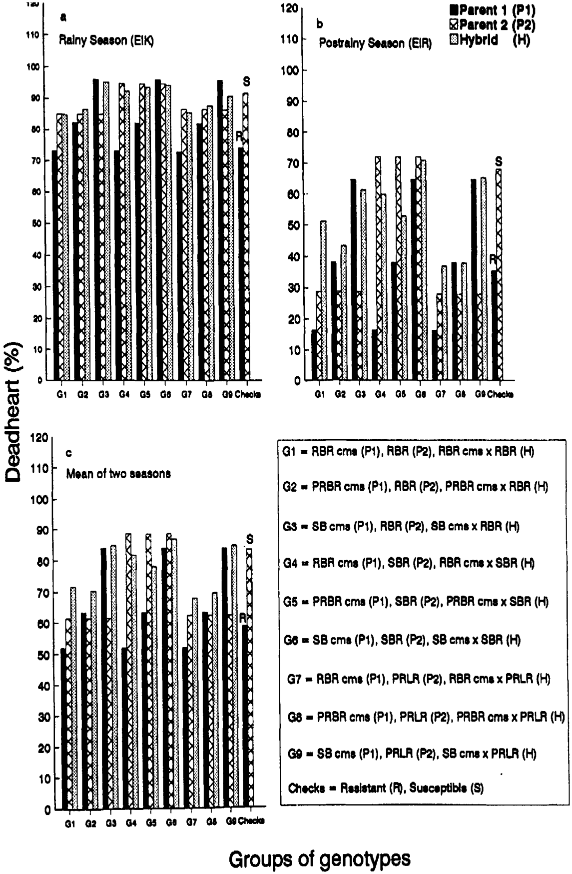


Figure 4. Mean deadheart (%) of parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

showed dominant/ overdominant for susceptibility even though the male parent was resistant bred lines. Thus, it clearly indicates that to have resistant hybrids both male and female parents should be resistant and that the susceptibility is influenced by the female parent.

Table 9b: Gene action for susceptibility (high deadheart %) in various hybrid groups

Cross	EIR/ EIIR	Deadhearts (%)				Gene action for susceptibility
		P1	P2	Mid Parent Value	Hybrid	
RBR cms x SBR	EIR	16.40	72.17	44.30	59.91	Partially dominant
	EIIR	37.95	81.03	59.49	78.31	Dominant
RBR cms x RBR	EIR	16.40	28.79	22.60	51.26	Dominant / Overdominant
	EIIR	37.95	51.79	44.87	62.70	Dominant / Overdominant
RBR cms x PRLR	EIR	16.40	27.81	22.11	36.98	Dominant
	EIIR	37.95	52.89	45.42	65.44	Dominant/ Overdominant
PRBR cms x SBR	EIR	38.09	72.17	55.13	52.93	Intermediate
	EIIR	50.26	81.03	65.65	69.41	Partially dominant
PRBR cms x RBR	EIR	38.09	28.79	33.34	43.35	Dominant/ Overdominant
	EIIR	50.26	51.79	51.03	63.21	Dominant/ Overdominant
PRBR cms x PRLR	EIR	38.09	27.81	32.95	37.88	Partially dominant
	EIIR	50.26	52.89	51.58	67.25	Dominant/ Overdominant
SB cms x RBR	EIR	64.75	28.79	46.77	61.44	Dominant
	EIIR	76.40	51.79	64.10	86.10	Dominant/ Overdominant
SB cms x PRLR	EIR	64.75	27.81	46.28	65.40	Dominant
	EIIR	76.40	52.89	64.65	84.72	Dominant/ Overdominant
SB cms x SBR	EIR	64.75	72.17	68.46	71.18	Partially dominant
	EIIR	76.40	81.03	78.72	85.31	Dominant/ Overdominant

EIR = Postrainy natural environment; EIIR = Postrainy artificial environment; P_1 = Parent 1; P_2 = Parent 2

4.4.5 Trichome Density

There was a clear environmental/season effect on the expression of trichome density and it was variable depending on the genotype groups. In general, trichome density was lower in postrainy season than in the rainy season. This reduction in density in postrainy season was contributed particularly by the susceptible cms lines (SB cms), susceptible restorer lines (SBR), susceptible controls (CSH-9, ICSV 112 and 296B) and the resistant rainy season-bred cms lines (RBR cms). In the susceptible controls, mean density was 41.91 in the rainy season while it was 1.28 in the postrainy season. Similarly the rainy season-bred resistant cms lines supported 62.38 trichomes in the rainy season, while there was only 41.54 in the postrainy season. On the other hand, it was reverse in the postrainy season-bred resistant cms lines which supported low density (29.40) in the rainy season, and high density (56.18) in the postrainy season. This clearly showed that the season-specific selection had profound effect on the trichome density. As expected, the bred resistant restorer lines (RBR) were stable across the seasons as they were selected alternatively in both rainy and postrainy seasons. Contrary to the expectation, the postrainy season-adapted landraces did not show any season specificity and they were stable across both the seasons (Table 9; Fig.5).

Season specificity for trichome density was also reflected in the hybrids of postrainy season-bred resistant cms (PRBR cms) lines. A comparison of hybrids of PRBR cms x RBR with RBR cms x RBR; PRBR cms x SBR with RBR cms x SBR; and PRBR cms x PRLR with RBR cms x PRLR showed that the hybrids made from PRBR cms lines had high density than the hybrids made from the other groups in postrainy season.

The hybrids of low density parents (SB cms and SBR) had low density and hybrids of high density parents (RBR cms, PRBR cms, RBR and PRLR) had high density (Plate. 2&3). For the hybrids of low density x high density or high density x low density groups, the explanation for gene action is given below (Table 9c).

Table 9c: Gene action for low trichome density in various hybrid groups

Cross type	Season	Trichome density (mm^2)				Gene action of low density
		P_1	P_2	Mid parent value	Hybrid	
RBR cms x SBR	R	62.38	17.40	39.89	22.6	Partially dominant
	PR	41.54	0.00	20.77	11.76	Partially dominant
PRBR cms x SBR	R	29.40	17.40	23.40	25.70	Additive
	PR	56.18	0.00	28.09	30.06	Partially dominant
SBS cms x RBR	R	8.71	69.84	39.27	22.93	Partially dominant
	PR	1.28	70.29	35.79	20.76	Partially dominant
SBS cms x PRLR	R	8.71	47.95	28.33	9.15	Dominant
	PR	1.28	25.08	25.1	6.13	Dominant

P_1= Parent 1; P_2= Parent 2; R= Rainy season; PR=Postrainy

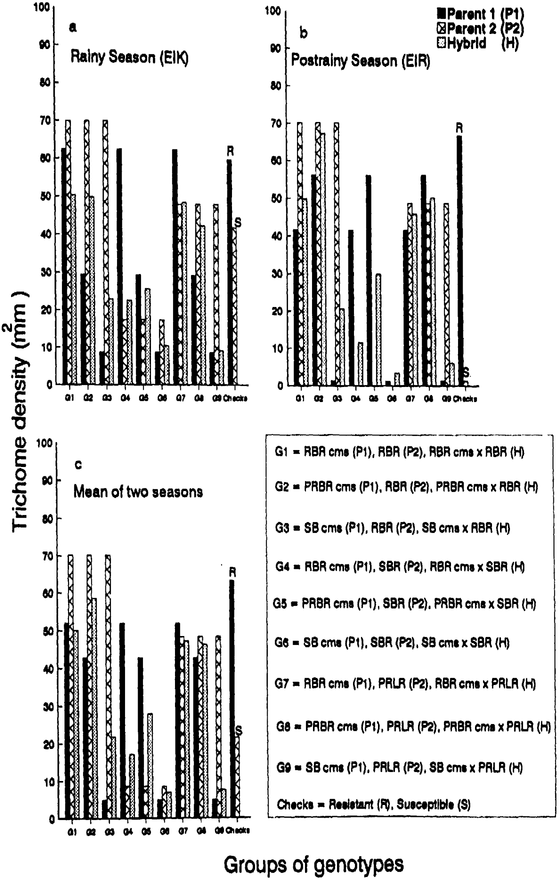


Figure 5. Mean Trichome density (mm^2) in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy Season (EIR) (c) Mean of two seasons

Plate 2: Trichomes on abaxial surface of

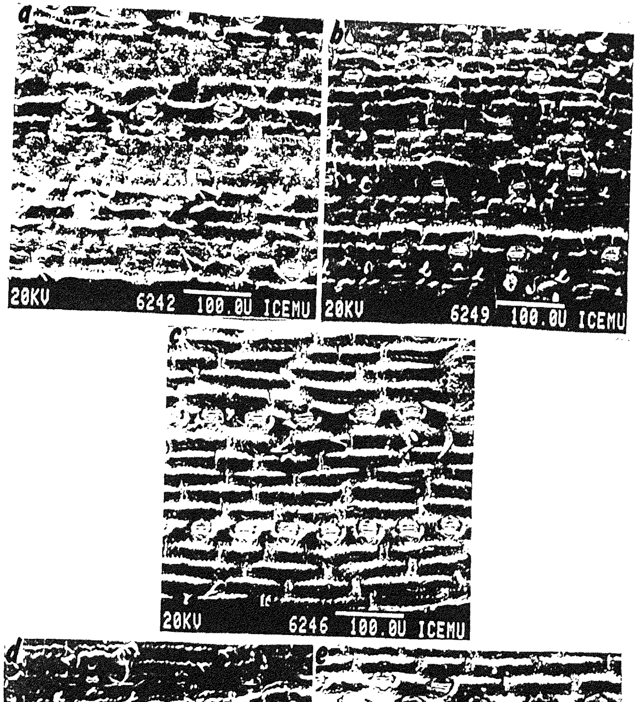
(a) SPSFR 94003A (RBR cms)

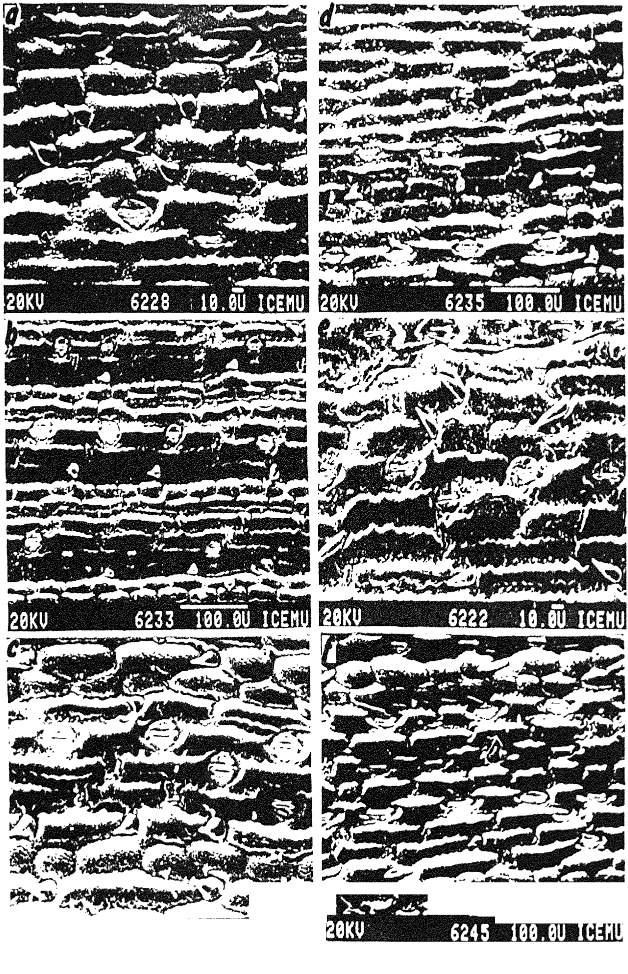
(b) ICSV 712 (RBR)

(c) ICSR 93031 (PRLR)

(d) SPSFR 94003A x ICSV 712 (RBR cms x RBR)

(e) SPSFR 94003A x ICSR 93031 (RBR cms x PRLR)


a
20KV 6242 100.0U ICEMU
b
20KV 6249 100.0U ICEMU
c
20KV 6246 100.0U ICEMU
d
20KV 6239 100.0U ICEMU
e
20KV 6236 100.0U ICEMU


a
20KV 6228 10.0U ICEMU
d
20KV 6235 100.0U ICEMU
b
20KV 6233 100.0U ICEMU
e
20KV 6222 10.0U ICEMU
c
f
20KV 6245 100.0U ICEMU

It is evident from the data that the expression of trichomes in the hybrids depended on the type of parents involved, and accordingly the gene action differed. If the postrainy season-bred resistant cms lines were involved, trichomes expression in hybrids was lower in the rainy season than in the postrainy season; the result was that the hybrids were intermediate between the parents for trichome density. Further, when the susceptible bred female lines had least number of trichomes (8.71 in rainy and 1.28 in postrainy seasons), and the resistant restorer lines were moderate for trichome density (69.84 in rainy and 70.29 in postrainy seasons), the low density appeared to be dominant. In other cases, the low density appeared to be partially dominant. Thus it appeared that the inheritance of trichome density was complex and it differed with the type of parents involved and with seasons (Table 9c).

4.4.6 Leaf Parameters

The differences between the means of rainy season trials (EIK and EIIK) which were planted at the same time were reflections of the period at which the observations were taken (with a gap of 6 days). On the other hand, during postrainy season the lowest mean growth of EIIR compared to EIR was due to low temperatures during early crop growth of EIIR compared to EIR which were planted at different times. No particular pattern was observed on the effects of G x E interaction covering various groups of materials. Therefore, the interpretations were based on the overall means.

4.4.6.1 5th Leaf Length

Among the groups of parental lines and checks, the postrainy season-adapted landraces (PRLR) had longest leaf length (28.25 cm) followed by resistant controls (22.08 cm), resistant bred restorers (21.07 cm), postrainy season-bred resistant cms lines-PRBR cms (20.65 cm) and rainy season-bred resistant cms-RBR cms (19.69 cm). The susceptible parentalline groups- both male sterile (SB cms) and restorers (SBR) had the shortest leaf length (17.86 cm and 18.58 cm respectively) (Table 10; Fig.6).

Among the hybrid groups, the hybrids of resistant females (RBR cms and PRBR cms) and the landraces (PRLR)- RBR cms x PRLR (23.39 cm), PRBR cms x PRLR (23.08 cm) had the longest leaf length.

Table 10: Group means of various types of sorghum genotypes for leaf parameters, uniformity in recovery and tiller count associated with shoot fly resistance in rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons of 1995-96

Genotype groups	5th Leaf length (cm)					5th leaf width (cm)					5th leaf droopiness (cm)					Uniformity in recovery					Total tillers $plant^{-1}$				
	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean
Hybrids																									
RBR cms x RBR	17.80	23.81	20.32	17.22	19.79	1.837	2.123	1.782	1.583	1.83	6.669	15.97	8.129	6.896	9.42	3.396	3.068	3.562	4.146	3.54	1.867	1.627	2.597	2.765	2.21
PRBR cms x RBR	19.03	21.53	21.30	17.15	19.75	1.872	2.058	1.929	1.613	1.87	7.206	15.19	8.325	7.138	9.46	3.312	3.500	3.199	3.354	3.34	1.858	1.492	2.474	2.742	2.14
SB cms x RBR	15.27	16.74	21.93	16.79	17.68	1.748	1.846	1.811	1.515	1.73	5.511	12.07	8.558	6.829	8.24	5.396	5.500	3.917	4.063	4.72	1.957	1.542	3.201	3.174	2.47
RBR cms x SBR	15.73	18.96	20.10	16.00	17.70	1.746	1.985	1.825	1.534	1.77	5.807	13.36	7.917	6.528	8.40	5.063	5.630	4.438	4.479	4.90	1.868	1.676	3.322	3.316	2.55
PRBR cms x SBR	15.49	17.87	22.30	16.69	18.09	1.773	1.948	1.885	1.543	1.79	5.750	12.80	8.640	6.804	8.50	5.064	5.312	4.188	4.458	4.76	1.904	1.513	3.295	2.955	2.42
SB cms x SBR	16.40	17.28	22.60	16.55	18.20	1.713	1.814	1.919	1.523	1.74	6.258	12.22	8.940	6.760	8.54	5.729	6.125	3.917	4.021	4.95	2.185	1.682	3.267	3.449	2.65
RBR cms x PRLR	21.63	25.51	25.48	20.94	23.39	2.154	2.354	2.058	1.692	2.06	8.283	17.33	10.327	8.644	11.15	2.479	2.146	3.167	3.729	2.88	1.654	1.426	2.515	2.662	2.06
PRBR cms x PRLR	18.75	25.08	26.51	21.99	23.08	1.996	2.206	2.037	1.701	1.99	7.092	17.41	10.507	9.284	11.07	3.000	2.771	2.703	2.688	2.79	1.726	1.458	2.307	2.481	1.99
SB cms x PRLR	15.81	18.00	26.23	16.85	19.22	1.779	1.875	2.135	1.427	1.80	5.783	12.62	10.442	7.310	9.04	5.417	5.583	3.542	3.500	4.51	2.090	1.749	3.113	3.015	2.49
CD	1.67	1.78	1.36	1.05	1.03	0.14	0.24	0.21	0.13	0.10	0.74	0.76	0.59	0.44	0.32	0.51	0.43	0.50	0.45	0.23	0.24	0.17	0.46	0.32	0.15
Lines																									
RBR cms	20.08	21.33	20.42	16.93	19.69	1.958	1.875	1.850	1.542	1.81	7.708	7.142	7.458	6.442	7.19	3.417	2.667	2.333	3.750	3.04	1.600	1.137	1.823	2.383	1.74
PRBR cms	20.62	23.27	21.08	17.63	20.65	1.758	2.017	1.808	1.592	1.79	7.392	8.025	8.158	7.392	7.74	3.167	3.583	3.083	4.500	5.56	1.733	1.433	3.433	3.083	2.47
SB cms	14.21	18.76	22.89	15.57	17.86	1.467	2.075	1.717	1.383	1.66	5.175	6.475	8.667	6.398	6.68	6.417	6.667	4.667	4.500	5.56	1.950	1.433	3.433	3.083	2.47
CD	3.33	3.56	2.72	2.11	2.07	0.25	0.49	0.41	0.26	0.18	1.5	1.53	1.18	0.89	0.65	1.02	0.85	1.00	0.90	0.46	0.49	0.34	0.92	0.63	0.29
Testers																									
RBR	18.25	23.48	24.27	18.26	21.07	1.783	2.100	1.792	1.517	1.80	6.833	7.900	9.692	7.400	7.96	3.500	2.417	1.917	2.250	2.52	1.883	1.550	2.317	2.700	2.11
SBR	13.99	18.09	24.27	17.95	18.58	1.675	1.950	1.975	1.575	1.79	5.050	6.300	9.150	7.158	6.91	5.917	7.000	3.167	3.250	4.83	1.761	1.333	2.900	3.400	2.35
PRLR	22.82	31.29	32.43	26.45	28.25	1.850	2.350	2.383	1.792	2.09	8.825	11.400	13.683	11.383	11.32	3.667	2.167	2.083	2.750	2.67	1.683	1.317	1.767	2.067	1.71
CD	3.33	3.56	2.72	2.11	2.07	0.25	0.49	0.41	0.26	0.18	1.5	1.53	1.18	0.89	0.65	1.02	0.85	1.00	0.90	0.46	0.49	0.34	0.92	0.63	0.29
Checks																									
Resistant	21.88	24.23	23.09	19.13	22.08	1.933	2.053	1.800	1.513	1.82	8.193	17.04	9.160	7.673	10.63	3.000	2.333	2.400	2.600	2.58	1.613	1.627	2.009	2.515	1.94
Susceptible	16.69	17.53	22.23	16.73	18.30	1.878	1.910	1.978	1.478	1.81	6.267	11.88	8.767	6.656	8.40	6.444	6.444	4.111	2.333	4.83	2.200	1.578	3.044	3.178	2.50
CD	2.36	2.52	1.93	1.49	1.46	0.20	0.35	0.29	0.19	0.13	1.05	1.08	0.84	0.63	0.46	0.72	0.60	0.61	0.63	0.33	0.35	0.24	0.66	0.45	0.21
Mean (Overall)	17.59	20.74	22.96	17.49		1.84	2.03	1.92	1.53		6.58	7.28	9.14	7.40		4.37	4.33	3.50	3.71		1.89	1.55	2.82	2.88	
CD	6.67	7.13	3.76	4.96		0.55	0.98	0.51	0.80		2.97	3.05	1.18	2.36		2.04	1.71	1.99	1.79		0.98	0.69	1.86	1.27	

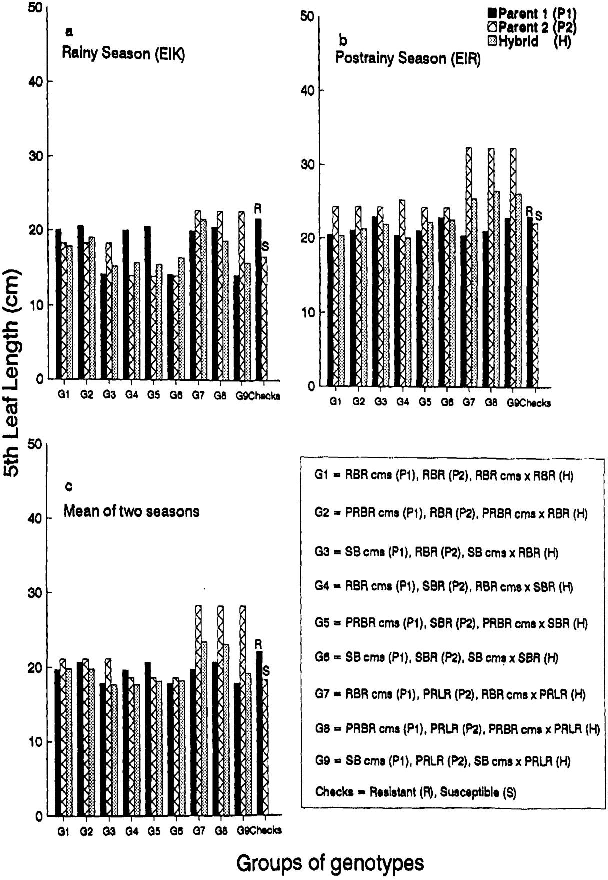


Figure 6. Mean 5th leaf length of parents and their hybrids groups (a) Rainy season (EIK) (b) Postrainy season (c) Mean of two seasons

Closely following these were the hybrids, RBR cms x RBR and PRBR cms x RBR which involved both the resistant females and male parent groups (Table 10). Considering the crosses of parental groups with contrasting leaf length (RBR cms x SBR, PRBR cms x SBR, SB cms x PRLR and SB cms x RBR), it was clear that short leaf dominates over the long leaf as shown in Table 10a.

Table 10a: Gene action for short leaf in various hybrid groups

Cross	5th leaf length (cm) P1	P2	Mid Parent Value	Hybrid	Gene action for short leaf
SB cms x PRLR	17.86	28.25	23.06	19.22	Dominant
SB cms x RBR	17.86	21.07	19.47	17.68	Dominant
PRBR cms x SBR	20.65	18.58	19.62	18.09	Dominant
RBR cms x RBR	21.07	19.69	20.38	19.79	Dominant

P_1= Parent 1; P_2= Parent 2

4.4.6.2 5th Leaf Width

Comparatively among the groups of parental lines and checks, postrainy season-adapted landraces- PRLR had maximum width (2.09 cm) followed by resistant checks (1.82 cm), rainy season-bred resistant cms lines- RBR cms (1.81 cm), resistant bred restorers- RBR (1.80 cm) and susceptible controls (1.81 cm). Susceptible bred cms lines- SB cms (1.66 cm) had the lowest width of all parental line groups (Table 10; Fig.7).

Among hybrid groups, RBR cms x PRLR had maximum width (2.06 cm), and SB cms x RBR had the lowest width (1.73 cm). However, the range among different groups of parents and consequently among different hybrid groups was not large. The patterns being not consistent it was not possible to infer the nature of gene action (recessive/ dominance/ partial dominance) of the trait in the hybrid groups.

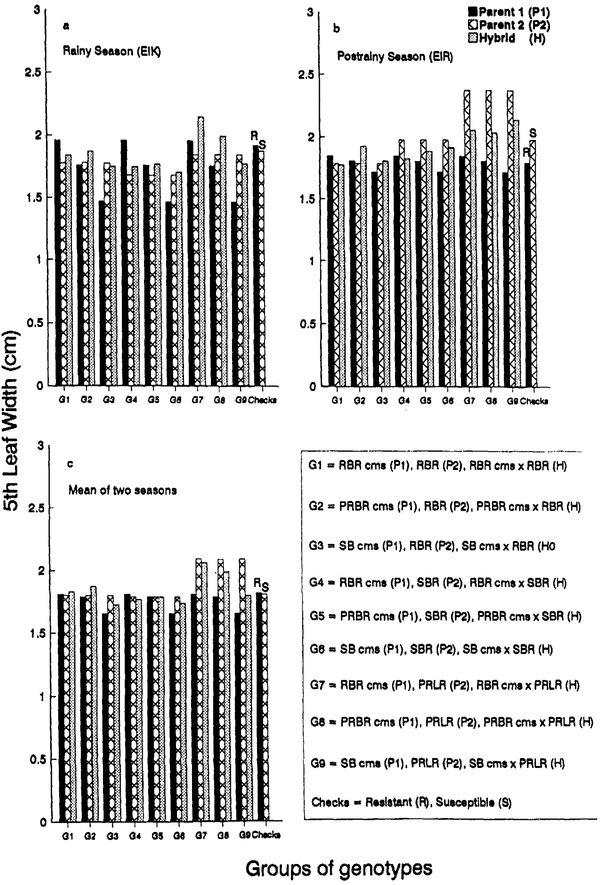


Figure 7. 5th Leaf width (cm) of parents and their hybrid groups (a) Rainy season (EIK) (b) postrainy season (EIR) (c) Mean of two seasons

4.4.6.3 5[th] Leaf Droopiness

Leaf droopiness of the susceptible line groups was also less than the resistant line groups and the hybrid groups involving susceptible line groups also had low leaf droopiness compared to others (Table 9). Among the parental lines and checks, postrainy season-adapted landraces (PRLR) had highest droopiness (11.32 cm) followed by resistant checks (10.63 cm). Both the susceptible parentalline groups (SB cms and SBR) had the least droopiness (6.68 and 6.91cm) (Table 10; Fig.8).

Comparatively, among hybrid groups, highest droopiness was measured in RBR cms x PRLR (11.15 cm) followed by PRBR cms x PRLR (11.07 cm). Hybrid groups involving susceptible lines (SB cms x RBR, RBR cms x SBR, PRBR cms x SBR and SB cms x SBR) had least droopiness (8.24, 8.40, 8.50 and 8.54 cm respectively) (Table 9). In all hybrid groups except those of RBR cms x PRLR, PRBR cms x PRLR, SB cms x PRLR and SB cms x RBR, the droopiness in hybrids was greater than the highest parents group indicating over dominance for droopiness, while in others it was dominant (Table 10b).

Table 10b : Gene action for 5[th] leaf droopiness in various hybrid groups

	5[th] Leaf droopiness (cm)				
Cross	P_1	P_2	Mid Parent Value	Hybrid	Gene action for droopi
RBR cms x PRLR	7.19	11.32	9.26	11.15	Dominant
PRBR cms x PRLR	7.74	11.32	9.53	11.07	Dominant
SB cms x PRLR	6.68	11.32	9.00	9.04	Dominant
RBR cms x RBR	7.19	7.96	7.58	9.42	Overdominant
PRBR cms x RBR	7.74	7.96	7.85	9.46	Overdominant
SB cms x RBR	6.68	7.96	7.32	8.24	Overdominant
RBR cms x SBR	7.19	6.91	7.05	8.40	Overdominant
PRBR cms x SBR	7.74	6.91	7.33	8.50	Over dominant
SB cms x SBR	6.68	6.91	6.80	8.54	Overdominant

P_1= Parent1; P_2= Parent

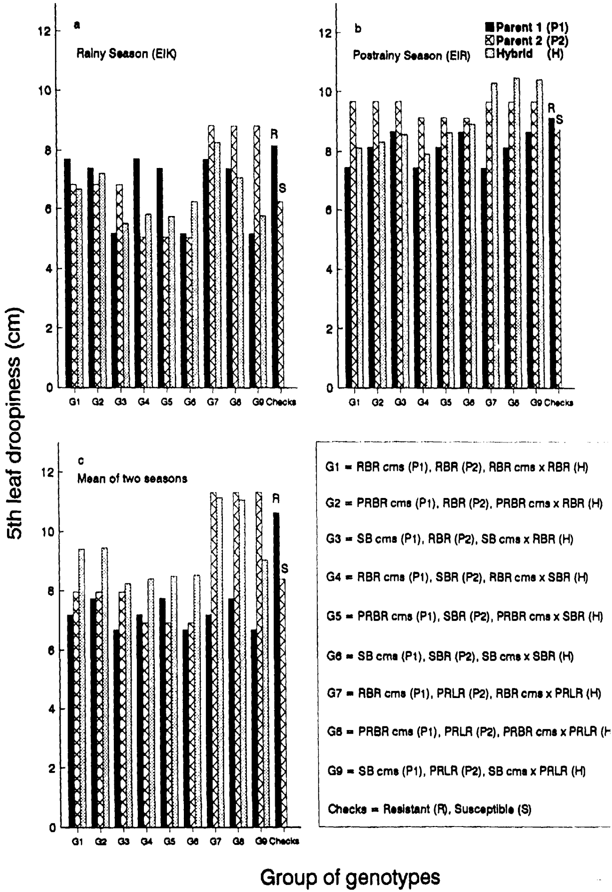


Figure 8. 5th leaf droopiness (cm) of parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

4.4.7 Unifomity in recovery

Uniformity in recovery was more during the postrainy season (EIR and EIIR) compared to the rainy season (EIK and EIIK).Among parental line groups, the susceptible line groups (SB cms and SBR) had the least uniformity in recovery (5.56 and 4.83) than the resistant line groups. Among the hybrid groups, PRBR cms x PRLR (2.79) and RBR cms x PRLR (2.88) showed the highest uniformity in recovery compared to other hybrid groups. Among these two hybrid groups, the rainy season-bred resistant female lines involved-hybrid group showed high uniformity in recovery during rainy season (2.48-EIK and 2.15-EIIK) and the postrainy season-bred resistant female lines involved-hybrid group showed high uniformity in recovery during postrainy season (2.70-EIR and 2.69-EIIR). Wherever susceptible lines were involved (SB cms and SBR), the corresponding hybrid showed poor uniformity in recovery. This indicated that high uniformity in recovery was intermediate/ partially dominant among crosses involving PRLR group of resistant parents and it was mostly recessive among all other crosses (Table 10; Fig.9)

Among crosses involving PRLR group as male parent, high uniformity in recovery was either partially dominant or intermediate irrespective of female parent (Table 10c). Whereas in the crosses involving either SBR or RBR as male parent, low uniformity in recovery is partially dominant/ dominant/ over dominant.

Table 10c: Gene action for uniformity in recovery in various hybrid groups

Cross	P_1	P_2	Mid Parent Value	Hybrid	Gene action for high/ low recovery
RBR cms x PRLR	2.67	3.04	2.86	2.88	High recovery partially dominant
PRBR cms x PRLR	2.67	3.46	3.07	2.79	High recovery partially dominant
SB cms x PRLR	2.67	5.56	4.12	4.51	Intermediate
RBR cms x SBR	4.83	3.04	3.94	4.90	Low recovery dominant
PRBR cms x SBR	4.83	3.46	4.16	4.76	Low recovery dominant
RBR cms x RBR	2.52	3.04	2.78	3.54	Low recovery overdominant
PRBR cms x RBR	2.52	3.46	2.99	3.34	Low recovery dominant
SB cms x RBR	2.52	5.56	4.04	4.72	Low recovery partially dominant

P_1= Parent 1; P_2= Parent 2

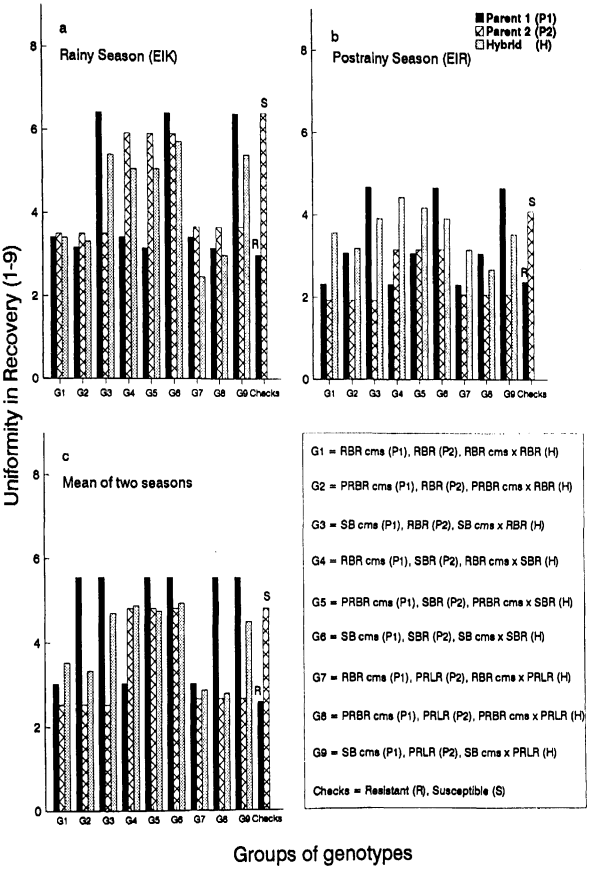


Figure 9. Mean uniformity in recovery of parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

4.4.8 Total Tillers

Total number of tillers produced were more during postrainy season than in rainy season. Among parental groups and checks, susceptible checks produced maximum number of tillers plant^{-1} (2.50) (Table 10; Fig.10). Among cms groups the number of tillers plant^{-1} ranged from 1.74 - 2.47 and among restorer groups, 1.71 - 2.35. Susceptible groups had more number of tillers than resistant groups. Among parental line groups, SB cms produced maximum number of tillers plant^{-1} (2.47) and the PRLR group produced the least number (1.71).

Among hybrid groups, the tiller number ranged between 1.99 - 2.65. SB cms and SBR produced maximum number of tillers plant^{-1} (2.65) followed by RBR cms x SBR (2.55), SB cms x PRLR (2.49), SB cms x RBR (2.47) and PRBR cms x SBR (2.42). PRBR cms x PRLR produced the least number of tillers plant^{-1} (1.99). Generally the crosses which involved susceptible parental lines produced more tillers plant^{-1}. As the range was negligible, it was not possible to consider gene action for this trait.

4.4.9 Productive Tillers

Productive tillers plant^{-1} are more during postrainy season than in rainy season. In postrainy season productive tillers plant^{-1} are more in EIR (1.36) than in EIIR (1.15) (Table 11; Fig.11). Among cms groups productive tillers plant^{-1} ranged between 0.96 - 1.05 and among restorers between 0.88 - 1.05. Among parental groups, SB cms (1.05) and PRLR (1.05) produced maximum number of productive tillers plant^{-1}. Among hybrid groups, the number of productive tillers plant^{-1} ranged from 1.02 to 1.18. As the range negligible gene action was not considered for this trait.

4.4.10 Yield

The differences between the means of EIK, EIIK, EIR and EIIR were reflections of the severe ergot disease due to continuous rains during flowering period in rainy season (EIK and EIIK) and severe bird damage in postrainy season (EIIR). Hence only EIR trial is considered for interpretations.

Table 11: Group means of various types of sorghum genotypes for yield parameters and plant characters in rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons of 1995-96

Genotype groups	Productive tillers plant^{-1}					Yield (UNI) g plant^{-1}					Yield (I) g plant^{-1}					Days to 50% flowering					Plant height (m)				
	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean	EIK	EIIK	EIR	EIIR	Mean
Hybrids																									
RBR cms x R	.888	0.973	1.393	1.136	1.10	12.21	14.11	52.32	23.50	25.54	8.80	11.86	49.20	19.83	22.42	72.22	66.48	72.33	82.56	73.40	1.57	1.65	1.32	1.43	1.50
PRBR cms x	.903	0.975	1.259	1.267	1.10	9.07	13.13	43.72	21.41	21.83	4.84	13.05	49.88	20.11	21.97	73.98	71.58	72.09	83.15	75.20	1.55	1.55	1.32	1.40	1.46
SB cms x RE	.833	0.996	1.285	1.031	1.04	10.92	12.88	38.33	20.06	20.55	7.72	10.97	50.44	20.35	22.37	73.39	70.00	72.15	85.09	75.16	1.52	1.67	1.29	1.45	1.48
RBR cms x	.963	1.018	1.549	1.196	1.18	17.52	14.83	45.43	22.75	25.13	11.56	12.64	48.85	20.37	23.36	72.45	69.69	73.85	86.90	75.72	1.42	1.56	1.29	1.34	1.40
PRBR cms x	.900	0.933	1.560	1.057	1.11	13.52	15.59	44.28	24.83	24.56	8.38	14.44	53.07	19.85	23.94	74.12	71.37	74.48	87.11	76.77	1.40	1.55	1.27	1.32	1.38
SB cms x S	.908	0.928	1.293	0.943	1.02	13.36	15.08	52.87	28.48	27.45	10.11	12.96	57.40	21.52	25.50	72.83	70.76	70.25	85.89	74.93	1.41	1.52	1.32	1.34	1.40
RBR cms x	.963	1.013	1.375	1.388	1.18	5.86	11.42	55.94	27.27	25.12	4.97	7.24	58.18	26.56	24.24	71.31	66.60	70.06	82.04	72.50	.15	2.26	1.64	1.72	1.94
PRBR cms x	.930	1.033	1.383	1.285	1.16	7.62	8.72	59.26	26.76	25.59	5.72	7.62	58.54	25.31	24.30	72.98	68.90	70.15	81.46	73.37	.12	2.31	1.80	1.86	2.02
SB cms x P	.937	1.016	1.383	1.256	1.15	14.05	10.86	48.21	35.94	27.27	7.47	10.12	58.94	32.34	27.22	71.95	69.50	69.75	82.51	73.43	.93	2.05	1.58	1.71	1.82
CD	.10	0.09	0.26	0.18	0.08	3.56	2.71	6.83	5.18	2.59	2.49	2.87	7.49	4.95	2.48	0.703	1.40	1.19	0.95	0.40	.09	0.10	0.05	0.06	0.05
Lines																									
RBR cms	.800	0.933	1.122	0.983	0.96	7.04	10.49	32.15	20.15	17.46	4.72	5.10	21.20	17.73	12.19	74.10	68.75	72.42	82.58	74.46	.26	1.28	1.01	1.12	1.18
PRBR cms	0.867	0.917	1.333	0.950	1.02	13.49	11.41	39.22	20.82	21.24	8.53	11.86	36.39	14.89	17.92	72.82	70.17	72.67	86.49	75.54	.20	1.19	1.07	1.09	1.14
SB cms	.783	0.783	1.550	1.067	1.05	11.76	.39	44.21	17.59	20.74	14.37	7.17	45.41	23.66	22.65	74.12	70.75	72.08	88.22	76.29	.21	1.25	1.22	1.12	1.20
CD	0.18	0.17	0.52	0.36	0.16	7.11	.43	13.65	10.35	5.18	4.98	5.75	14.98	9.90	5.00	0.812	2.80	1.37	1.09	0.80	.10	0.11	0.06	0.07	0.10
Testers																									
RBR	0.950	0.917	0.867	0.800	0.88	8.33	.69	43.42	23.481	22.23	4.51	7.04	32.60	12.16	14.08	73.29	71.50	70.58	82.50	74.47	.34	1.61	1.25	1.28	1.37
SBR	0.783	0.817	0.983	0.983	0.89	7.23	11.06	49.10	26.09	23.37	6.58	5.68	54.60	29.37	24.06	73.63	78.25	72.58	87.75	78.05	.20	1.23	1.19	1.27	1.22
[illegible]	0.933	0.917	1.033	1.300	1.05	17.82	3.46	35.47	20.90	19.41	2.84	5.29	38.27	14.45	15.21	73.51	68.75	71.83	81.25	73.84	.86	2.13	1.64	1.71	1.84
	0.18	0.17	0.52	0.36	0.16	7.11	5.43	13.65	10.35	5.18	4.98	5.75	14.98	9.90	5.00	0.812	2.80	1.37	1.09	0.80	.10	0.11	0.06	0.07	0.10
	1.013	1.013	1.449	1.289	1.91	7.44	.44	32.51	25.04	19.61	4.87	6.72	37.38	18.77	16.94	71.82	67.05	71.60	79.88	72.59	.69	1.60	1.29	1.37	1.19
	0.911	0.933	1.911	0.844	1.15	4.73	.49	45.12	27.85	22.30	9.78	8.21	56.11	30.73	26.21	72.83	71.33	74.89	88.78	76.96	.31	1.43	1.25	1.16	1.29
	0.13	0.12	0.37	0.26	0.11	5.03	.84	9.65	7.32	3.66	3.52	4.06	10.59	7.00	3.50	0.574	1.99	0.97	0.77	0.56	.07	0.08	0.04	0.50	0.07
	0.91	0.97	1.36	1.15		10.92	.54	47.27	25.20		7.56	10.49	51.26	22.46		72.88	69.66	71.78	84.13		.62	1.73	1.39	1.46	
	0.37	0.34	1.05	0.72		14.22	.85	27.30	20.71		9.95	14.66	29.96	19.80		3.18	5.62	5.38	4.28		.39	0.43	0.24	0.27	

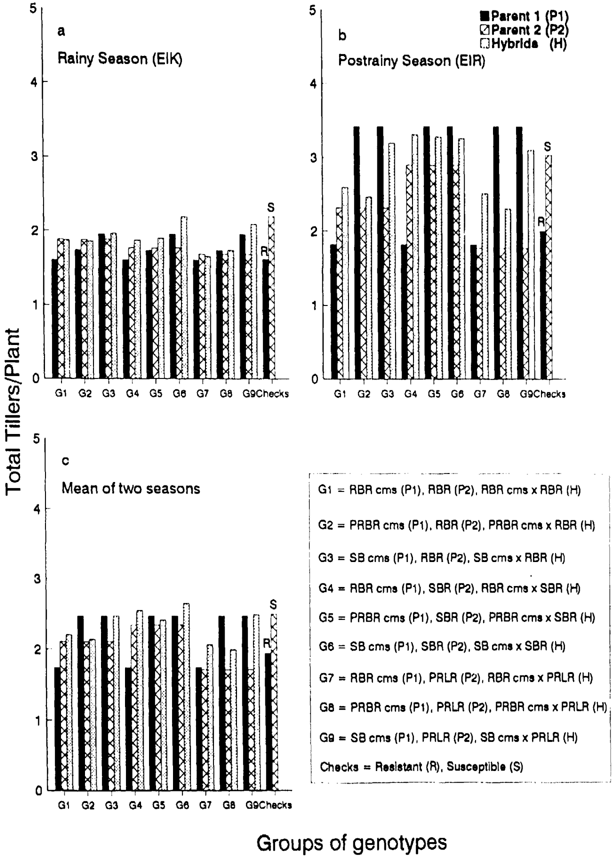


Figure 10.Mean total tillers/plant in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

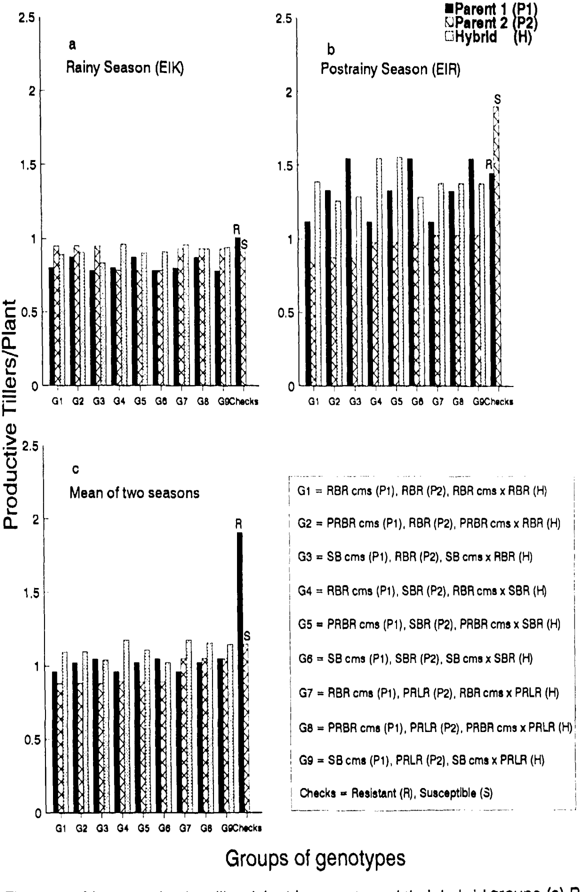


Figure 11. Mean productive tillers/plant in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

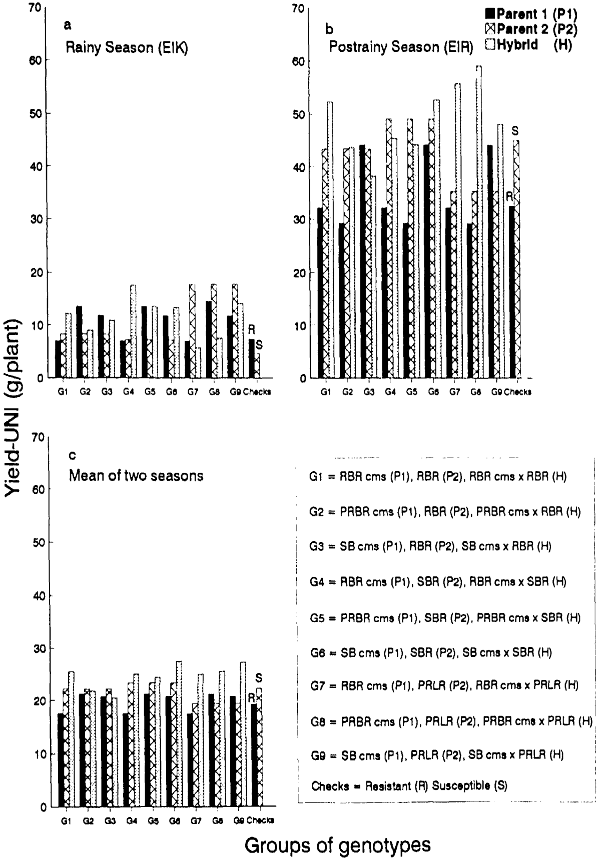


Figure 12. Mean yield-UNI (g/plant) in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

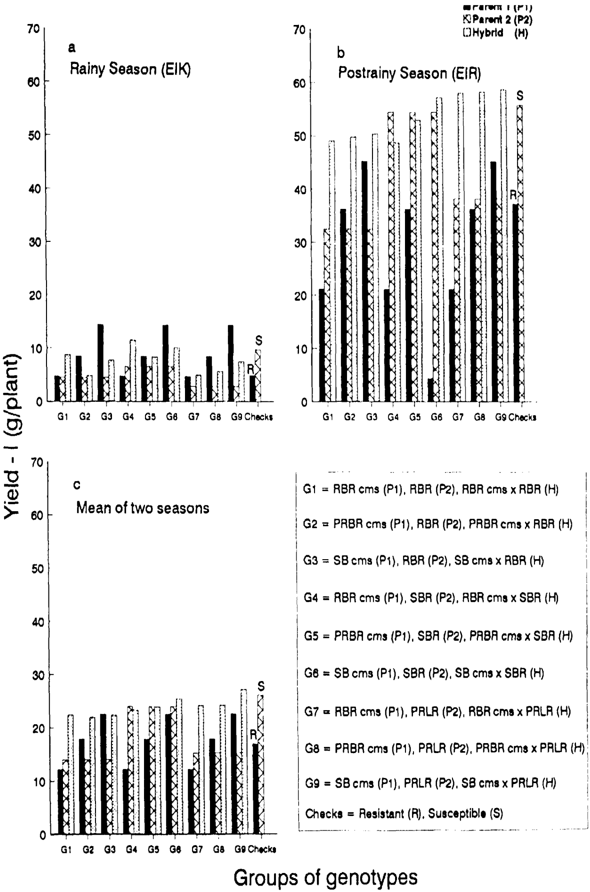


Figure 13. Mean grain yield-I (g/plant) of parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

Among the cms groups, the yield ranged from 32.15 - 44.21 (UNI) and 21.20 - 45.41 (I). It ranged between 35.47 - 49.10 (UNI) and 32.60 - 54.60 (I) among restorers (Table 11; Fig.12 & 13). In both the cases the susceptible groups- SB cms and SBR produced maximum yield in both infested and uninfested samples.

Among hybrid groups, SB cms x RBR produced lowest yield and the rest of the groups did not differ significantly. Generally crosses which involved postrainy season-bred resistant lines produced higher yield than the hybrids involving rainy season-bred resistant lines in postrainy season. In other words, in the hybrids the susceptibility of parent did not account for yield, although among parents, susceptible parental line groups yielded higher than resistant groups (Table 11).

4.4.11 Days to 50% Flowering

In general, the late planted postrainy season (EIIR) took more days to 50% flowering compared to EIK, EIIK and EIR. Among parental line groups, the susceptible line groups (SB cms and SBR) took more days to flower than resistant line groups. Postrainy season-adapted landraces (PRLR) group took least days (73.84) to flower compared to others (Table 11; Fig.14).

In case of hybrids, there was significant difference among both rainy and postrainyseasons. Interestingly where ever PRLR group were used as restorers, the hybrids were early in all locations/ seasons including the late postrainy season. Crosses involving susceptible line groups (SB cms and SBR) were late compared to others. Particularly, PRBR cms x SBR hybrids were late in all the four environments.

4.4.12 Plant Height

Usually all genotype groups were short in postrainy season than in rainy season. Among parental line groups, the PRLR group were tallest (1.84 m) restorers and SBR group were shortest (1.22 m) restorers. Among hybrids there was significant difference between rainy season and postrainy season. Generally where ever

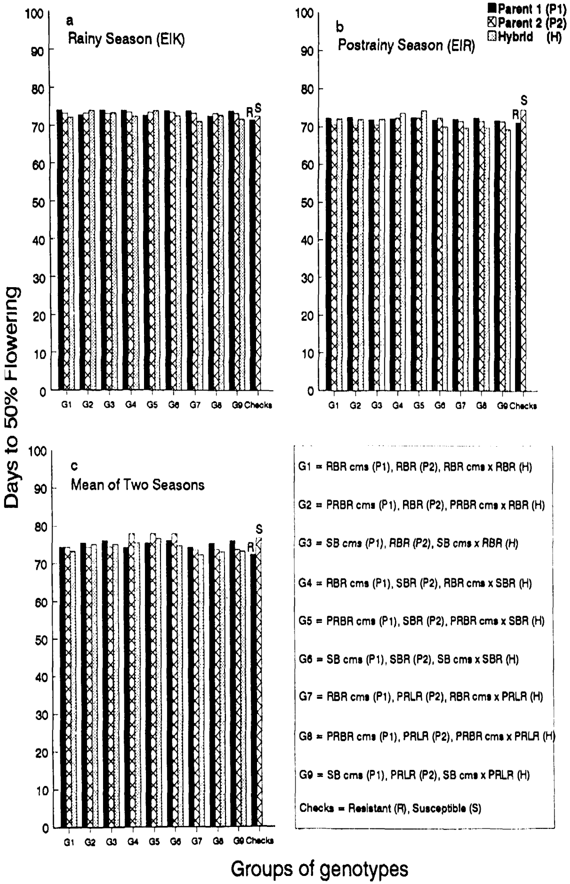


Figure 14. Mean number of days to 50% flowering in parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

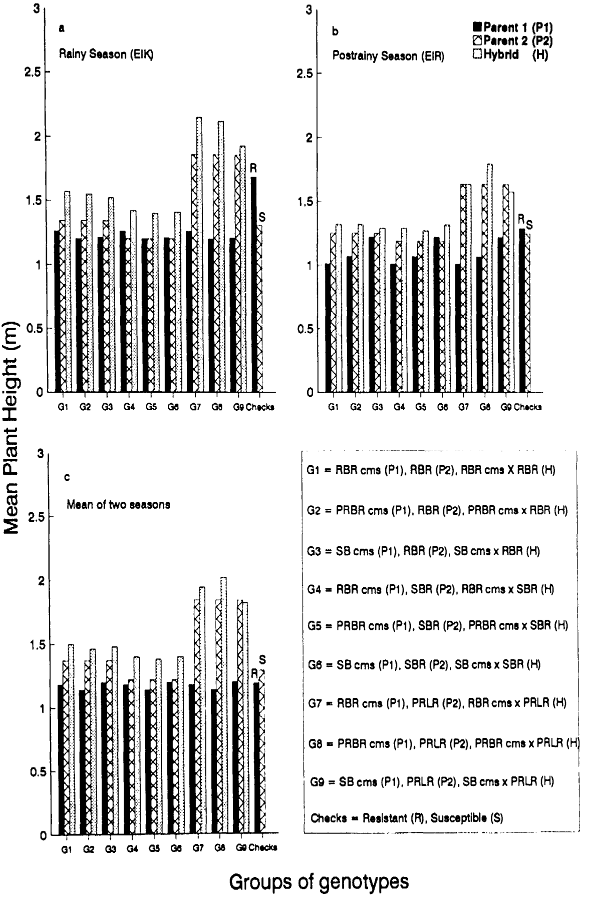


Figure 15. Mean plant height of parents and their hybrid groups (a) Rainy season (EIK) (b) Postrainy season (EIR) (c) Mean of two seasons

PRLR group was used as restorer the hybrids were tall in all locations/ seasons (Table 11; Fig.15).

4.5. GENERAL (GCA) AND SPECIFIC COMBINING (SCA) ABILITY EFFECTS

Combining ability analysis helps the plant breeders in selecting the parents and the breeding method to be employed for the improvement by providing information on the genetic nature of the characters. General combining ability (GCA) refers to the average performance of a line in a series of crosses, while the specific combining ability (SCA) refers to the deviation in the performance of a cross that would be expected on the basis of the average performance of the lines involved and is attributable primarily to dominant and epistatic effects (non-additive effects) of genes. For improvement of self pollinated crops, high SCA effects of a particular cross combination will be useful if it is accompanied by high GCA effect of the respective parents, unlike the cross pollinated crops where predominant SCA effects are of primary consideration (Raghavaiah and Joshi, 1986). These observations are applicable to sorghum which is a self pollinated crop. The GCA and SCA effects computed for 24 parental lines and 144 hybrid combinations for the selected variables for rainy (EIK) and postrainy (EIR) season experiments are given in Tables 12 to 16.

4.5.1 Early Seedling Vigour

In rainy and postrainy seasons, highly significant GCA effects were noticed among lines and testers. The estimated effects ranged from -0.85 to 1.62 and from -1.12 to 1.20 during rainy and postrainy seasons respectively (Table 12; Fig.16).

Lines, SPSFR 94002A (-0.52), SPSFR 94031A (-0.74), SPSFPR 94002A (-0.63) and SPSFPR 94007A (-0.65) in rainy season and SPSFPR 94007A (-0.61) and ICSA 20 (-0.89) in postrainy season recorded high negative GCA effects (desirable). Of the four female lines with the desirable GCA effects in rainy season, two were bred under rainy season, and two were bred under postrainy season for shoot fly resistance. Among the two female lines selected for postrainy season, one was bred under postrainy season for shoot fly resistance and one was from susceptible female lines.

Table 12: Estimation of General Combining Ability (GCA) effects of parents for different characters associated with shoot fly resistance

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	LINES										
	RBR cms										
1	SPSFR 94002A	-0.52**	0.33	-0.87**	0.81*	-0.12	0.40**	-4.19**	9.76**	3.93	-16.13**
2	SPSFR 94003A	0.04	0.22	-0.94**	-1.11**	-0.27	-0.51**	0.13	-11.00**	0.14	4.26
3	SPSFR 94001A	-0.33	0.52*	-0.82**	-0.63	-0.43**	-0.04	-1.79	-0.82	15.32**	23.87**
4	SPSFR 94031A	-0.74**	-0.45	-1.93**	-0.88*	-0.36*	-0.45**	-4.61**	-13.93**	18.55**	6.46
	PRBR cms										
5	SPSFPR 94001A	1.23**	1.20**	1.62**	0.78*	-0.05	-0.36**	-0.22	-3.72	19.11**	54.10**
6	SPSFPR 94002A	-0.63**	0.16	-0.76**	-1.22**	-0.41**	-0.66**	-0.98	-12.14**	12.78**	21.86**
7	SPSFPR 94005A	-0.32	-0.42	-0.84**	-0.88*	-0.28	-0.16	0.15	-4.44	9.72**	4.65
8	SPSFPR 94007A	-0.65**	-0.61**	1.62**	-2.99**	-0.31**	-0.73**	-2.00	-14.22**	-7.48*	-7.50
	SB cms										
9	ICSA 20	-0.07	-0.89**	1.23**	0.59	1.08**	0.19	4.59**	7.86**	-22.01**	-18.02**
10	ICSA 89001	1.62**	0.22	2.48**	2.39**	-0.08	1.17**	2.07	16.12**	-19.55**	-30.77**
11	ICSA 89004	0.37*	-0.31	1.76**	1.25**	0.42**	0.44**	3.31**	11.18**	-12.29**	-18.79**
12	ICSA 90002	-0.02	0.03	0.70**	1.89**	0.81**	0.72**	3.54**	15.34**	-18.22**	-23.99**
	TESTERS										
1	ICSV 712	-0.10	0.56*	-0.61**	-0.08	-0.24	-0.23	-0.53	-1.41	27.46**	26.84**
2	ICSV 88088	-0.60**	-0.39	-1.09**	-0.47	-0.27	-0.39**	-4.69**	-12.79**	20.75**	34.09**
3	ICSV 89015	0.29	0.08	-0.37	-0.05	-0.02	-0.15	0.22	4.12	-4.02	-0.94
4	ICSV 89030	0.35	0.89**	-0.29	-0.11	-0.30*	0.06	-0.61	4.75	-9.70**	-5.19
	SBR										
5	ICSR 89076	0.46**	0.69**	1.47**	1.34**	0.38*	0.71**	3.11*	11.39**	-9.78**	-13.00**
6	ICSR 90002	0.64**	0.16	1.84**	1.28**	0.48**	0.21	3.70**	5.61	-4.24	-15.41**
7	ICSR 90005	0.32	0.36	1.71**	1.75**	0.42**	0.39**	3.60**	10.07**	-17.85**	-19.17**
8	ICSR 90014	0.57**	0.16	1.35**	0.67	0.22	0.58**	2.80*	4.77	-13.35**	-13.95**
	PRLR										
9	ICSR 93031	-0.54**	-0.64**	-1.06**	-0.77*	-0.18	-0.46**	-2.25	-3.07	3.73	4.70
10	ICSR 93011	-0.65**	-0.34	-1.20**	-1.80**	-0.18	-0.31**	-1.27	-4.42	-2.92	-2.17
11	ICSR 93009	0.12	-0.42	-0.77**	-1.08**	-0.32*	-0.07	-3.32**	-6.38*	2.48	0.48
12	ICSR 93010	-0.85**	-1.12**	-0.98**	-0.69	0.01	-0.34**	-0.77	-12.64**	7.44*	3.73
SE± (gi)		0.18	0.24	0.20	0.36	0.15	0.12	1.24	2.95	3.63	3.51
SE±(gi-gj)		0.25	0.34	0.28	0.51	0.21	0.17	1.76	4.17	5.13	4.96

Contd..

Table 12: Contd..

S.No.	Genotypes	5th Leaf Length (cm)		5th Leaf Width (cm)		5th Leaf Droopiness (cm)		Uniformity in recovery	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	LINES								
	RBR cms								
1	SPSFR 94002A	0.78	-0.56	0.02	0.01	0.20	-0.09	-0.45*	0.62**
2	SPSFR 94003A	0.07	-1.27*	-0.05	-0.03	0.02	-0.64**	-0.07	-0.21
3	SPSFR 94001A	1.12	-2.28**	0.21**	-0.12	0.54	-0.65**	-0.62**	0.68**
4	SPSFR 94031A	2.38**	0.08	0.09	-0.03	1.03**	0.19	-1.54**	-0.71**
	PRBR cms								
5	SPSFPR 94001A	-2.63**	-3.56**	-0.28**	-0.05	-1.07**	-1.71**	0.93**	0.43*
6	SPSFPR 94002A	0.25	1.23*	0.10	0.15	0.25	0.33	-0.76**	-0.60**
7	SPSFPR 94005A	1.29	1.68**	0.17**	-0.06	0.56	0.82**	-0.76**	-0.24
8	SPSFPR 94007A	2.78**	2.24**	0.14*	0.04	1.02**	0.83**	-1.18**	-0.65**
	SB cms								
9	ICSA 20	-0.21	4.16**	-0.05	0.09	-0.15	1.64**	1.24**	-0.46*
10	ICSA 89001	-2.61**	-0.78	-0.18**	0.05	-1.05**	-0.57*	2.26**	0.93**
11	ICSA 89004	-1.85**	-0.01	-0.08	0.12	-0.69**	0.12	1.16**	-0.18
12	ICSA 90002	-1.36	-0.93	-0.10	-0.16	-0.67*	-0.29	-0.20	0.37
	TESTERS								
	RBR								
1	ICSV 712	-0.61	-1.80**	-0.08	-0.02	-0.21	-0.73**	-0.35	0.03
2	ICSV 88088	0.94	0.72	0.04	0.02	0.17	0.05	-0.98**	-0.46*
3	ICSV 89015	0.22	-2.55**	0.03	-0.13	0.14	-0.92**	-0.12	-0.15
4	ICSV 89030	-0.42	-3.53**	-0.10	-0.24**	-0.21	-1.38**	-0.15	0.32
	SBR								
5	ICSR 89076	-1.45*	-2.68**	-0.09	-0.15	-0.63*	-1.13**	0.78**	1.26**
6	ICSR 90002	-0.86	-0.67	-0.08	-0.01	-0.17	-0.23	1.61**	0.49*
7	ICSR 90005	-2.31**	-0.85	-0.14*	-0.04	-0.87**	-0.47	1.21**	0.15
8	ICSR 90014	-1.09	-1.05*	-0.09	-0.03	-0.45	-0.52*	1.21**	0.32
	PRLR								
9	ICSR 93031	1.64*	3.15**	0.19**	0.23**	0.62*	1.23**	-1.01**	-0.43*
10	ICSR 93011	1.45*	2.85**	0.07	-0.01	0.56	1.05**	-0.82**	-0.71**
11	ICSR 93009	0.42	2.73**	0.05	0.10	0.24	1.55**	-0.37	-0.26
12	ICSR 93010	2.07**	3.67**	0.20**	0.27**	0.83**	1.52**	-1.01**	-0.55**
SE± (gi)		0.70	0.51	0.06	0.09	0.31	0.24	0.19	0.21
SE±(gi-gj)		0.99	0.72	0.08	0.12	0.44	0.34	0.27	0.30

* Significant at 5 per cent level; ** Significant at 1 per cent level

Table 13: Estimation of General Combining Ability (GCA) effects of parents for yield parameters, yield and plant characters

	Genotypes	Total tillers ($Plant^{-1}$)		Productive tillers ($Plant^{-1}$)		Yield-(UNI) (g $plant^{-1}$)		Yield-(I) (g $plant^{-1}$)		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	LINES												
	RBR cms												
1	SPSFR 94002A	0.06	0.02	0.03	-0.09	3.98**	-1.30	4.68**	-11.17**	-2.36**	2.71**	-7.82	-12.39**
2	SPSFR 94003A	-0.08	-0.57**	0.06	-0.16	-4.02**	1.19	-1.37	3.37	0.57	-0.32	-1.43	4.42
3	SPSFR 94001A	-0.26*	0.47**	-0.02	0.51**	-3.34*	11.26**	0.38	7.93*	-1.06**	0.35	13.25**	-2.39
4	SPSFR 94031A	-0.14	-0.27	0.03	-0.11	1.12	0.95	-1.03	-0.40	-0.62	-1.12*	11.07**	6.64**
	PRBR cms												
5	SPSFPR 94001A	-0.05	-0.23	-0.01	-0.08	-1.19	4.21	-2.42*	2.96	1.64**	2.62**	5.79	7.39**
6	SPSFPR 94002A	-0.00	-0.13	-0.00	0.12	-2.45	0.17	-2.56*	5.06	1.18**	-1.96**	-2.13	5.78*
7	SPSFPR 94005A	-0.07	-0.07	-0.02	-0.08	-2.28	1.98	-0.86	0.91	0.87**	1.51**	8.84*	9.00**
8	SPSFPR 94007A	-0.16	-0.40*	0.02	-0.05	-1.59	-6.10*	0.28	-8.99**	0.11	0.07	-6.47	-7.39*
	SB cms												
9	ICSA 20	0.20*	0.10	0.00	-0.11	0.04	1.82	1.18	8.98**	0.24	-3.93**	-5.32	8.86**
10	ICSA 89001	0.42**	0.80**	-0.03	0.20	9.17**	-9.54**	-2.21*	-6.96*	0.94**	-0.82	-4.49	12.39**
11	ICSA 89004	0.23*	0.31	-0.03	-0.30**	-2.56	0.14	2.45*	2.07	-0.86**	0.01	-10.60*	-5.99
12	ICSA 90002	-0.15	-0.03	-0.02	-0.02	3.13*	-4.78	1.46	2.99	-0.64	0.88	-0.67	-1.55
	TESTERS												
	RBR												
1	ICSV 712	-0.17	-0.15	-0.07	0.05	-3.04*	-0.89	0.03	-6.63*	0.83*	-0.67	-16.82**	-2.78
2	ICSV 88088	0.02	-0.54**	-0.04	-0.22*	-1.01	-9.81**	-1.38	-8.42**	0.33	-0.85	-17.13**	-16.69**
3	ICSV 89015	-0.01	0.02	-0.04	0.01	0.38	-10.60**	0.01	-9.77**	0.20	0.90	-3.45	-16.83**
4	ICSV 89030	0.13	0.10	-0.01	-0.22*	1.29	6.35*	-0.99	8.87**	0.41	2.65**	-14.14**	-8.91**

Contd..

Contd..

	Genotypes	Total tillers (Plant^{-1})		Productive tillers (Plant^{-1})		Yield-(UNI) (g plant^{-1})		Yield-(I) (g plant^{-1})		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	SBR												
5	ICSR 89076	-0.01	1.33**	0.04	0.56**	4.30**	-2.64	2.68*	-5.99	0.30	2.88**	-24.35**	-9.47**
6	ICSR 90002	0.08	0.38*	-0.04	0.17	2.40	0.35	0.84	-1.11	0.80*	2.21**	-23.69**	-9.75**
7	ICSR 90005	0.14	0.00	0.01	-0.22*	5.90**	-9.25**	3.05**	0.22	0.41	-0.57	-28.66**	-15.02**
8	ICSR 90014	0.12	-0.12	0.03	-0.13	1.63	5.41	2.52*	3.96	-0.10	0.21	-30.12**	-18.91**
	PRLR												
9	ICSR 93031	-0.18	-0.13	0.08**	-0.08	-0.41	2.43	-1.07	3.32	-2.19**	-2.54**	41.90**	20.11**
10	ICSR 93011	-0.14	-0.13	0.01	-0.11	-4.59**	9.09**	-2.98**	4.08	-0.81*	-2.96**	32.31**	24.42**
11	ICSR 93009	0.06	-0.12	0.01	0.23*	-4.01**	6.16*	-2.00	4.93*	-0.22	0.79	36.90**	24.70**
12	ICSR 93010	-0.05	-0.63**	0.03	-0.05	-2.83	3.42	-0.72	4.53	0.04	-2.06**	47.25**	29.14**
SE± (gi)		0.10	0.16	0.04	0.10	1.51	2.91	1.05	3.15	0.33	0.56	4.16	2.52
SE± (gi-gj)		0.14	0.23	0.05	0.15	2.41	4.11	1.49	4.45	0.47	0.80	5.88	3.57

* Significant at 5 per cent level; ** Significant 1 per cent level

Table 14: Estimates of specific combining ability (SCA) of crosses for early seedling traits, shootfly parameters and leaf characters

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	RBR cms x RBR hybrids										
1	SPSFR 94002A x ICSV 712	0.13	-1.28	-0.53	1.58	-0.26	0.03	-1.73	8.85	-3.18	-0.00
2	SPSFR 94002A x ICSV 88088	-0.09	0.83	-0.80	-1.17	0.09	-0.43	3.92	8.00	-22.21	11.61
3	SPSFR 94002A x ICSV 89015	0.61	1.53	-0.08	-0.32	0.52	-0.51	-0.24	4.40	7.52	19.14
4	SPSFR 94002A x ICSV 89030	0.01	-0.50	0.36	-1.73	-0.12	-0.16	2.05	-18.33	19.28	-6.63
5	SPSFR 94003A x ICSV 712	0.38	0.92	0.98	1.96	-0.13	-0.03	-7.10	16.13	-7.17	-45.60**
6	SPSFR 94003A x ICSV 88088	-0.09	-0.45	-0.31	-0.40	-0.00	0.05	-1.11	-6.57	10.37	9.43
7	SPSFR 94003A x ICSV 89015	-0.40	-0.53	-0.56	-0.73	0.30	0.38	-2.93	5.86	-7.30	9.39
8	SPSFR 94003A x ICSV 89030	1.26*	-0.67	-0.12	-0.62	0.55	0.11	4.00	-7.75	12.13	17.14
9	SPSFR 94001A x ICSV 712	0.68	2.27**	0.37	0.47	0.11	0.07	3.06	-1.50	0.14	5.52
10	SPSFR 94001A x ICSV 88088	-1.68**	-0.17	-1.05	0.66	-0.37	0.18	2.29	0.95	-23.93	-29.61*
11	SPSFR 94001A x ICSV 89015	-0.76	0.36	0.67	1.13	-0.33	-0.45	2.54	-3.46	33.44**	0.15
12	SPSFR 94001A x ICSV 89030	-0.04	-2.31**	1.06	-0.84	-0.35	0.77	-4.75	-6.58	-19.10	9.47
13	SPSFR 94031A x ICSV 712	0.63	0.67	-0.71	2.30	-0.67	0.06	3.04	9.60	24.58*	-8.19
14	SPSFR 94031A x ICSV 88088	-0.26	0.11	-0.48	2.22	-0.21	-0.27	0.34	-14.66	7.59	-4.39
15	SPSFR 94031A x ICSV 89015	-0.55	-0.52	-0.59	-2.26	-0.12	-0.81*	-3.85	-13.29	-6.63	-5.25
16	SPSFR 94031A x ICSV 89030	0.85	0.45	0.00	-1.00	0.30	-0.13	-7.43	-6.87	-11.87	2.43
	PRBR cms x RBR hybrids										
17	SPSFPR 94001A x ICSV 712	-0.46	-1.53	1.63*	0.99	-0.17	0.08	-0.92	-0.91	-16.74	-10.40
18	SPSFPR 94001A x ICSV 88088	-0.59	0.84	-0.32	0.10	-0.44	0.18	-2.73	-1.93	8.94	-1.52
19	SPSFPR 94001A x ICSV 89015	0.09	0.75	-0.24	-1.34	-0.34	-0.12	0.21	2.67	-6.92	25.87*
20	SPSFPR 94001A x ICSV 89030	-0.23	-0.05	-0.29	-0.56	0.05	0.14	-9.92*	12.92	21.96	10.68

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
21	SPSFPR 94002A x ICSV 712	0.51	-0.11	-0.14	-0.48	0.70	0.13	4.18	10.99	0.17	41.64**
22	SPSFPR 94002A x ICSV 88088	-0.85	1.11	0.11	0.05	0.99	0.31	5.44	0.17	-5.77	-36.85**
23	SPSFPR 94002A x ICSV 89015	1.07	-0.36	1.83**	-0.48	-0.34	0.38	9.10*	8.24	-16.68	-8.79
24	SPSFPR 94002A x ICSV 89030	-0.21	-1.36	-0.78	-0.45	0.24	0.07	2.54	-6.92	1.37	-5.22
25	SPSFPR 94005A x ICSV 712	0.07	-1.13	0.23	0.55	-0.28	0.01	-11.84**	17.09	13.88	-8.52
26	SPSFPR 94005A x ICSV 88088	0.18	0.31	0.47	-1.20	0.04	0.15	2.10	5.53	0.09	8.93
27	SPSFPR 94005A x ICSV 89015	1.22*	1.62*	-0.15	1.70	-0.20	0.95*	-4.13	43.32**	-8.76	0.04
28	SPSFPR 94005A x ICSV 89030	-0.37	-1.02	-0.71	-2.09	-0.04	-0.44	3.46	-17.39	18.38	18.82
29	SPSFPR 94007A x ICSV 712	0.32	-0.33	1.24	1.91	-0.05	-0.30	5.02	-20.13*	-31.25*	5.41
30	SPSFPR 94007A x ICSV 88088	-0.15	0.37	-0.55	-0.76	0.28	0.33	-2.48	12.95	23.37	0.04
31	SPSFPR 94007A x ICSV 89015	0.87	0.95	-0.13	-1.76	0.28	-0.83*	1.69	-16.28	35.62**	17.12
32	SPSFPR 94007A x ICSV 89030	-0.79	-0.85	-0.18	0.02	-0.89	0.46	-5.95	-5.58	-15.28	-23.44
	SB cms x RBR hybrids										
33	ICSA 20 x ICSV 712	0.63	0.09	0.47	1.10	-0.08	-0.15	0.43	-1.28	0.23	-4.12
34	ICSA 20 x ICSV 88088	-1.40*	-1.69*	-0.78	0.63	1.24*	0.67	5.31	4.72	0.16	-0.41
35	ICSA 20 x ICSV 89015	-0.15	0.51	-0.56	-0.90	0.24	-0.60	2.18	-14.03	0.07	-3.31
36	ICSA 20 x ICSV 89030	-0.43	1.17	0.66	0.80	-0.54	-0.24	4.20	-8.91	-8.76	-10.56
37	ICSA 89001 x ICSV 712	0.35	0.39	-1.02	0.27	-0.27	-0.99*	-1.27	5.08	-6.86	-1.63
38	ICSA 89001 x ICSV 88088	-0.21	0.84	0.55	-0.14	0.09	-0.27	-3.39	1.93	7.88	1.51
39	ICSA 89001 x ICSV 89015	0.17	-0.47	-0.40	-0.62	-0.15	-0.63	-3.33	7.77	-1.41	0.02
40	ICSA 89001 x ICSV 89030	0.57	-0.16	0.20	-0.37	0.57	0.38	-0.34	10.25	-14.80	-34.88**
41	ICSA 89004 x ICSV 712	0.59	-0.14	0.49	-0.97	0.16	0.49	4.40	25.24*	-26.08*	40.46**
42	ICSA 89004 x ICSV 88088	0.13	0.56	-1.13	-1.03	-0.51	-0.44	-3.86	-4.72	-2.23	-8.16
43	ICSA 89004 x ICSV 89015	-0.18	1.14	-0.71	-1.37	-0.24	-0.27	-2.65	-2.05	-7.22	-15.57

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-1})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
44	ICSA 89004 x ICSV 89030	-0.51	-0.66	-0.77	1.08	-0.25	-0.24	0.09	-9.36	33.54**	25.08**
45	ICSA 90002 x ICSV 712	0.43	-1.72*	0.71	1.16	0.14	-0.22	1.51	-5.63	2.70	-3.80
46	ICSA 90002 x ICSV 88088	0.54	-0.50	1.80**	1.02	0.02	0.63	3.66	-19.70	0.10	4.08
47	ICSA 90002 x ICSV 89015	-0.54	0.70	-0.64	-1.50	0.42	0.26	3.22	-9.48	17.47	-7.20
48	ICSA 90002 x ICSV 89030	-0.48	0.03	0.91	0.52	0.00	1.32**	1.95	0.70	-3.08	0.02
	RBR cms x SBR hybrids										
49	SPSFR 94002A x ICSR 89076	0.57	-1.08	1.56*	-1.17	1.08*	-0.28	4.05	-4.65	-25.15*	0.70
50	SPSFR 94002A x ICSR 90002	0.35	-0.64	-0.21	0.08	-0.29	0.33	2.77	2.12	13.90	6.42
51	SPSFR 94002A x ICSR 90005	-1.60**	0.06	-3.40**	-2.27	-1.65**	0.38	-3.62	-2.84	24.70*	0.09
52	SPSFR 94002A x ICSR 90014	0.13	-0.30	0.44	0.52	0.62	0.46	3.87	18.75	-8.96	2.26
53	SPSFR 94003A x ICSR 89076	-0.5	0.05	-0.60	-1.81	-0.72	0.14	-1.83	-2.80	10.89	0.01
54	SPSFR 94003A x ICSR 90002	2.01**	1.75*	3.11**	-0.81	-0.16	-0.83*	-0.21	2.81	-0.02	11.68
55	SPSFR 94003A x ICSR 90005	0.04	-1.00	0.53	-1.86	0.45	0.41	1.96	7.33	-29.53*	-21.67
56	SPSFR 94003A x ICSR 90014	-0.62	1.20	0.14	-0.03	0.34	-0.83*	1.50	-5.16	-13.74	-11.38
57	SPSFR 94001A x ICSR 89076	-0.87	-1.19	-0.71	0.72	1.39*	0.42	-0.07	-13.36	2.36	-0.86
58	SPSFR 94001A x ICSR 90002	0.09	1.36	-0.96	-0.09	-0.12	-0.29	-0.86	-7.74	11.15	12.58
59	SPSFR 94001A x ICSR 90005	-0.32	-1.78*	0.10	-1.95	-0.02	0.14	-1.29	-11.20	-0.00	0.08
60	SPSFR 94001A x ICSR 90014	0.74	1.56	-0.01	0.41	-0.91	-0.03	-6.25	16.72	14.43	0.09
61	SPSFR 94031A x ICSR 89076	0.06	0.45	0.52	-1.45	2.12**	0.79	3.52	-21.61*	-0.0	3.11
62	SPSFR 94031A x ICSR 90002	0.17	0.56	1.59*	-0.20	-0.36	-0.97*	2.35	-14.55	-25.32*	23.10
63	SPSFR 94031A x ICSR 90005	1.39*	2.92**	2.66**	2.99*	-0.43	0.95*	8.02	-7.56	-0.04	-39.65**
64	SPSFR 94031A x ICSR 90014	0.28	1.56	-0.92	0.58	-0.84	0.83	-1.56	19.68	-2.67	-3.08

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	PRBR cms x SBR hybrids										
65	SPSFPR 94001A x ICSR 89076	-1.03	-1.08	-0.63	0.24	0.78	0.41	0.53	19.46	18.07	-29.76*
66	SPSFPR 94001A x ICSR 90002	-0.50	-2.72**	0.74	-1.75	1.21*	-0.59	2.44	-11.86	-40.23**	27.74*
67	SPSFPR 94001A x ICSR 90005	-0.14	0.14	0.33	1.91	0.68	-0.31	2.03	35.66**	57.41**	-24.74*
68	SPSFPR 94001A x ICSR 90014	-0.14	1.06	0.94	-2.31	-0.72	-0.36	-5.76	-20.39*	-13.92	-9.20
69	SPSFPR 94002A x ICSR 89076	-0.05	0.34	-1.24	-1.23	-0.78	-0.04	-2.48	0.45	9.58	1.56
70	SPSFPR 94002A x ICSR 90002	1.58*	-0.44	-0.83	-0.37	-1.13*	-0.29	-2.62	-3.15	0.06	41.55**
71	SPSFPR 94002A x ICSR 90005	-1.50*	-1.25	-1.77**	1.11	-0.75	-0.49	-4.69	7.85	-0.03	2.09
72	SPSFPR 94002A x ICSR 90014	-0.11	-1.25	-1.38*	0.47	0.23	-0.54	-1.78	-3.98	-2.87	7.29
73	SPSFPR 94005A x IGSR 89076	1.38*	2.92**	0.48	-0.59	0.17	-0.36	-3.64	-10.24	-7.62	1.76
74	SPSFPR 94005A x ICSR 90002	0.15	-0.30	0.71	1.66	-0.60	1.38**	-2.38	22.43*	0.08	-15.07
75	SPSFPR 94005A x ICSR 90005	0.53	0.06	1.59*	0.52	1.02	0.50	4.23	21.01*	0.04	0.04
76	SPSFPR 94005A x ICSR 90014	-0.40	0.64	0.70	-0.23	0.48	-0.15	1.35	8.82	-25.65*	-19.41
77	SPSFPR 94007A x ICSR 89076	-0.63	0.39	-0.84	-1.23	0.00	-0.81*	-0.29	-24.77*	-6.23	47.57**
78	SPSFPR 94007A x ICSR 90002	-0.51	-1.58	-0.29	0.77	-0.17	0.16	4.18	-12.73	-24.32	-15.71
79	SPSFPR 94007A x ICSR 90005	0.18	-1.33	1.62*	1.77	-0.19	2.33**	-2.51	21.77*	-14.01	-17.36
80	SPSFPR 94007A x ICSR 90014	0.18	1.53	0.73	0.88	-0.50	-0.11	1.83	-5.20	10.68	-5.45
	SB cms x SBR hybrids										
81	ICSA 20 x ICSR 89076	-0.73	-1.86*	-0.95	-1.70	0.81	-1.32**	-4.91	-22.80*	0.22	5.31
82	ICSA 20 x ICSR 90002	-0.76	0.70	-2.03**	-0.50	-0.60	-1.57**	3.71	10.99	3.40	0.03
83	ICSA 20 x ICSR 90005	-0.51	1.89*	-1.31	0.63	0.30	-0.21	-0.89	1.93	-0.78	6.09
84	ICSA 20 x ICSR 90014	-0.12	-1.78*	-0.42	-2.00	-0.72	0.18	-0.67	-11.22	64.19**	12.20
85	ICSA 89001 x ICSR 89076	0.13	-1.55	2.01**	-0.50	-0.16	0.28	4.32	5.97	8.50	-0.28

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
86	ICSA 89001 x ICSR 90002	-0.76	0.22	-0.25	1.41	0.93	0.46	-5.44	2.36	-18.49	-22.43
87	ICSA 89001 x ICSR 90005	0.94	-0.74	2.12**	-1.06	0.38	0.85*	4.02	-8.61	-21.81	-10.27
88	ICSA 89001 x ICSR 90014	-0.32	-0.11	-0.27	0.19	-0.39	0.13	1.73	9.99	6.71	-20.12
89	ICSA 89004 x ICSR 89076	0.38	0.25	-1.31	-2.15	-0.16	-0.36	3.69	-12.28	46.91**	40.52**
90	ICSA 89004 x ICSR 90002	1.24*	0.28	1.37*	2.86*	0.46	0.44	7.12	22.80*	0.00	-37.90**
91	ICSA 89004 x ICSR 90005	0.60	0.86	1.15	0.86	0.47	-0.33	2.07	-13.50	-28.27*	-11.44
92	ICSA 89004 x ICSR 90014	0.27	-0.61	-0.24	-0.37	-0.07	-0.26	-1.61	2.35	-0.24	25.02*
93	ICSA 90002 x ICSR 89076	-0.99	-0.33	-1.09	0.38	-1.16*	0.19	-4.83	7.97	1.35	-3.52
94	ICSA 90002 x ICSR 90002	-0.01	0.56	-2.34**	-1.42	-0.78	-0.16	-2.53	-4.87	0.11	14.73
95	ICSA 90002 x ICSR 90005	-0.76	0.09	-0.45	1.72	0.23	-0.33	-6.43	4.72	3.08	21.30
96	ICSA 90002 x ICSR 90014	-0.71	1.09	-0.73	-1.92	0.24	-0.91*	-2.11	-16.89	2.14	4.40
	RBR cms x PRLR hybrids										
97	SPSFR 94002A x ICSR 93031	-1.09	-0.75	-0.74	-0.39	-0.39	0.26	3.20	-11.14	12.10	-20.69
98	SPSFR 94002A x ICSR 93011	1.01	0.36	0.66	-0.81	-0.81	-0.30	-5.87	-18.95	22.30	3.46
99	SPSFR 94002A x ICSR 93009	-0.28	-0.94	-0.13	-1.62	-0.01	-0.44	-4.90	-4.38	-3.34	13.31
100	SPSFR 94002A x ICSR 93010	-0.54	0.03	0.31	1.30	-0.29	0.01	-5.37	-7.17	6.46	11.69
101	SPSFR 94003A x ICSR 93031	0.15	-1.28	0.27	-1.03	0.90	0.08	10.23*	-7.94	-24.80*	17.38
102	SPSFR 94003A x ICSR 93011	0.01	0.75	-0.35	1.63	0.80	0.55	1.19	1.78	8.02	-24.81*
103	SPSFR 94003A x ICSR 93009	-0.63	-0.33	-0.60	-1.17	-0.46	-0.45	-3.07	-18.88	0.30	7.99
104	SPSFR 94003A x ICSR 93010	-0.62	-0.47	-0.66	-0.25	-0.04	0.25	2.60	12.17	21.73	14.71
105	SPSFR 94001A x ICSR 93031	-0.79	2.81**	-0.34	2.50*	-0.96	0.50	-0.32	16.95	-6.20	-15.29
106	SPSFR 94001A x ICSR 93011	1.76**	-0.64	2.41	-0.64	0.12	-0.08	-6.60	17.19	-13.18	-2.36
107	SPSFR 94001A x ICSR 93009	-0.32	-0.78	-0.53	-1.17	0.73	-0.09	7.21	5.63	-9.50	5.30

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm^{-2})	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
108	SPSFR 94001A x ICSR 93010	-0.26	1.22	-0.31	2.19	0.41	-0.29	1.73	14.74	-13.89	-10.69
109	SPSFR 94031A x ICSR 93031	-0.65	-0.39	-1.27	-3.03*	0.00	-0.89*	5.59	-15.63	2.67	8.37
110	SPSFR 94031A x ICSR 93011	0.12	-0.94	-0.86	-0.12	-0.14	0.12	1.48	-0.34	1.93	-4.80
111	SPSFR 94031A x ICSR 93009	-0.50	-1.24	0.18	0.08	0.32	-0.22	2.35	2.23	-24.10	4.54
112	SPSFR 94031A x ICSR 93010	-0.76	0.06	-0.21	1.00	-0.29	-0.11	2.51	-8.80	7.88	-4.63
	PRBR cms x PRLR										
113	SPSFPR 94001A x ICSR 93031	-0.07	2.08*	0.08	0.33	-0.50	-0.24	-7.38	-1.61	-2.35	2.02
114	SPSFPR 94001A x ICSR 93011	-0.21	0.11	-0.88	-0.34	-0.07	0.29	1.87	9.97	14.57	8.10
115	SPSFPR 94001A x ICSR 93009	-0.49	-1.30	-1.31	-1.00	0.21	-0.27	-2.03	-18.05	16.87	17.20
116	SPSFPR 94001A x ICSR 93010	0.82	-0.78	0.32	1.11	0.23	-0.14	-0.15	-4.57	-14.41	-9.53
117	SPSFPR 94002A x ICSR 93031	-0.10	-0.50	0.47	-2.14	-0.42	0.31	0.22	3.96	12.24	-8.47
118	SPSFPR 94002A x ICSR 93011	-0.13	0.06	1.55*	-0.28	0.50	0.73	-4.22	1.06	-6.92	1.06
119	SPSFPR 94002A x ICSR 93009	0.46	1.25	0.94	3.52*	0.60	0.73	-0.86	20.88*	-4.90	-9.02
120	SPSFPR 94002A x ICSR 93010	1.51*	1.59	0.99	0.88	-0.35	-0.31	0.64	10.92	-3.46	-5.72
121	SPSFPR 94005A x ICSR 93031	-0.76	1.36	0.30	1.58	-0.75	0.50	-7.36	6.07	1.49	25.38*
122	SPSFPR 94005A x ICSR 93011	0.01	-1.19	-0.63	-0.17	0.67	-0.22	2.61	6.28	-5.90	-22.48
123	SPSFPR 94005A x ICSR 93009	-1.28*	-1.16	-1.08	-0.31	0.19	-0.53	-2.33	-28.62**	40.66**	21.62
124	SPSFPR 94005A x ICSR 93010	0.46	0.47	-0.14	1.61	-0.05	-0.52	-1.40	-8.02	-9.28	35.91**
125	SPSFPR 94007A x ICSR 93031	-0.51	0.83	-0.52	-1.40	0.11	0.02	1.40	8.58	20.78	-64.54**
126	SPSFPR 94007A x ICSR 93011	-0.65	0.86	-0.31	0.94	-0.73	0.19	-0.65	6.89	-4.34	10.92
127	SPSFPR 94007A x ICSR 93009	0.04	0.78	0.27	-0.06	-0.62	-0.51	4.92	3.74	-4.29	13.27
128	SPSFPR 94007A x ICSR 93010	0.38	-0.69	0.05	0.38	0. 7	0.32	7.72	1.44	-19.50	-10.13

Contd..

Contd..

S.No.	Genotypes	Early seedling vigour		Glossiness		Egg count		Dead hearts (%)		Trichome density (mm⁻²)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	S8 cms x PRLR hybrids										
129	ICSA 20 x ICSR 93031	-0.21	-0.08	0.20	-1.20	0. 8	-0.36	3.12	-2.78	-9.47	-12.44
130	ICSA 20 x ICSR 93011	0.10	-0.19	1.29	0.66	-0.39	-0.07	-4.27	8.45	0.12	0.04
131	ICSA 20 x ICSR 93009	2.01**	-0.66	0.84	-0.20	-1.19*	1.06*	-10.11*	2.18	0.03	10.13
132	ICSA 20 x ICSR 93010	0.40	-0.33	0.27	-1.84	1.82**	0.11	6.35	-4.19	-10.28	-7.68
133	ICSA 89001 x ICSR 93031	-0.79	0.39	-0.82	0.86	-0.61	0.60	2.11	10.62	7.39	-0.02
134	ICSA 89001 x ICSR 93011	-0.68	-0.16	-0.75	-1.56	0.61	0.04	1.51	-0.15	18.16	14.16
135	ICSA 89001 x ICSR 93009	-0.64	-1.13	-0.70	-1.37	0.14	-0.50	3.79	-13.42	-6.83	-3.62
136	ICSA 89001 x ICSR 93010	0.10	0.17	0.23	0.22	0.06	-0.29	1.12	-0.90	14.51	17.57
137	ICSA 89004 x ICSR 93031	0.13	-0.16	-0.81	1.22	-0.11	0.52	-7.74	1.05	18.01	-3.07
138	ICSA 89004 x ICSR 93011	-0.68	-0.77	-1.10	-2.12	-0.68	-0.31	-5.72	-19.38	5.87	19.30
139	ICSA 89004 x ICSR 93009	0.01	0.14	-0.35	1.55	-0.54	-0.64	0.37	-8.28	-12.65	-0.07
140	ICSA 89004 x ICSR 93010	0.01	1.00	0.09	0.66	0.84	0.66	5.65	29.14 **	-22.94	-23.49
141	ICSA 90002 x ICSR 93031	0.77	0.28	2.24**	0.41	-0.24	0.48	0.09	7.02	-13.32	-5.52
142	ICSA 90002 x ICSR 93011	0.74	-0.16	0.82	0.27	0.52	-0.07	0.68	-8.07	34.68**	-4.84
143	ICSA 90002 x ICSR 93009	1.32*	0.03	0.88	-1.92	0.12	-0.38	0.01	-13.25	-22.20	-16.81
144	ICSA 90002 x ICSR 93010	-0.29	0.37	0.27	1.77	-0.09	-0.12	-1.84	-15.63	-20.66	6.40
	SE± (gi)	0.62	0.83	0.68	1.25	0.52	0.41	4.30	10.21	12.57	12.17
	SE± (gi-gj)	0.87	1.17	0.96	1.77	0.74	0.58	6.09	14.44	17.77	17.19

* Significant at 5 per cent level; ** Significant at 1 per cent level

Table 15: Estimates of specific combining ability (SCA) effects of crosses for leaf parameters and recovery rating

S.No.	Genotypes	5th Leaf Length (cm)		5th Leaf Width (cm)		5th Leaf Droopiness (cm)		Uniformity in recovery	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	RBR cms x RBR hybrids								
1	SPSFR 94002A x ICSV 712	2.10	1.81	-0.03	0.21	0.99	0.76	0.01	0.05
2	SPSFR 94002A x ICSV 88088	-1.02	-0.68	-0.06	-0.12	-0.16	-0.79	-0.38	-0.11
3	SPSFR 94002A x ICSV 89015	1.45	-4.00*	0.41*	-0.49	0.71	-0.01	-0.15	0.67
4	SPSFR 94002A x ICSV 89030	-1.33	-0.16	0.01	-0.08	-0.91	-0.02	0.10	-0.61
5	SPSFR 94003A x ICSV 712	2.11	2.08	0.18	0.40	0.65	0.19	0.29	0.43
6	SPSFR 94003A x ICSV 88088	-1.40	-0.24	-0.27	-0.07	-0.63	0.04	-1.01	-0.06
7	SPSFR 94003A x ICSV 89015	1.02	-0.53	-2.4	0.15	0.56	-0.45	-0.68	-0.42
8	SPSFR 94003A x ICSV 89030	1.73	2.15	0.31	0.11	0.63	0.81	0.04	-1.00
9	SPSFR 94001A x ICSV 712	-1.37	-3.97*	0.11	-0.07	-0.52	-1.67*	0.65	1.47*
10	SPSFR 94001A x ICSV 88088	-0.54	0.60	-0.22	0.07	-0.03	-0.19	-0.36	1.42*
11	SPSFR 94001A x ICSV 89015	-1.77	-1.51	-0.09	-0.24	-0.93	-0.84	0.40	-0.47
12	SPSFR 94001A x ICSV 89030	-0.96	4.45*	-0.11	0.11	-0.34	2.16**	1.10	-1.36
13	SPSFR 94031A x ICSV 712	-4.65	0.17	-0.17	0.14	-1.73	0.05	-0.02	-0.46
14	SPSFR 94031A x ICSV 88088	-2.00	1.91	-0.30	0.38	-0.61	0.27	-0.41	-0.62
15	SPSFR 94031A x ICSV 89015	-1.06	0.38	0.03	-0.16	-0.43	-0.33	0.15	-0.18
16	SPSFR 94031A x ICSV 89030	2.21	4.83**	-0.13	0.15	0.57	1.60	0.06	-0.12
	PRBR cms x RBR hybrids								
17	SPSFPR 94001A x ICSV 712	-1.74	0.50	0.10	0.20	-0.59	0.60	0.59	-0.27
18	SPSFPR 94001A x ICSV 88088	-1.15	-0.59	-0.25	-0.00	-0.35	-0.28	-0.38	0.43
19	SPSFPR 94001A x ICSV 89015	0.20	-2.94	-0.16	-0.12	-0.02	-0.77	-0.38	1.40
20	SPSFPR 94001A x ICSV 89030	7.38**	-0.86	0.24	-0.02	3.12**	-0.10	0.04	-0.85
21	SPSFPR 94002A x ICSV 712	-2.99	-1.59	0.03	-0.07	-0.97	-0.82	0.62	0.29
22	SPSFPR 94002A x ICSV 88088	3.90	-2.25	0.57**	-0.13	0.92	-0.74	-0.39	0.90
23	SPSFPR 94002A x ICSV 89015	-2.52	-4.02*	0.06	-0.47	-0.87	-1.29	1.04	1.01
24	SPSFPR 94002A x ICSV 89030	2.42	4.46*	-0.02	0.11	0.97	1.81*	-0.93	-1.54*
25	SPSFPR 94005A x ICSV 712	-0.93	1.13	-0.23	0.11	-0.20	0.64	0.12	-1.10
26	SPSFPR 94005A x ICSV 88088	-3.19	1.74	0.10	0.03	-1.15	1.06	1.06	1.74*
27	SPSFPR 94005A x ICSV 89015	-3.11	-8.64**	-0.42*	-0.88**	-1.67	-2.60**	-0.38	2.85**
28	SPSFPR 94005A x ICSV 89030	3.93	3.32	0.27	0.19	1.50	0.96	-0.79	-1.10
29	SPSFPR 94007A x ICSV 712	-1.76	0.10	0.11	0.08	-1.06	0.49	0.40	-0.57
30	SPSFPR 94007A x ICSV 88088	1.66	-0.49	-0.18	-0.06	0.58	-0.18	-1.24	0.13
31	SPSFPR 94007A x ICSV 89015	0.82	-2.38	0.15	0.19	0.97	-1.57	0.10	0.43
32	SPSFPR 94007A x ICSV 89030	1.46	1.27	0.01	0.25	0.82	0.32	-0.15	-0.49

Contd..

Contd..

S.No.	Genotypes		5th Leaf Length (cm)		5th Leaf Width (cm)		5th Leaf Droopi-ness (cm)		Uniformity in recovery	
			EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	SB cms x RBR hybrids									
33	ICSA 20	x ICSV 712	0.29	0.91	-0.16	-0.03	0.22	0.64	0.43	-1.01
34	ICSA 20	x ICSV 88088	0.95	2.15	0.14	0.11	0.29	0.92	-0.92	-1.40
35	ICSA 20	x ICSV 89015	0.92	0.48	0.16	-0.26	0.39	-0.46	0.84	-0.29
36	ICSA 20	x ICSV 89030	-1.06	0.40	0.05	0.25	-0.69	-0.20	0.54	0.82
37	ICSA 89001	x ICSV 712	0.87	-0.05	-0.23	-0.01	0.28	0.15	-0.52	-1.56*
38	ICSA 89001	x ICSV 88088	-1.65	0.89	0.13	0.11	-0.60	0.17	0.09	-0.40
39	ICSA 89001	x ICSV 89015	-1.04	0.43	-0.19	0.19	-0.35	-0.39	0.31	0.71
40	ICSA 89001	x ICSV 89030	-1.06	-0.73	0.00	-0.03	-0.11	-0.10	0.90	-1.24
41	ICSA 89004	x ICSV 712	-0.22	-2.52	0.07	-0.27	0.01	-0.93	0.43	-0.38
42	ICSA 89004	x ICSV 88088	5.17*	0.36	0.15	0.12	2.20*	0.43	-0.88	-0.35
43	ICSA 89004	x ICSV 89015	-1.24	-3.90*	-0.25	-0.30	-0.54	-1.33	-0.54	0.63
44	ICSA 89004	x ICSV 89030	5.80*	3.48*	0.35	0.43	2.50*	1.40	-0.46	-0.62
45	ICSA 90002	x ICSV 712	0.50	1.09	0.14	0.06	-0.09	0.89	0.12	1.18
46	ICSA 90002	x ICSV 88088	-4.31	1.77	-0.29	0.13	-1.86	0.13	1.77**	-0.87
47	ICSA 90002	x ICSV 89015	-2.40	0.69	-0.17	-0.22	-1.26	0.35	-0.79	1.24
48	ICSA 90002	x ICSV 89030	-0.42	-1.52	0.28	-0.22	-0.18	-0.77	-0.43	1.68*
	RBR cms x SBR hybrids									
49	SPSFR 94002A	x ICSR 89076	1.40	2.83	0.32	0.20	0.47	1.33	0.56	-1.51*
50	SPSFR 94002A	x ICSR 90002	-2.61	0.57	-0.31	0.15	-2.08	0.25	0.17	0.32
51	SPSFR 94002A	x ICSR 90005	-5.73*	-1.66	-0.21	-0.46	-2.43*	-0.10	-2.50**	0.43
52	SPSFR 94002A	x ICSR 90014	-1.79	-1.51	-0.08	0.05	-0.59	-1.01	0.64	1.15
53	SPSFR 94003A	x ICSR 89076	1.52	0.76	0.06	0.10	0.81	-0.58	0.50	0.01
54	SPSFR 94003A	x ICSR 90002	0.70	0.54	0.21	0.03	0.39	0.38	2.53**	0.71
55	SPSFR 94003A	x ICSR 90005	-1.57	2.18	0.10	0.08	-0.42	1.59	0.86	-1.65*
56	SPSFR 94003A	x ICSR 90014	0.90	-2.74	0.00	-0.26	0.32	-1.92*	-1.05	1.10
57	SPSFR 94001A	x ICSR 89076	4.93*	1.57	0.33	0.26	2.40*	0.34	-0.80	-1.10
58	SPSFR 94001A	x ICSR 90002	-2.04	-1.79	-0.14	0.04	-1.07	-0.92	-1.15	0.51
59	SPSFR 94001A	x ICSR 90005	2.80	4.71**	-0.01	0.19	1.09	2.17**	-0.05	-0.37
60	SPSFR 94001A	x ICSR 90014	1.48	-5.47**	-0.26	-0.39	1.11	-1.53	0.31	0.40
61	SPSFR 94031A	x ICSR 89076	-2.78	-3.32	-0.02	-0.30	-1.65	-1.34	1.06	1.60*
62	SPSFR 94031A	x ICSR 90002	-1.43	-5.78**	0.11	-0.42	-0.67	-2.65**	1.00	0.10
63	SPSFR 94031A	x ICSR 90005	0.02	-2.73	0.00	-0.14	0.00	-1.45	2.47**	0.54
64	SPSFR 94031A	x ICSR 90014	-0.58	-0.32	-0.29	-0.25	-0.22	-0.35	0.81	0.26

Contd..

Contd..

S.No.	Genotypes	5th Leaf Length (cm)		5th Leaf Width (cm)		5th Leaf Droopi-ness (cm)		Uniformity in recovery	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	PRBR cms x SBR hybrids								
65	SPSFPR 94001A x ICSR 89076	1.49	0.22	0.05	0.10	-0.08	0.34	-0.10	-0.21
66	SPSFPR 94001A x ICSR 90002	-2.65	6.69**	-0.03	0.03	-1.14	2.17**	0.03	-1.85*
67	SPSFPR 94001A x ICSR 90005	-4.33	-0.13	-0.07	0.34	-1.35	0.08	0.70	1.46*
68	SPSFPR 94001A x ICSR 90014	-3.42	-0.01	-0.24	0.20	-1.73	0.21	-0.22	1.21
69	SPSFPR 94002A x ICSR 89076	5.68*	0.06	0.25	0.23	2.20*	0.30	-1.30*	-0.32
70	SPSFPR 94002A x ICSR 90002	1.17	1.77	-0.01	0.30	2.15*	0.97	-0.80	-2.04*
71	SPSFPR 94002A x ICSR 90005	1.78	2.93	0.00	0.02	0.83	1.66*	-2.22**	0.40
72	SPSFPR 94002A x ICSR 90014	5.06*	0.61	0.26	-0.09	1.65	0.06	-0.53	-1.15
73	SPSFPR 94005A x ICSR 89076	-2.47	-4.66**	-0.16	-0.51	-0.75	-2.00*	0.12	1.60*
74	SPSFPR 94005A x ICSR 90002	0.44	-0.22	0.21	0.20	0.03	-0.04	0.73	-0.57
75	SPSFPR 94005A x ICSR 90005	-1.88	1.25	-0.09	0.43	-0.62	-0.30	0.95	0.21
76	SPSFPR 94005A x ICSR 90014	-0.40	2.20	-0.32	0.34	-0.35	0.82	-0.13	-0.07
77	SPSFPR 94007A x ICSR 89076	-0.39	-0.76	0.01	-0.14	-0.25	-0.14	0.40	1.12
78	SPSFPR 94007A x ICSR 90002	0.23	-2.95	-0.00	-0.25	-0.40	-1.38	0.43	-0.51
79	SPSFPR 94007A x ICSR 90005	-2.58	1.53	-0.11	-0.20	-1.01	0.83	1.10	-0.87
80	SPSFPR 94007A x ICSR 90014	-2.54	0.97	-0.01	0.10	-0.93	0.55	0.85	1.54*
	SB cms x SBR hybrids								
81	ICSA 20 x ICSR 89076	6.42**	2.78	0.41*	-0.01	2.97**	1.31	-1.57*	0.01
82	ICSA 20 x ICSR 90002	0.08	-5.74**	-0.09	-0.24	-0.13	-2.32**	-0.59	-0.04
83	ICSA 20 x ICSR 90005	1.59	1.15	0.10	-0.05	0.67	0.43	-1.16	-0.60
84	ICSA 20 x ICSR 90014	1.51	4.47*	0.05	0.33	0.78	2.24**	-1.13	-1.82*
85	ICSA 89001 x ICSR 89076	-0.82	6.54**	-0.08	0.55	0.03	3.46**	1.12	-0.90
86	ICSA 89001 x ICSR 90002	-2.27	-1.42	-0.31	0.06	-1.12	-0.52	-0.60	-0.40
87	ICSA 89001 x ICSR 90005	-0.83	1.69	-0.04	0.11	-0.58	0.55	2.29**	-0.62
88	ICSA 89001 x ICSR 90014	3.21	-2.37	0.35	-0.14	1.86	-1.22	-0.79	0.43
89	ICSA 89004 x ICSR 89076	-0.58	0.14	-0.11	0.15	-0.07	0.14	-0.60	1.29
90	ICSA 89004 x ICSR 90002	0.04	-0.79	0.21	0.31	0.14	-0.57	1.76**	0.65
91	ICSA 89004 x ICSR 90005	1.56	-0.70	-0.00	-0.21	0.43	0.05	0.76	0.96
92	ICSA 89004 x ICSR 90014	-1.85	-1.19	-0.17	-0.55	-1.08	0.63	-0.82	-0.62
93	ICSA 90002 x ICSR 89076	-2.33	-1.48	-0.28	0.08	-1.45	1.17	-0.57	0.51
94	ICSA 90002 x ICSR 90002	2.00	1.66	0.09	-0.12	0.78	1.54	-1.25	1.13
95	ICSA 90002 x ICSR 90005	-0.26	-0.75	0.05	-0.20	0.18	-1.21	-1.16	-1.43*
96	ICSA 90002 x ICSR 90014	2.12	-1.33	0.30	-0.04	0.87	-0.41	-0.13	-0.99

Contd..

Contd..

S.No.	Genotypes	5th Leaf Length (cm) EIK	5th Leaf Length (cm) EIR	5th Leaf Width (cm) EIK	5th Leaf Width (cm) EIR	5th Leaf Droopiness (cm) EIK	5th Leaf Droopiness (cm) EIR	Uniformity in recovery EIK	Uniformity in recovery EIR
	RBR cms x PRLR hybrids								
97	SPSFR 94002A x ICSR 93031	3.00	-2.26	0.41*	0.10	1.09	-0.80	-1.32*	0.85
98	SPSFR 94002A x ICSR 93011	3.99	-0.26	0.07	-0.33	1.44	-0.25	0.29	0.01
99	SPSFR 94002A x ICSR 93009	1.97	1.18	-0.12	0.33	1.08	0.20	-0.82	-0.87
100	SPSFR 94002A x ICSR 93010	-0.59	0.13	0.74**	-0.06	-0.11	0.35	-0.57	-0.49
101	SPSFR 94003A x ICSR 93031	-2.75	3.27	-0.25	0.16	-0.84	2.02*	0.29	-0.63
102	SPSFR 94003A x ICSR 93011	-3.32	2.71	-0.27	0.22	-1.39	0.18	-0.35	0.74
103	SPSFR 94003A x ICSR 93009	6.29**	0.66	0.32	0.24	2.33*	0.32	-0.35	-0.29
104	SPSFR 94003A x ICSR 93010	0.00	-2.40	0.02	-0.13	-0.19	-1.15	0.07	-0.54
105	SPSFR 94001A x ICSR 93031	-3.76	2.48	-0.49*	0.19	-1.62	1.37	1.31*	-0.40
106	SPSFR 94001A x ICSR 93011	-5.53*	-2.11	-0.19	-0.30	-2.72*	-0.92	1.97**	1.21
107	SPSFR 94001A x ICSR 93009	2.20	-0.22	-0.03	-0.25	1.04	0.57	-0.27	-0.35
108	SPSFR 94001A x ICSR 93010	-1.51	-3.17	-0.21	-0.16	-0.11	-1.90*	-0.24	0.76
109	SPSFR 94031A x ICSR 93031	0.94	1.97	0.29	-0.30	0.28	0.35	-1.51*	-1.54*
110	SPSFR 94031A x ICSR 93011	0.65	0.00	-0.14	-0.12	0.33	0.23	-0.57	0.29
111	SPSFR 94031A x ICSR 93009	1.46	1.11	0.10	0.47	1.41	0.47	-0.02	0.07
112	SPSFR 94031A x ICSR 93010	-2.10	-0.91	0.03	-0.32	-1.39	-0.77	-0.43	0.13
	PRBR cms x PRLR								
113	SPSFPR 94001A x ICSR 93031	4.28	1.13	0.27	0.17	2.25*	0.56	0.10	1.32
114	SPSFPR 94001A x ICSR 93011	-3.46	-1.96	0.22	0.03	-1.54	-1.08	-0.88	0.35
115	SPSFPR 94001A x ICSR 93009	-3.28	4.15*	-0.32	0.05	-1.38	1.13	0.09	-1.35
116	SPSFPR 94001A x ICSR 93010	-1.33	1.93	-0.32	0.24	-0.37	1.23	1.54*	0.07
117	SPSFPR 94002A x ICSR 93031	0.13	-0.56	0.00	-0.24	0.20	-0.15	0.12	-0.46
118	SPSFPR 94002A x ICSR 93011	4.39	-0.05	0.20	0.04	2.06	0.19	0.11	-0.85
119	SPSFPR 94002A x ICSR 93009	2.40	-5.66**	0.09	-0.34	0.37	-2.06*	0.87	1.60*
120	SPSFPR 94002A x ICSR 93010	-4.08	-1.17	-0.42*	0.31	-2.22*	-0.12	0.57	0.38
121	SPSFPR 94005A x ICSR 93031	-0.93	-1.74	-0.32	-0.11	-0.53	-1.28	0.04	1.35
122	SPSFPR 94005A x ICSR 93011	7.18**	1.67	0.38	0.17	3.39**	1.07	-0.35	-0.15
123	SPSFPR 94005A x ICSR 93009	3.39	6.84**	0.05	0.42	1.40	2.35**	-1.46*	-1.71*
124	SPSFPR 94005A x ICSR 93010	1.80	-5.38**	-0.11	0.30	1.00	-0.03	0.45	0.35
125	SPSFPR 94007A x ICSR 93031	-1.39	-2.07	-0.25	-0.31	-0.96	-0.93	-1.02	-0.80
126	SPSFPR 94007A x ICSR 93011	3.00	-4.40*	-0.06	-0.15	1.42	-1.04	0.34	1.24
127	SPSFPR 94007A x ICSR 93009	-0.51	-0.62	0.13	-0.10	-0.32	-1.09	-0.65	-0.54
128	SPSFPR 94007A x ICSR 93010	-7.43**	0.06	0.03	-0.24	-2.64*	0.80	-0.24	-0.04

Contd..

Contd..

S.No.	Genotypes		5th Leaf Length (cm)		5th Leaf Width (cm)		5th Leaf Droopiness (cm)		Uniformity in recovery	
			EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	SB cms x PRLR hybrids									
129	ICSA 20	x ICSR 93031	-1.24	-0.50	0.22	-0.18	-0.97	-1.25	0.01	-0.57
130	ICSA 20	x ICSR 93011	-1.04	1.05	-0.08	0.12	-0.58	-0.10	1.33*	-0.04
131	ICSA 20	x ICSR 93009	-0.30	1.54	-0.12	-0.22	0.06	0.42	1.09	-0.51
132	ICSA 20	x ICSR 93010	-2.52	3.56*	0.13	0.30	-1.25	1.08	0.45	0.26
133	ICSA 89001	x ICSR 93031	4.28	-2.41	0.22	-0.08	1.71	-1.32	0.34	1.64*
134	ICSA 89001	x ICSR 93011	1.92	1.59	0.12	-0.10	1.19	1.20	-1.04	-0.20
135	ICSA 89001	x ICSR 93009	5.37*	4.14*	0.47*	0.18	1.47	1.61	-0.82	-2.09*
136	ICSA 89001	x ICSR 93010	-3.29	0.91	-0.47*	-0.17	-1.26	-0.23	-0.24	1.30
137	ICSA 89004	x ICSR 93031	-0.58	-2.87	-0.23	-0.65*	0.14	-1.75*	-0.38	-1.30
138	ICSA 89004	x ICSR 93011	1.18	1.13	0.28	-0.22	0.72	1.33	-0.35	-1.47*
139	ICSA 89004	x ICSR 93009	3.63	2.68	0.47*	-0.11	0.78	1.20	-1.01	-0.84
140	ICSA 89004	x ICSR 93010	-0.75	-2.68	-0.23	-0.14	-0.44	-1.54	0.40	0.25
141	ICSA 90002	x ICSR 93031	-6.26**	-0.80	-0.57**	-0.22	-2.37**	0.22	0.98	0.39
142	ICSA 90002	x ICSR 93011	0.97	2.94	0.03	-0.02	0.19	1.43	0.30	-0.00
143	ICSA 90002	x ICSR 93009	-4.43	0.66	-0.04	2.04**	-1.57	0.28	1.40*	-0.22
144	ICSA 90002	x ICSR 93010	-2.04	-5.28**	-0.06	-0.51	-0.59	-2.42**	0.43	2.55**
	SE ±(gi)		2.42	1.77	0.20	0.30	1.07	0.84	0.67	0.72
	SE ±(gi-gj)		3.42	2.51	0.29	0.42	1.52	1.19	0.95	1.02

* Significant at 5 per cent level; ** Significant at 1 per cent level

Table 16: Estimates of specific combining ability (SCA) effects of crosses for yield and yield components and plant characters

S.No.	Genotypes	Total Tillers (plant^{-1})		Productive Tillers (plant^{-1})		Yield-UNI (g plant^{-1})		Yield-I (g plant^{-1})		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	RBR cms x RBR hybrids												
1	SPSFR 94002A x ICSV 712	0.21	-0.37	0.00	0.14	1.43	57.03**	1.10	18.56	-0.70	-2.39	-7.76	-4.02
2	SPSFR 94002A x ICSV 88088	0.21	-0.58	-0.12	-0.27	4.30	-5.33	2.43	-0.63	-0.01	2.64	0.85	2.50
3	SPSFR 94002A x ICSV 89015	-0.14	-0.02	-0.22	-0.61	9.44	7.15	2.98	23.38*	0.92	-1.03	-17.17	-7.36
4	SPSFR 94002A x ICSV 89030	0.07	0.46	0.13	0.01	0.02	-0.84	-1.75	-13.79	1.22	-0.22	5.01	11.95
5	SPSFR 94003A x ICSV 712	-0.21	-0.00	-0.03	0.19	0.00	-32.51**	-2.87	7.69	-0.03	3.54	-6.38	-1.88
6	SPSFR 94003A x ICSV 88088	0.13	-0.28	0.09	-0.22	3.03	8.78	2.11	-0.00	-1.13	-0.39	-5.13	-20.52*
7	SPSFR 94003A x ICSV 89015	-0.00	-0.55	-0.02	-0.36	0.06	-15.70	-3.31	4.39	-0.01	-1.86	3.91	-3.75
8	SPSFR 94003A x ICSV 89030	-0.18	-0.42	0.04	-0.05	-2.32	1.55	-0.16	-6.96	-0.23	-2.08	1.27	-9.02
9	SPSFR 94001A x ICSV 712	-0.13	2.09**	0.02	1.01**	0.04	2.89	3.87	-15.48	-0.28	4.92*	9.74	13.06
10	SPSFR 94001A x ICSV 88088	-0.35	0.05	-0.01	0.37	-13.17*	-18.42	-3.18	-11.12	-2.04	0.14	0.57	2.64
11	SPSFR 94001A x ICSV 89015	-0.16	0.07	0.12	-0.13	1.53	2.44	4.60	0.32	1.25	0.97	6.68	-10.41
12	SPSFR 94001A x ICSV 89030	0.55	-0.45	-0.02	-0.08	-4.37	-7.03	-5.80	-6.35	1.03	-4.22*	8.42	26.81**
13	SPSFR 94031A x ICSV 712	-0.25	0.15	-0.04	0.08	6.97	10.25	13.75**	21.58*	1.47	-1.88	-9.12	3.22
14	SPSFR 94031A x ICSV 88088	-0.11	0.48	0.05	-0.01	-2.96	-6.91	-2.22	-13.23	-0.11	-1.18	-8.84	3.08
15	SPSFR 94031A x ICSV 89015	0.00	-0.62	0.14	-0.34	1.56	-3.07	-1.29	-5.58	-3.33**	-1.51	38.14**	9.89
16	SPSFR 94031A x ICSV 89030	0.22	-0.48	-0.04	-0.39	-3.94	-12.59	-4.06	-2.99	0.58	1.62	26.99	-4.14
	PRBR cms x RBR hybrids												
17	SPSFPR 94001A x ICSV 712	-0.07	0.14	-0.13	-0.08	-1.58	10.48	-0.83	1.54	-0.03	-5.12**	-2.73	3.45
18	SPSFPR 94001A x ICSV 88088	-0.19	-0.29	0.06	-0.28	1.14	-13.15	-0.07	3.20	-0.63	-0.54	-28.15*	-11.61
19	SPSFPR 94001A x ICSV 89015	-0.05	-0.09	-0.06	0.24	0.05	-2.11	-0.00	13.75	-0.01	1.65	14.22	-11.50
20	SPSFPR 94001A x ICSV 89030	0.35	0.11	0.10	-0.45	1.34	-2.37	-4.10	-18.92	-1.00	-0.90	-22.14	-3.45
21	SPSFPR 94002A x ICSV 712	-0.45	-0.32	0.05	-0.06	-11.63*	11.04	1.94	-10.42	0.65	0.43	-11.62	5.30
22	SPSFPR 94002A x ICSV 88088	0.19	1.11	-0.18	0.97**	-0.02	-12.17	-1.12	8.41	0.41	4.32*	-0.79	-3.45
23	SPSFPR 94002A x ICSV 89015	0.45	0.20	-0.04	0.13	-2.22	18.97	-4.02	11.72	1.25	6.89**	-9.68	-3.17

Contd..

Contd..

S.No.	Genotypes	Total Tillers (plant^{-1})		Productive Tillers (plant^{-1})		Yield-UNI (g plant^{-1})		Yield-I (g plant^{-1})		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
24	SPSFPR 94002A x ICSV 89030	-0.04	-0.39	0.08	0.19	11.29*	1.64	2.01	-9.06	0.75	-3.71	13.73	12.39
25	SPSFPR 94005A x ICSV 712	-0.15	-0.41	-0.04	0.19	-3.79	8.71	-4.10	15.55	-0.12	-3.30	-14.47	23.36**
26	SPSFPR 94005A x ICSV 88088	-0.01	0.65	0.12	0.11	0.00	15.39	-2.21	-5.02	0.02	3.74	15.81	-5.11
27	SPSFPR 94005A x ICSV 89015	0.71*	0.61	0.01	1.11**	-4.30	-0.01	-1.36	-11.79	-1.04	8.74**	-15.54	23.31**
28	SPSFPR 94005A x ICSV 89030	-0.41	-0.12	0.03	0.05	5.12	-3.49	3.54	0.59	-1.81	-0.46	-26.69	-12.34
29	SPSFPR 94007A x ICSV 712	0.43	0.38	0.07	-0.31	-0.02	-2.64	-1.40	-8.27	2.83	-3.53	26.92	-6.41
30	SPSFPR 94007A x ICSV 88088	0.65	-0.32	0.06	-0.17	-0.65	-11.75	2.16	1.30	-0.28*	2.04	31.50*	30.19**
31	SPSFPR 94007A x ICSV 89015	-0.02	0.34	0.01	0.69	-3.82	-4.66	-3.77	-1.61	-0.30	1.57	-20.30	5.30
32	SPSFPR 94007A x ICSV 89030	-0.12	-0.12	0.03	-0.34	3.18	6.34	3.70	3.00	0.45	-2.32	-27.49	-19.98**
	SB cms x RBR hybrids												
33	ICSA 20 x ICSV 712	-0.15	-0.08	-0.08	-0.28	1.73	9.83	-0.19	-4.13	0.33	-1.32	4.70	-2.89
34	ICSA 20 x ICSV 88088	-0.53	-0.72	-0.18	-0.59	-0.03	-7.38	-1.55	26.31*	0.62	-3.43	8.87	6.69
35	ICSA 20 x ICSV 89015	-0.25	-0.23	0.09	-0.09	2.61	-4.32	5.13	-8.29	-0.24	-1.93	6.64	3.63
36	ICSA 20 x ICSV 89030	-0.14	0.04	-0.12	-0.37	-0.02	-6.01	0.06	-7.64	-0.46	0.21	10.05	0.86
37	ICSA 89001 x ICSV 712	-0.03	-0.49	0.01	-0.26	2.17	13.46	-2.35	-6.37	0.38	-6.71**	-12.11	7.11
38	ICSA 89001 x ICSV 88088	0.45	-0.37	-0.16	0.33	-4.59	-9.24	-1.11	-1.75	0.23	-3.35	13.17	20.30*
39	ICSA 89001 x ICSV 89015	0.09	0.01	0.05	-0.34	7.58	-0.06	3.24	-7.38	0.08	2.32	-9.85	-4.56
40	ICSA 89001 x ICSV 89030	0.37	-0.07	-0.12	-0.06	-0.65	5.33	9.30*	6.70	0.31	-1.21	-6.00	9.75
41	ICSA 89004 x ICSV 712	0.08	0.09	0.11	-0.08	-5.13	-11.20	0.99	-10.83	-0.03	1.38	-5.72	-11.00
42	ICSA 89004 x ICSV 88088	-0.16	0.33	-0.03	-0.28	4.30	8.03	-1.40	-2.84	-0.30	-1.71	0.53	-2.72
43	ICSA 89004 x ICSV 89015	0.37	-0.14	0.12	0.24	-5.30	18.02	-1.79	8.89	-0.41	1.49	6.23	5.72
44	ICSA 89004 x ICSV 89030	-0.40	-0.40	0.08	-0.12	-1.54	16.80	-3.06	6.23	-0.09	-3.74	15.71	15.44
45	ICSA 90002 x ICSV 712	-0.43	-0.77	0.10	0.27	-7.09	-2.20	3.18	12.15	-0.22	-1.74	3.73	14.19
46	ICSA 90002 x ICSV 88088	0.07	0.86	0.06	0.63	-0.05	-33.83**	-0.35	-29.98*	-0.01	-1.18	-27.11	-17.89*
47	ICSA 90002 x ICSV 89015	-0.26	0.42	0.13	0.13	10.33*	-5.11	-1.51	2.56	-0.78	5.99**	17.34	-17.61*
48	ICSA 90002 x ICSV 89030	-0.15	0.52	-0.34*	-0.48	-0.01	0.01	-5.13	22.61*	0.83	8.46**	4.07	-18.73*

Contd..

Contd..

S.No.	Genotypes	Total Tillers ($plant^{-1}$)		Productive Tillers ($plant^{-1}$)		Yield-UNI (g $plant^{-1}$)		Yield-I (g $plant^{-1}$)		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	RBR cms x SBR												
49	SPSFR 94002A x ICSR 89076	0.58	-0.11	0.02	-0.37	0.94	-0.13	-0.05	34.51**	-0.84	-5.93**	9.77	16.00
50	SPSFR 94002A x ICSR 90002	0.32	-0.12	-0.02	-0.78*	-11.05*	-13.58	-4.83	-6.22	-3.67**	-2.24	-1.62	-7.48
51	SPSFR 94002A x ICSR 90005	-0.39	1.87**	0.04	1.55**	-0.02	-0.11	-2.51	-35.60**	-0.01	6.76*	-11.30	-0.67
52	SPSFR 94002A x ICSR 90014	0.04	0.31	0.09	0.16	1.82	10.92	0.91	-13.42	1.75	-2.43	-25.79	-3.03
53	SPSFR 94003A x ICSR 89076	-0.51	0.14	-0.01	0.47	-0.06	47.68**	2.22	-15.14	-0.03	3.50	7.82	2.89
54	SPSFR 94003A x ICSR 90002	0.51	-0.49	0.05	-0.73*	-3.51	-18.61	1.34	-21.91*	-0.19	2.07	-4.26	-35.50**
55	SPSFR 94003A x ICSR 90005	0.18	-0.29	-0.07	-0.87*	-7.11	9.72	9.28*	31.52**	0.51	-4.40*	1.44	-8.73
56	SPSFR 94003A x ICSR 90014	-0.13	2.31**	0.02	1.44 **	-0.15	-27.93**	-1.63	9.07	-0.32	3.04	6.75	-10.67
57	SPSFR 94001A x ICSR 89076	-0.43	-0.99	-0.02	-0.51	16.97**	-7.77	1.59	6.59	0.26	-1.96	5.60	8.08
58	SPSFR 94001A x ICSR 90002	-0.28	-1.09	0.07	-0.14	-0.07	-0.06	-3.46	-18.19	-0.01	-1.40	23.10	12.66
59	SPSFR 94001A x ICSR 90005	0.01	-0.54	-0.19	-0.31	2.30	-0.08	-2.85	6.01	1.99	-0.90	10.88	9.61
60	SPSFR 94001A x ICSR 90014	0.12	-0.99	0.00	0.08	-0.05	-0.05	-0.01	22.77*	0.55	3.90*	-22.39	16.83
61	SPSFR 94031A x ICSR 89076	-0.04	0.90	-0.16	-0.31	10.67*	-16.48	8.18*	-1.94	1.32	4.40*	5.78	9.61
62	SPSFR 94031A x ICSR 90002	0.10	-0.76	0.06	-0.06	0.01	-2.83	-4.51	-28.65**	1.48	4.10*	-2.28	-20.53*
63	SPSFR 94031A x ICSR 90005	-0.40	1.44*	0.10	0.61	0.02	-0.06	-0.00	12.77	-0.01	-0.24	32.60*	1.27
64	SPSFR 94031A x ICSR 90014	0.02	-0.47	0.03	-0.12	1.37	-25.07*	-4.18	-6.32	-1.40	2.90	-28.11*	-6.09
	PRBR cms x SBR hybrids												
65	SPSFPR 94001A x ICSR 89076	-0.20	0.15	-0.06	-0.14	-0.01	4.66	0.47	20.90	-0.03	0.50	10.50	16.50
66	SPSFPR 94001A x ICSR 90002	-0.31	0.19	-0.00	-0.01	0.02	-8.47	-0.49	-10.11	0.22	-3.26	-19.92	44.78**
67	SPSFPR 94001A x ICSR 90005	-0.18	0.52	0.08	0.52	0.05	35.98**	-1.86	11.87	-0.01	2.26	-5.89	-8.45
68	SPSFPR 94001A x ICSR 90014	-0.42	-1.01	-0.10	-0.17	0.02	-27.11**	1.41	-29.03**	0.76	4.71*	-5.58	-32.06**
69	SPSFPR 94002A x ICSR 89076	1.28**	0.23	0.26	-0.45	0.03	24.89*	-5.53	27.13*	-0.26	-2.29	13.28	1.69
70	SPSFPR 94002A x ICSR 90002	-0.14	-0.61	-0.18	-0.09	-0.02	7.71	3.44	2.73	0.54	-3.07	2.44	1.27
71	SPSFPR 94002A x ICSR 90005	-0.41	0.21	0.02	0.41	-4.76	11.14	0.35	-5.71	0.34	-4.24*	-9.78	-13.45

Contd..

Contd..

S.No.	Genotypes	Total Tillers ($plant^{-1}$)		Productive Tillers ($plant^{-1}$)		Yield-UNI (g $plant^{-1}$)		Yield-I (g $plant^{-1}$)		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
72	SPSFPR 94002A x ICSR 90014	0.70*	-0.78	-0.05	-0.20	-7.40	-3.86	2.72	6.37	-2.95**	-5.76**	6.96	5.44
73	SPSFPR 94005A x ICSR 89076	0.09	0.07	-0.02	0.08	14.82**	5.10	11.42**	-29.74 **	-0.28	9.18**	9.07	-5.11
74	SPSFPR 94005A x ICSR 90002	-0.43	0.27	0.07	0.33	0.01	2.54	-1.75	17.90	-0.19	-1.79	12.68	1.41
75	SPSFPR 94005A x ICSR 90005	0.15	-0.70	-0.04	-0.67	-9.64	-0.05	-2.81	5.28	0.75	-2.13	-13.67	6.55
76	SPSFPR 94005A x ICSR 90014	0.23	0.37	0.11	0.27	3.22	9.36	-0.16	33.78**	1.64	-0.99	-9.82	7.52
77	SPSFPR 94007A x ICSR 89076	0.01	-0.40	-0.05	-0.08	-0.02	-17.83	-7.86*	-26.34 *	-0.37	1.94	10.46	-11.55
78	SPSFPR 94007A x ICSR 90002	-0.11	0.17	0.01	0.38	3.33	-8.53	-4.76	11.07	-0.38	-0.15	-13.29	-23.28**
79	SPSFPR 94007A x ICSR 90005	-0.44	0.77	0.09	-0.09	24.03**	-4.98	3.55	-3.79	-1.07	-2.63	-14.25	0.16
80	SPSFPR 94007A x ICSR 90014	-0.15	0.37	-0.02	0.22	-3.29	-12.32	-4.08	14.19	0.27	3.15	-10.61	3.22
	SB cms x SBR hybrids												
81	ICSA 20 x ICSR 89076	0.62	-0.66	-0.06	-0.06	13.69**	-2.26	0.31	-10.61	-0.36	-1.18	24.91	6.97
82	ICSA 20 x ICSR 90002	-0.40	0.17	-0.10	-0.37	-0.03	25.73*	2.03	-24.17*	-0.00	0.04	-14.26	-15.11
83	ICSA 20 x ICSR 90005	0.79*	-0.01	-0.03	0.13	-9.29	-6.07	4.46	-5.78	0.66	-2.13	6.85	5.16
84	ICSA 20 x ICSR 90014	-0.36	-0.40	0.03	-0.14	-2.79	8.42	-0.35	18.22	-0.67	-3.32	11.02	24.05**
85	ICSA 89001 x ICSR 89076	0.05	-0.20	-0.03	0.33	2.78	-14.80	3.01	-24.10*	-0.60	3.74	0.53	7.11
86	ICSA 89001 x ICSR 90002	-0.48	-0.07	-0.07	-0.09	5.78	-5.10	5.39	17.09	0.24	-2.57	-19.19	0.30
87	ICSA 89001 x ICSR 90005	0.10	-0.31	0.08	-0.42	-0.85	-16.69	1.43	-10.14	0.46	-2.57	-15.54	-1.23
88	ICSA 89001 x ICSR 90014	-0.15	-0.64	-0.03	-0.14	0.69	16.88	2.12	-5.14	0.16	-0.76	11.64	3.08
89	ICSA 89004 x ICSR 89076	0.49	0.05	-0.12	-0.50	-1.92	-39.01**	-3.19	-31.92**	-0.24	2.83	-14.75	-14.33
90	ICSA 89004 x ICSR 90002	0.64	0.94	-0.00	0.63	0.58	14.50	-0.67	40.57**	1.13	-2.60	-11.83	-16.06
91	ICSA 89004 x ICSR 90005	0.31	0.36	-0.05	0.49	-2.42	-13.08	4.91	1.05	0.02	4.93*	0.53	-5.95
92	ICSA 89004 x ICSR 90014	0.14	-0.44	-0.09	-0.20	-3.22	13.00	-2.20	-2.44	0.76	1.04	18.35	3.77
93	ICSA 90002 x ICSR 89076	-0.62	0.53	-0.21	0.19	0.95	-11.06	-4.05	-8.44	-1.70	1.71	-8.63	0.86
94	ICSA 90002 x ICSR 90002	0.15	0.36	0.02	-0.12	-0.03	37.19**	-6.53	0.86	-0.00	-0.74	5.53	8.77
95	ICSA 90002 x ICSR 90005	-0.32	-0.02	0.16	0.05	-0.18	17.84	1.43	8.06	-1.26	-2.57	14.98	5.72
96	ICSA 90002 x ICSR 90014	-0.34	-0.55	0.35**	-0.23	-2.14	0.34	-1.64	1 .55	1.04	-2.43	18.38	7.94

Contd..

Contd..

S.No.	Genotypes	Total Tillers (plant^{-1})		Productive Tillers (plant^{-1})		Yield-UNI (g plant^{-1})		Yield-I (g plant^{-1})		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
	RBR cms x PRLR												
97	SPSFR 94002A x ICSR 93031	-0.31	-0.06	-0.01	-0.06	-9.58	-12.49	-9.22*	-2.90	-2.85*	1.15	11.85	-33.59**
98	SPSFR 94002A x ICSR 93011	-0.10	-0.06	-0.05	-0.19	-2.53	22.43*	6.17	10.50	0.55	-0.15	-4.54	12.94
99	SPSFR 94002A x ICSR 93009	-0.06	-0.83	-0.24	-0.48	0.76	-27.72**	-2.37	-2.91	-1.65	-1.49	9.11	-1.92
100	SPSFR 94002A x ICSR 93010	-0.18	-0.30	-0.28*	-0.20	-2.70	-0.57	-3.80	-3.50	-0.93	-0.35	29.63*	14.05
101	SPSFR 94003A x ICSR 93031	-0.07	0.06	0.09	0.11	-3.94	18.74	5.38	1.56	1.42	-2.75	-30.09*	9.98
102	SPSFR 94003A x ICSR 93011	-0.18	0.43	-0.05	0.24	-3.64	22.14*	-0.55	-2.49	1.79	2.15	7.82	11.58
103	SPSFR 94003A x ICSR 93009	0.29	-0.03	0.09	-0.23	-3. 6	10.90	-2.31	-4.73	-0.75	-0.65	-4.81	0.02
104	SPSFR 94003A x ICSR 93010	-0.09	-0.57	-0.15	-0.26	-2.66	23.15*	1.63	-0.66	0.17	-1.21	15.50	28.08**
105	SPSFR 94001A x ICSR 93031	0.42	0.80	0.07	0.47	-6.81	-12.55	-0.64	24.76*	1.71	0.79	-18.98	-11.50
106	SPSFR 94001A x ICSR 93011	0.80*	-0.63	0.59**	-0.51	37.69**	-42.66**	-0.25	-19.03	0.46	1.68	-8.15	-26.92**
107	SPSFR 94001A x ICSR 93009	-0.35	-0.35	-0.02	-0.01	1.63	-1.43	-1.31	9.03	-0.52	-1.82	-13.70	31.69**
108	SPSFR 94001A x ICSR 93010	-0.17	1.53**	-0.03	0.72*	-4.77	0.07	7.26*	-9.64	0.60	2.65	6.37	-34.42**
109	SPSFR 94031A x ICSR 93031	-0.02	-0.26	0.12	-0.03	-10.08	-9.73	-7.05	-3.99	0.60	-3.76	1.44	5.44
110	SPSFR 94031A x ICSR 93011	-0.08	-0.07	-0.05	0.22	0.37	-2.18	4.09	17.05	2.02	2.93	-3.28	1.97
111	SPSFR 94031A x ICSR 93009	0.23	9.09	0.03	0.55	0.99	10.63	-3.20	29.48**	0.97	-1.74	15.36	12.11
112	SPSFR 94031A x ICSR 93010	0.18	-0.37	0.12	-0.17	-2.88	-2.90	0.30	-3.92	-2.81*	1.40	7.55	-3.59
	PRBR cms x PRLR hybrids												
113	SPSFPR 94001A x ICSR 93031	-0.31	-0.27	-0.04	-0.19	-0.03	-4.35	2.15	-5.13	-0.54	1.66	9. 9	5.67
114	SPSFPR 94001A x ICSR 93011	-0.69	-0.24	-0.05	0.27	4.70	-9.02	2.28	-7.89	-0.27	1.57	2.41	0.61
115	SPSFPR 94001A x ICSR 93009	0.20	-1.04	-0.10	-0.53	-0.67	-13.09	-1.26	-24.07*	0.15	-2.90	13.08	7.39
116	SPSFPR 94001A x ICSR 93010	0.67	0.96	0.05	0.44	8.44	9.07	-0.99	12.90	-0.54	-1.13	6.75	8.77
117	SPSFPR 94002A x ICSR 93031	-0.56	-0.33	0.14	-0.17	0.08	-25.26*	0.94	-8.06	0.00	1.54	-6.06	-7.48
118:	SPSFPR 94002A x ICSR 93011	-0.11	0.76	-0.16	-0.14	0.26	23.91*	2.29	13.38	0.16	-0.57	21.44	5.44
119	SPSFPR 94002A x ICSR 93009	0.55	0.45	-0.16	-0.31	-1.16	-3.74	0.43	-24.06*	-3.43**	4.26*	-12.45	-37.61**
120	SPSFPR 94002A x ICSR 93010	-0.08	0.32	0.10	0.08	-0.01	26.66**	-0.00	4.32	3.66**	-3.26	-55.72**	1.27

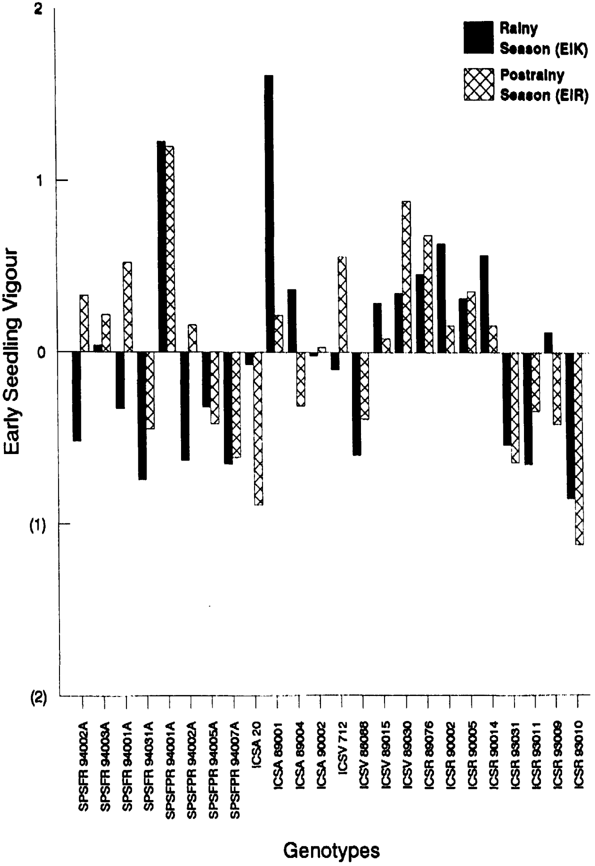


Figure 16. General Combining Ability (GCA) effects of parents for early seedling vigour in rainy (EIK) and postrainy (EIR) seasons

Among testers, ICSV 88088 (-0.60), ICSR 93031 (-0.54), ICSR 93011 (-0.65) and ICSR 93010 (-0.85) in rainy season and ICSR 93031 (-0.64) and ICSR 93010 (-1.12) in postrainy season exhibited high negative GCA effects (desirable). Among the four male lines selected for rainy season, one was from resistant bred restorer lines and three were from postrainy season-adapted landraces. Similarly the two male lines selected under postrainy season, were postrainy season-adapted landraces.

Statistically significant SCA effects were noticed among hybrids for both rainy and postrainy seasons. The estimates of SCA effects ranged between -1.68 to 2.01 in rainy season and -2.72 to 2.92 in postrainy season. Significant negative SCA effects (desirable) were shown by SPSFR 94001A x ICSV 88088 (-1.68), SPSFR 94002A x ICSR 90005 (-1.60), SPSFPR 94002A x ICSR 90005 (-1.50), ICSA 20 x ICSV 88088 (-1.40), and SPSFPR 94005A x ICSR 93009 (-1.28) in rainy season and SPSFPR 94001A x ICSR 90002 (-2.72), SPSFR 94001A x ICSV 89030 (-2.31), ICSA 20 x ICSR 89076 (-1.86), SPSFR 94001A x ICSR 90005 (-1.78), ICSA 20 x ICSR 90014 (-1.78), ICSA 90002 x ICSV 712 (-1.72) and ICSA 20 x ICSV 88088 (-1.69) in postrainy season. Of the five hybrids selected under rainy season, two were developed on rainy season-bred resistant female lines, two were based on postrainy season-bred resistant female lines, and one was developed on susceptible bred female line. Of the seven hybrids selected under postrainy season, two were developed on rainy season-bred resistant female lines, one was developed on postrainy season-bred resistant female line, and four were based on susceptible bred female lines (Table 14).

4.5.2 Glossiness

Significant GCA effects were noticed among lines and testers during rainy and postrainy seasons. The estimates of GCA effects for lines and testers ranged from -1.93 to 2.48 in rainy season and from -2.99 to 2.39 in postrainy season (Table 12; Fig.17).

Among lines, SPSFR 94002A (-0.87), SPSFR 94003A (-0.94), SPSFR 94001A (-0.82), SPSFR 94031A (-1.93), SPSFPR 94002A (-0.76) and SPSFPR 94005A (-0.84) in rainy season and SPSFR 94003A (-1.11), SPSFR 94031A (-0.88), SPSFPR 94002A (-1.22), SPSFPR 94005A (-0.88) and SPSFPR 94007A (-2.99) in postrainy season showed highly significant negative GCA effects (desirable). Among six female lines selected under rainy season, four were from rainy season-bred resistant female lines, and two were from postrainy season-bred resistant

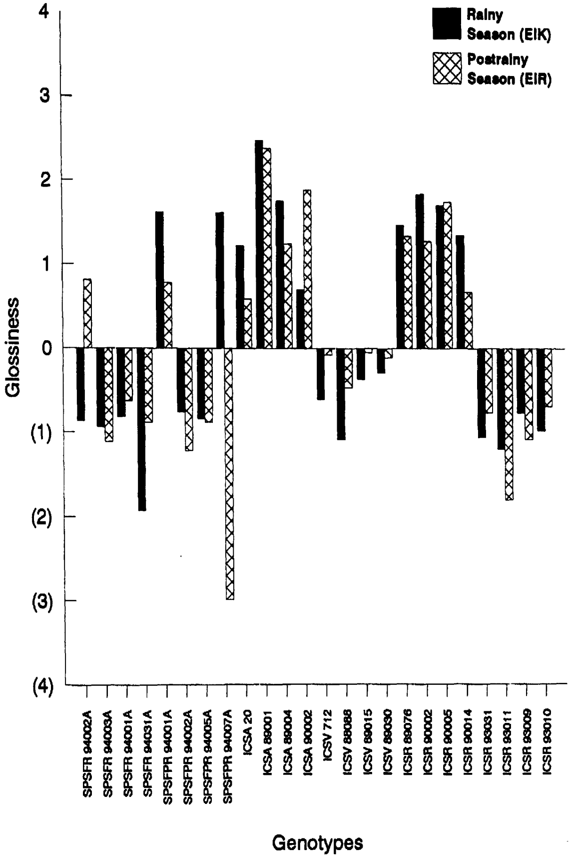


Figure 17. General Combining Ability (GCA) effects of parents for glossiness in rainy (EIK) and postrainy seasons (EIR)

female lines. Of five female lines selected under postrainy season, two were from rainy season-bred resistant female lines, and three were from postrainy season-bred resistant female lines.

Testers, ICSV 712 (-0.61), ICSV 88088 (-1.09), ICSR 93031 (-1.06), ICSR 93011 (-1.20), ICSR 93009 (-0.77) and ICSR 93010 (-0. 98) in rainy season and ICSR 93031 (-0.77), ICSR 93011 (-1.80) and ICSR 93009 (-1.08) in postrainy season exhibited high negative GCA effects (desirable). Among six male lines selected under rainy season, two were from resistant bred restorers, and four were postrainy season-adapted landraces. All the three lines selected during postrainy season were from postrainy season-adapted landraces.

Significant SCA effects were exhibited by hybrids during rainy and postrainy seasons. The estimates of SCA effects ranged between -3.40 to 3.11 during rainy season and between -2.31 to 3.52 during postrainy season (Table 14). Significant negative SCA effects (desirable) were shown by SPSFR 94002A x ICSR 90005 (-3.40),ICSA 90002 x ICSR 90002 (-2.34), ICSA 20 x ICSR 90002 (-2.03), SPSFPR 94002A x ICSR 90005 (-1.77), and SPSFPR 94002A x ICSR 90014 (-1.38) during rainy season. Except SPSFR 94031A x ICSR 93031 (-3.03), none of the hybrids exhibited significant negative SCA effects during postrainy season. Of five hybrids selected under rainy season, one was developed on rainy season-bred resistant female lines, two were developed on susceptible bred female lines and two were based on postrainy season-bred resistant female lines (Table 14).

4.5.3 Egg Count

During rainy and postrainy seasons highly significant GCA effects were noticed among lines and testers. The estimated effects ranged from -0.43 to 1.08 in rainy season and from -0.73 to 1.17 in postrainy season (Table 12; Fig.18).

Lines, SPSFR 94001A (-0.43), SPSFR 94031A (-0.36), SPSFPR 94002A (-0.41), SPSFPR 94007A (-0.31) in rainy season and SPSFR 94003A (-0.51), SPSFR 94031A (-0.45), SPSFPR 94001A (-0.36), SPSFPR 94002A (-0.66) and SPSFPR 94007A (-0.73) in postrainy season exhibited high negative GCA effects (desirable). Of the four lines selected under rainy season, two were from rainy season-bred resistant female lines, and two were

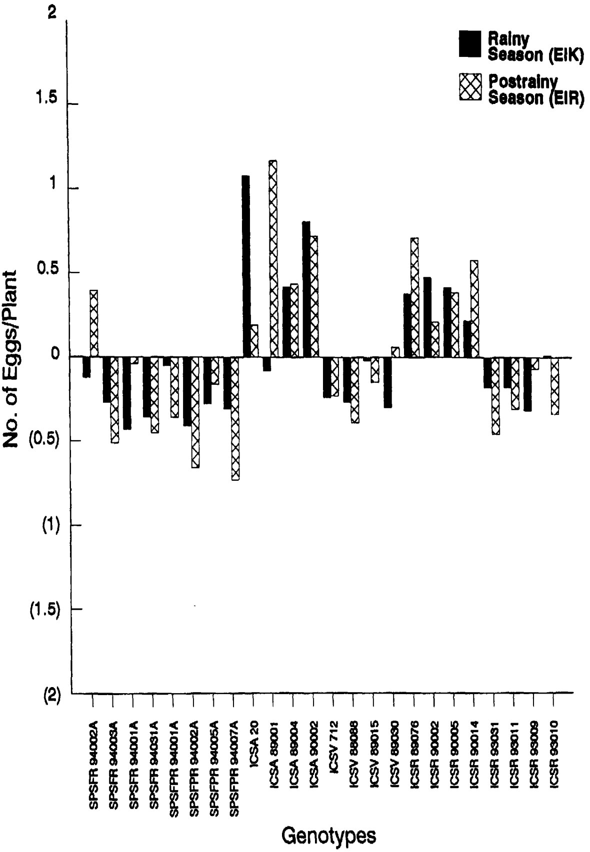


Figure 18. General Combining Ability (GCA) effects of eggs/plant for parents in rainy (EIK) and postrainy (EIR) seasons

Of the four lines selected under rainy season, two were from rainy season-bred resistant female lines, and two were from postrainy season-bred resistant female lines. Among the five lines selected under postrainy season, two were from rainy season-bred resistant female lines and three were from postrainy season-bred resistant female lines.

Among testers, ICSV 89030 (-0.30) and ICSR 93009 (-0.32) during rainy season and ICSV 88088 (-0.39), ICSR 93031 (-0.46), ICSR 93011 (-0.31) and ICSR 93010 (-0.34) during postrainy season showed highly significant negative GCA effects(desirable). Of the two lines selected under postrainy season, one was from resistant bred restorers and the other was from postrainy season-adapted landraces. During postrainy season among four lines selected, one was from resistant bred restorers and three were postrainy season- adapted landraces.

Significantly high SCA effects were noticed for hybrids during rainy and postrainy seasons. The estimates of SCA effects ranged from -1.65 to 2.12 in rainy season, and -1.57 to 2.33 in postrainy season (Table 14). Significant negative SCA effects (desirable) were noticed among SPSFR 94002A x ICSR 90005 (-1.65), ICSA 20 x ICSR 93009 (-1.19), ICSA 90002 x ICSR 89076 (-1.16) and SPSFPR 94002A x ICSR 90002 (-1.13) during rainy season, and ICSA 20 x ICSR 90002 (-1.57), ICSA 20 x ICSR 89076 (-1.32), ICSA 89001 x ICSV 712 (-0.99), SPSFR 94031A x ICSR 90002 (-0.97), ICSA 90002 x ICSR 90014 (-0.91), SPSFR 94031A x ICSR 93031 (-0.89), SPSFPR 94007A x ICSV 89015 (-0.83), SPSFR 94003A x ICSR 90002 (-0.83), SPSFR 94003A x ICSR 90014 (-0.83), SPSFR 94031A x ICSV 89015 (-0.81) and SPSFPR 94007A x ICSR 89076 (-0.81) during postrainy season. Of the four hybrids selected under rainy season, one was developed on rainy season-bred resistant female line, two were developed on susceptible bred female lines and one was developed on postrainy season-bred resistant female lines. Of the eleven hybrids selected during postrainy season, four were developed on susceptible bred female lines, five were developed on rainy season-bred resistant female lines and two were developed on postrainy season-bred resistant female lines (Table 14).

4.5.4 Deadhearts

During rainy and postrainy seasons significant GCA effects were noticed among lines and testers. During rainy season the estimates of GCA effects ranged from -4.69 to 4.59 and during postrainy season between -14.22 to 16.12 (Table 12; Fig.19).

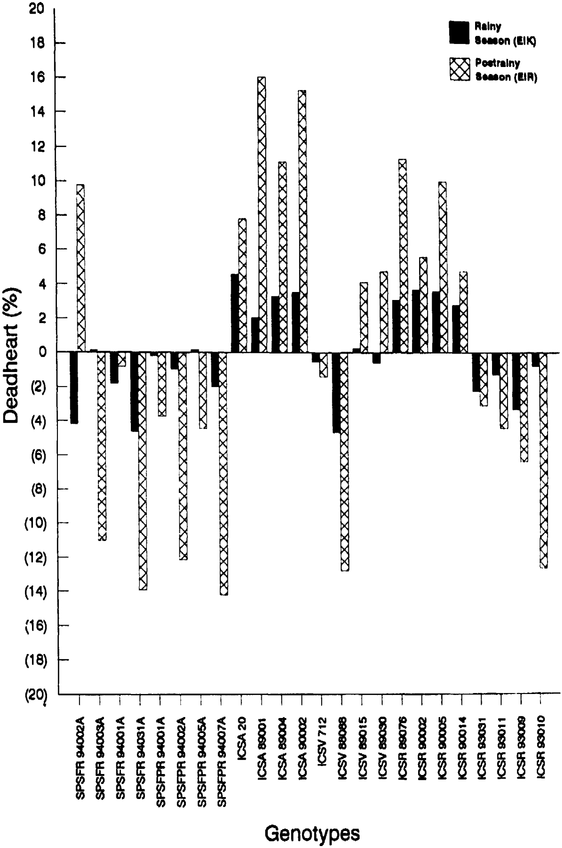


Figure 19. General Combining Ability (GCA) effects for deadheart (%) for parents in rainy (EIK) and postrainy (EIR) seasons

Among lines, SPSFR 94002A (-4.19), SPSFR 94031A (-4.61) in rainy season and SPSFR 94003A (-11.00), SPSFR 94031A (-13.93), SPSFPR 94002A (-12.14) and SPSFPR 94007A (-14.22) in postrainy season exhibited significant negative GCA effects (desirable). Among these lines, two lines selected during rainy season were from rainy season-bred resistant female lines, and among the four lines selected during postrainy season, two were from postrainy season-bred resistant female lines and two were from rainy season-bred resistant female lines.

Testers, ICSV 88088 (-4.69) and ICSR 93009 (-3.32) in rainy season, and ICSV 88088 (-12.79), ICSR 93009 (-6.38) and ICSR 93010 (-12.64) in postrainy season showed significant negative GCA effects (desirable). Among the two male lines selected during rainy season, one was from resistant bred restorer and the other was from postrainy season-adapted landraces. In addition to the above lines selected during rainy season, one more landrace was selected for postrainy season.

During rainy and postrainy seasons, significant SCA effects were noticed for hybrids. Among the hybrids the SCA effects ranged from -11.84 to 10.23 (rainy season) and -28.62 to 43.32 (postrainy season). Significant negative SCA effects (desirable) were noticed for SPSFPR 94005A x ICSV 712 (-11.84), ICSA 20 x ICSR 93009 (-10.11) and SPSFPR 94001A x ICSV 89030 (-9.92) during rainy season and for SPSFPR 94005A x ICSR 93009 (-28.62), SPSFPR 94007A x ICSR 89076 (-24.77), ICSA 20 x ICSR 89076 (-22.80), SPSFR 94031A x ICSR 89076 (-21.61), SPSFPR 94001A x ICSR 90014 (-20.39) and SPSFPR 94007A x ICSV 712 (-20.13) during postrainy season (Table 14). Of the three hybrids selected under rainy season, two were developed on postrainy season-bred resistant female parent and one was based on susceptible bred female line. During postrainy season, among the six superior hybrids, four were based on postrainy season-bred resistant female lines, one was based on susceptible female line, and one was based on rainy season-bred resistant female line.

4.5.5 Trichome Density

Lines and testers showed significant GCA effects during both seasons. The estimates of GCA effects ranged between -22.01 to 27.46 in rainy season, and between -30.77 to 54.10 in postrainy season (Table 12; Fig.20).

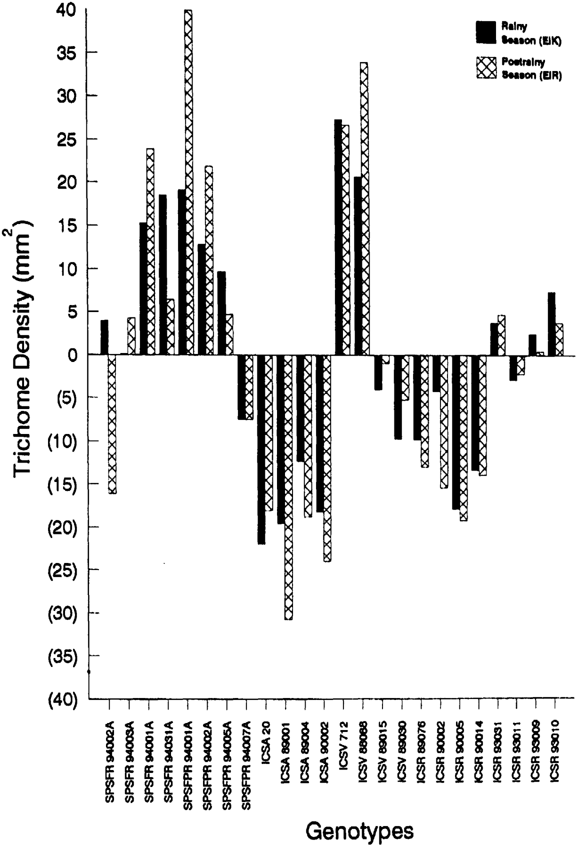


Figure 20. General Combining Ability (GCA) effects of trichome density (mm^2) for parents in rainy (EIK) and postrainy (EIR) seasons.

Lines, SPSFR 94001A (15.32 in rainy and 23.87 in postrainy season), SPSFPR 94001A (19.11 and 54.10), SPSFPR 94002A (12.78 and 21.86), SPSFPR 94005A (9.72 in rainy), and SPSFR 94031A (18.55 in rainy season) showed significant positive (desirable) GCA effects. Among the five female lines selected during rainy season, two were from rainy season-bred resistant female lines, and three were from postrainy season-bred resistant female lines. Of the three female lines selected during postrainy season two were from postrainy season-bred resistant female lines and one was from rainy season-bred resistant female lines.

Among testers, ICSV 712 (27.46 in rainy and 26.84 in postrainy season), ICSV 88088 (20.75 and 34.09) and ICSR 93010 (7.44 in rainy season) exhibited significantly high positive (desirable) GCA effects. Of the three male lines selected during rainy season, two were from resistant bred restorers, and one is postrainy season-adapted landrace. Except the landrace, the same resistant bred restorers were selected during postrainy season also.

Statistically significant SCA effects were noticed during rainy and postrainy seasons for hybrids. The SCA effects ranged from -40.23 to 64.19 during rainy and -64.54 to 47.57 during postrainy season (Table 14). Significant positive SCA effects (desirable) were noticed for ICSA 20 x ICSR 90014 (64.19), SPSFPR 94001A x ICSR 90005 (57.41),ICSA 89004 x ICSR 89076 (46.91), SPSFPR 94005A x ICSR 93009 (40.66), SPSFPR 94007A x ICSV 89015 (35.62), ICSA 90002 x ICSR 93011 (34.68), ICSA 89004 x ICSV 89030 (33.54), SPSFR 94001A x ICSV 89015 (33.44), SPSFR 94002A x ICSR 90005 (24.70) and SPSFR 94031A x ICSV 712 (24.58) in rainy season and SPSFPR 94007A x ICSR 89076 (47.57), SPSFPR 94002A x ICSV 712 (41.64), SPSFPR 94002A x ICSR 90002 (41.55), ICSA 89004 x ICSR 89076 (40.52), ICSA 89004 x ICSV 712 (40.46), SPSFPR 94005A x ICSR 93010 (35.91), SPSFPR 94001A x ICSR 90002 (27.74), SPSFPR 94001A x ICSV 89015 (25.87), SPSFPR 94005A x ICSR 93031 (25.38), ICSA 89004 x ICSV 89030 (25.08) and ICSA 89004 x ICSR 90014 (25.02) in postrainy season. Of the ten hybrids selected during rainy season, three were developed on postrainy season-bred resistant female lines, four were developed on susceptible bred female lines and three were developed on rainy season-bred resistant female lines. Of the eleven hybrids selected during postrainy season, seven were developed on postrainy season-bred resistant female lines and four were developed on susceptible bred female lines.

4.5.6 5th Leaf Length

Significant GCA effects were found both in lines and testers during rainy and postrainy seasons. During rainy season the GCA estimates ranged from -2.63 to 2.78 and during postrainy season from -3.56 to 4.16 (Table 12; Fig.21).

Lines with significant positive GCA estimates (desirable) were SPSFR 94031A (2.38), SPSFPR 94007A (2.78) in rainy season and SPSFPR 94002A (1.23), SPSFPR 94005A (1.68), SPSFPR 94007A (2.24), ICSA 20 (4.16) in postrainy season. Of the two female lines selected under rainy season, one was from rainy season-bred resistant female line and the other from postrainy season-bred resistant female line. Among the four lines selected during postrainy season, three were selected from postrainy season-bred resistant female lines and one was from susceptible bred female lines.

Among testers, ICSR 93031 (1.64), ICSR 93011 (1.45) and ICSR 93010 (2.07) in rainy season and ICSR 93031 (3.15), ICSR 93011 (2.85), ICSR 93009 (2.73) and ICSR 93010 (3.67) in postrainy season showed significant positive GCA effects (desirable). All the three male lines selected during rainy season and the four lines selected during postrainy season were from postrainy season-adapted landraces.

The SCA effects were found significant during both rainy and postrainy seasons. The SCA estimates ranged between -7.43 to 7.38 during rainy season and between -8.64 to 6.84 during postrainy season. Significant positive SCA effects (desirable) were noticed for SPSFPR 94001A x ICSV 89030 (7.38), SPSFPR 94005A x ICSR 93011 (7.18), ICSA 20 x ICSR 89076 (6.42), SPSFR 94003A x ICSR 93009 (6.29), ICSA 89004 x ICSV 89030 (5.80), SPSFPR 94002A x ICSR 89076 (5.68), ICSA 89001 x ICSR 93009 (5.37), ICSA 89004 x ICSV 88088 (5.17), SPSFPR 94002A x ICSR 90014 (5.06) and SPSFR 94001A x ICSR 89076 (4.93) in rainy season, and SPSFPR 94005A x ICSR 93009 (6.84), SPSFPR 94001A x ICSR 90002 (6.69), ICSA 89001 x ICSR 89076 (6.54), SPSFR 94031A x ICSV 89030 (4.83), SPSFR 94001A x ICSR 90005 (4.71), ICSA 20 x ICSR 90014 (4.47), SPSFPR 94002A x ICSV 89030 (4.46), SPSFR 94001A x ICSV 89030 (4.45), SPSFPR 94001A x ICSR 93009 (4.15), ICSA 89001 x ICSR 93009 (4.14), ICSA 20 x ICSR 93010 (3.56) and ICSA 89004 x ICSV 89030 (3.48) in postrainy season. Of the ten hybrids selected under rainy season, four were developed on postrainy season-bred resistant

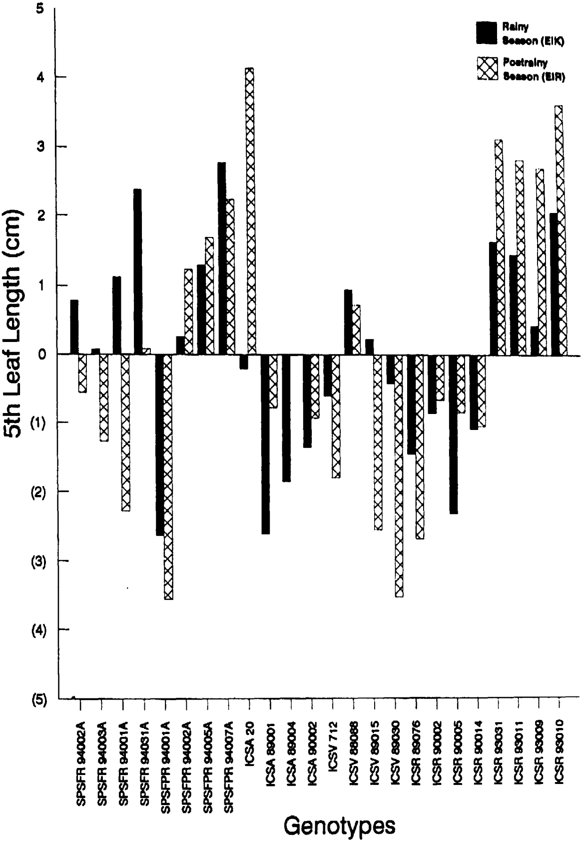


Figure 21. General Combining Ability (GCA) effects for 5th leaf length (cm) of parents in rainy (EIK) and postrainy (EIR) seasons

female lines, four were based on susceptible bred female lines, and two were developed on rainy season-bred resistant female lines. Of the twelve hybrids selected during postrainy season, three were developed on rainy season-bred resistant female lines, four were developed on postrainy season-bred resistant female lines, and five were developed on susceptible bred female lines (Table 15).

4.5.7 5th Leaf Width

The GCA effects were found significant for both lines and testers during rainy and postrainy seasons. The estimates of GCA effects ranged from -0.28 to 0.21 during rainy season, and from -0.24 to 0.27 during postrainy season (Table 12; Fig.22).

Among lines, SPSFR 94001A (0.21), SPSFPR 94005A (0.17), SPSFPR 94007A (0.14) exhibited significant positive GCA effects (desirable) during rainy season. None of the lines showed significant GCA effects during postrainy season. Among the three female lines selected during rainy season, two were from postrainy season-bred resistant female lines and one was from rainy season-bred resistant female line.

Testers, ICSR 93031 (0.19 in rainy and 0.23 in postrainy season) and ICSR 93010 (0.20 and 0.27) showed significant positive GCA effects (desirable). Both the male lines selected during rainy and postrainy season were developed on postrainy season-adapted landraces.

The SCA estimates for the hybrids ranged from -0.57 to 0.74 in rainy season and from -0.88 to 2.04 in postrainy season (Table 15). SPSFR 94002A x ICSR 93010 (0.74), SPSFPR 94002A x ICSV 88088 (0.57), ICSA 89004 x ICSR 93009 (0.47), ICSA 89001 x ICSR 93009 (0.47), ICSA 20 x ICSR 89076 (0.41), SPSFR 94002A x ICSR 93031 (0.41) and SPSFR 94002A x ICSV 89015 (0.41) exhibited significant positive SCA effects (desirable) during rainy season. During postrainy season, significant positive SCA effect was noticed for only ICSA 90002 x ICSR 93009 (2.04). Among the seven hybrids selected during rainy season, three were developed on rainy season-bred resistant female lines, and three were based on susceptible bred female lines and one was developed on postrainy season-bred resistant female lines. During postrainy season, only one hybrid (developed on susceptible bred female line) was selected.

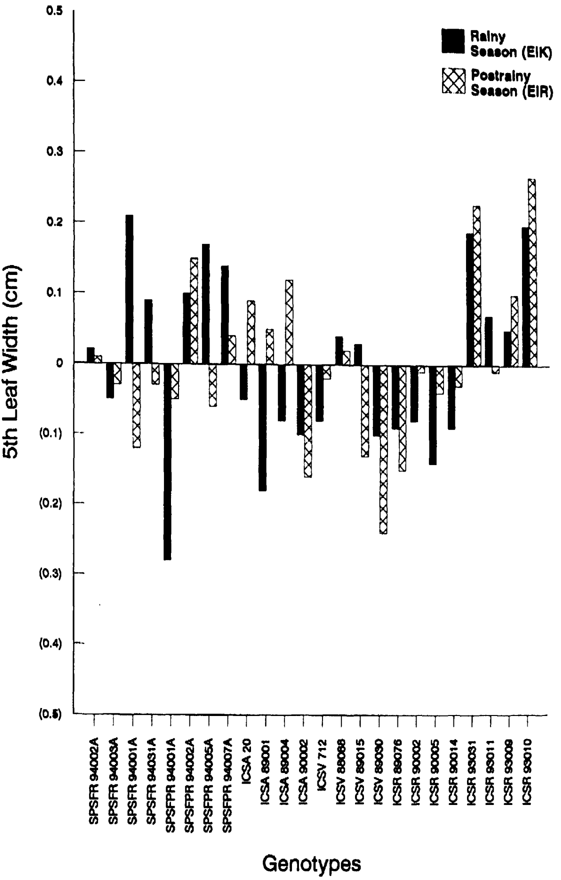


Figure 22. General Combining Ability (GCA) effects of 5th leaf width (cm) for parents in rainy (EIK) and postrainy seasons (EIR)

4.5.8 5th Leaf Droopiness

The GCA effects for lines and testers were found significant during rainy and postrainy seasons. The GCA estimates for lines and testers ranged between -1.07 to 1.03 (rainy season) and -1.71 to 1.64 (postrainy season) (Table 12 ; Fig.23).

Among lines, SPSFR 94031A (1.03), SPSFPR 94007A (1.02) in rainy season and SPSFPR 94005A (0.82), SPSFPR 94007A (0.83), ICSA 20 (1.64) in postrainy season exhibited significant positive GCA effects (desirable). Of the two female lines selected during rainy season, one was from rainy season bred resistant female line and the other was from postrainy season-bred resistant female line. During postrainy season, two postrainy season-bred resistant female lines and one susceptible bred female line were selected.

Testers, ICSR 93031 (0.62 in rainy and 1.23 in postrainy season), ICSR 93010 (0.83 and 1.52), ICSR 93011 (1.05 in postrainy season) and ICSR 93009 (1.55 in postrainy season) exhibited significant high GCA effects (desirable). Among the two male lines selected during rainy season, both were postrainy season-adapted landraces and the same lines were found superior during postrainy season also.

The hybrids exhibited significant SCA effects during both rainy and postrainy seasons.The estimated SCA effects ranged from -2.72 to 3.39 (rainy season) and from -2.65 to 3.46 (postrainy season). Significant positive SCA effects (desirable) were noticed for SPSFPR 94005A x ICSR 93011 (3.39), SPSFPR 94001A x ICSV 89030 (3.12),ICSA 20 x ICSR 89076 (2.97), ICSA 89004 x ICSV 89030 (2.50), SPSFR 94001A x ICSR 89076 (2.40), SPSFR 94003A x ICSR 93009 (2.33), SPSFPR 94001A x ICSR 93031 (2.25), SPSFPR 94002A x ICSR 89076 (2.20), ICSA 89004 x ICSV 88088 (2.20) and SPSFPR 94002A x ICSR 90002 (2.15) in rainy season. During postrainy season, ICSA 89001 x ICSR 89076 (3.46), SPSFPR 94005A x ICSR 93009 (2.35),ICSA 20 x ICSR 90014 (2.24), SPSFPR 94001A x ICSR 90002 (2.17), SPSFR 94001A x ICSR 90005 (2.17), SPSFR 94001A x ICSV 89030 (2.16), SPSFR 94003A x ICSR 93031 (2.02), SPSFPR 94002A x ICSV 89030 (1.81) and SPSFPR 94002A x ICSR 90005 (1.66) exhibited significant positive SCA effects. Among the ten hybrids selected during rainy season, five hybrids were developed on postrainy season-bred resistant female parents, three were based on susceptible bred female lines and two were developed on rainy season-bred resistant female lines. Of the nine hybrids selected

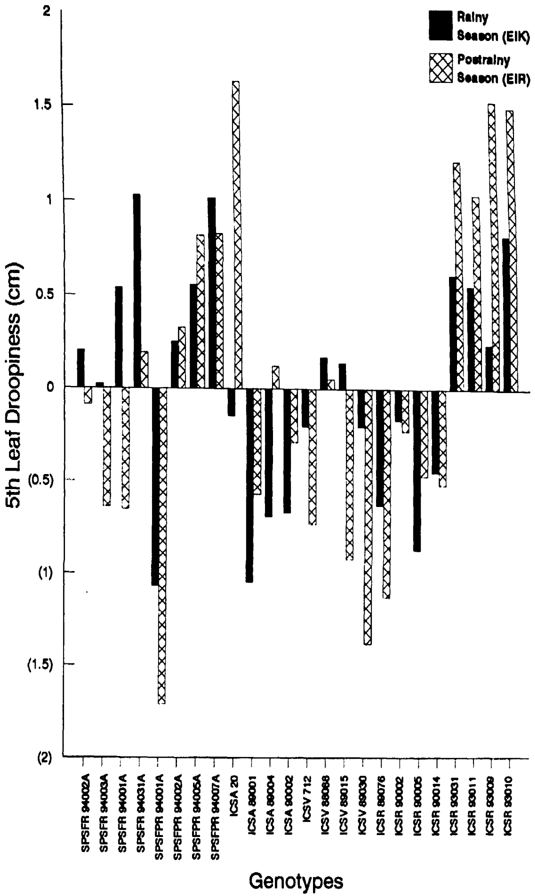


Figure 23. General Combining Ability (GCA) effects for 5th leaf droopiness (cm) of parents in rainy (EIK) and postrainy (EIR) seasons

during postrainy season, two were developed on susceptible bred female lines, four were developed on postrainy season-bred resistant female lines and three were based on rainy season-bred resistant female lines (Table 15).

4.5.9 Uniformity in Recovery

The lines and testers exhibited significantly high GCA effects during rainy and postrainy seasons. The estimated GCA effects ranged from -1.54 to 2.26 during rainy season, and from -0.71 to 1.26 during postrainy season (Table 12; Fig.24).

Among lines, SPSFR 94002A (-0.45), SPSFR 94001A (-0.62), SPSFR 94031A (-1.54), SPSFPR 94002A (-0.76), SPSFPR 94005A (-0.76), SPSFPR 94007A (-1.18) in rainy season and SPSFR 9403AB (-0.71), SPSFPR 94002A (-0.60), SPSFPR 94007A (-0.65) and ICSA 20 (-0.46) in postrainy season exhibited significant negative GCA effects (desirable). Of the six female lines selected during rainy season, three were from rainy season-bred resistant female lines and three were from postrainy season-bred resistant female lines. Of the four lines found superior during postrainy season, one was from rainy season-bred resistant female line, one was from susceptible bred female lines and two were from postrainy season-bred resistant female lines.

Testers, ICSV 88088 (-0.98 in rainy and -0.46 in postrainy season), ICSR 93031 (-1.01 and -0.43), ICSR 93011 (-0.82 and 0.71) and ICSR 93010 (-1.01 and -0.55) showed high significant negative GCA effects(desirable). Among the four testers found superior during rainy and postrainy seasons, three were from postrainy season-adapted landraces and one was from resistant bred restorers.

The hybrids exhibited significantly different SCA effects during rainy and postrainy seasons. The range of estimated SCA effects was from -2.50 to 2.53 and from -2.09 to 2.85 during rainy and postrainy seasons respectively (Table 15). Among the hybrids, SPSFR 94002A x ICSR 90005 (-2.50), SPSFPR 94002A x ICSR 90005 (-2.22), ICSA 20 x ICSR 89076 (-1.57), SPSFR 94031A x ICSR 93031 (-1.51), SPSFPR 94005A x ICSR 93009 (-1.46), SPSFR 94002A x ICSR 93031 (-1.32) and SPSFPR 94002A x ICSR 89076 (-1.30) in rainy season and ICSA 89001 x ICSR 93009 (-2.09), SPSFPR 94002A x ICSR 90002 (-2.04), SPSFPR 94001A x ICSR 90002 (-1.85),ICSA 20 x ICSR 90014 (-1.82), SPSFPR 94005A x ICSR 93009 (-1.71), SPSFR 94003A x ICSR 90005 (-1.65), ICSA 89001

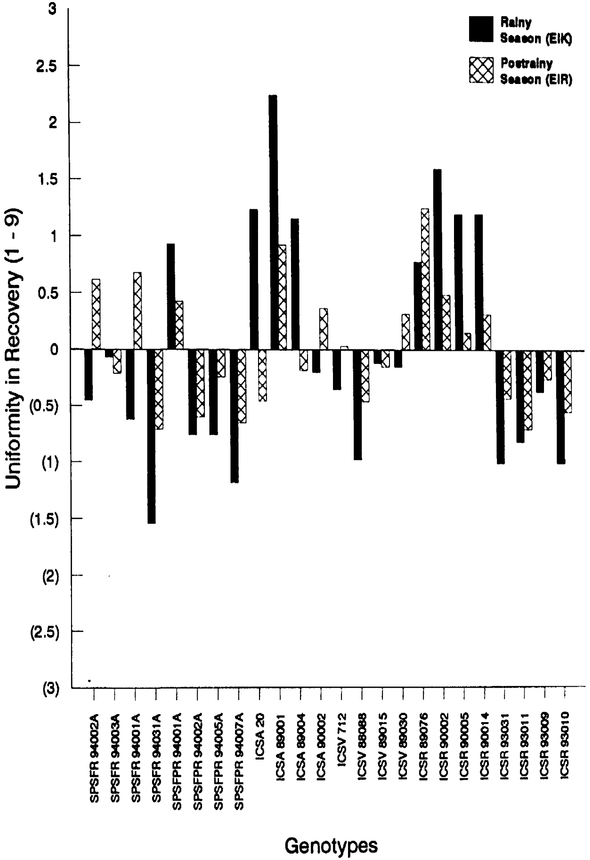


Figure 24. General Combining Ability (GCA) for uniformity in recovery (1-9) of parents in rainy (EIK) and postrainy (EIR) seasons

x ICSV 712 (-1.56),SPSFR 94031A x ICSR 93031 (-1.54), SPSFPR 94002A x ICSV 89030 (-1.54), SPSFR 94002A x ICSR 89076 (-1.51), ICSA 89004 x ICSR 93011 (-1.47) and ICSA 90002 x ICSR 90005 (-1.43) in postrainy season showed highly significant negative SCA effects (desirable). Of the seven hybrids found superior during rainy season, three were developed on rainy season-bred resistant female lines, three were based on postrainy season-bred resistant female lines and one was developed on susceptible bred female line. Of the twelve hybrids selected during postrainy season, three were developed on rainy season-bred resistant female lines, four were developed on postrainy season-bred resistant female lines and five were developed on susceptible bred female lines.

4.5.10 Total Tillers

Lines and testers exhibited significantly different GCA effects both during rainy and postrainy seasons. Among lines and testers the estimates of GCA effects ranged from -0.26 to 0.42 (rainy season) and from -0.63 to 1.33 (postrainy season) (Table 13; Fig.25).

Lines, ICSA 20 (0.20), ICSA 89001 (0.42), ICSA 89004 (0.23) in rainy season and SPSFR 94001A (0.47) and ICSA 89001 (0.80) in postrainy season exhibited significant positive GCA effects (desirable). All the three lines found superior during rainy season were from susceptible bred female lines. Among the two female lines selected during postrainy season, one was from rainy season-bred resistant female parent and the other was from susceptible bred female parent.

Among testers, ICSR 89076 (1.33) and ICSR 90002 (0.38) showed significant high GCA effects (desirable) during postrainy season. None of the testers showed significant GCA effects during rainy season. Both the male lines selected during rainy season were from susceptible bred restorer lines.

Statistically significant SCA effects were found among the hybrids during rainy and postrainy seasons. Among the hybrids, the SCA estimated effects ranged from -0.69 to 1.28 (rainy season) and -1.09 to 2.31 (postrainy season). The hybrids showing significant high positive SCA estimates (desirable) were SPSFPR 94002A x ICSR 89076 (1.28) SPSFR 94001A x ICSR 93011 (0.80),ICSA 20 x ICSR 90005 (0.79),SPSFPR 94005A x ICSV

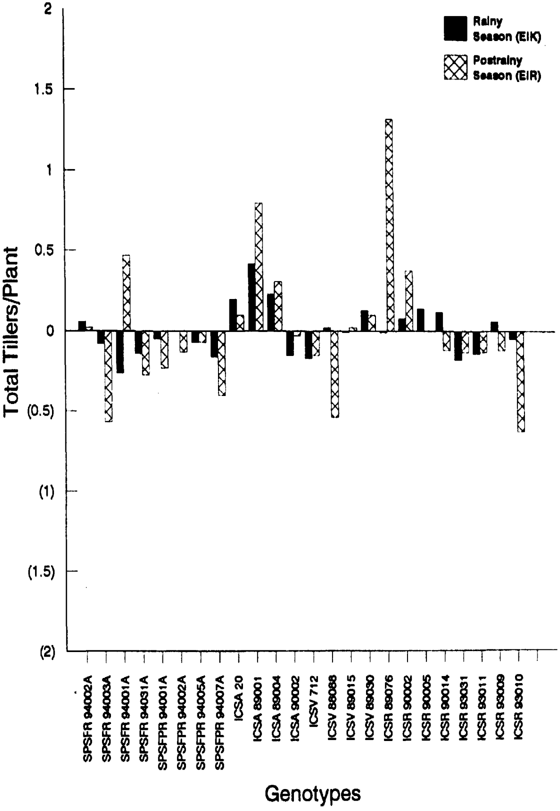


Figure 25. General Combining Ability (GCA) effects of total tillers/plant for parents in rainy (EIK) and postrainy (EIR) seasons

89015 (0.71) and SPSFPR 94002A x ICSR 90014 (0.70) during rainy season and SPSFR 94003A x ICSR 90014 (2.31), SPSFR 94001A x ICSV 712 (2.09), SPSFR 94002A x ICSR 90005 (1.87), SPSFR 94001A x ICSR 93010 (1.53) and SPSFR 94031A x ICSR 90005 (1.44) during postrainy season (Table 16). Of the five hybrids selected during rainy season, three were developed on postrainy season-bred resistant female lines, and one from rainy season-bred resistant female lines and one from susceptible bred female lines. All the five hybrids selected during postrainy season were developed on rainy season-bred resistant female lines.

4.5.11 Productive Tillers

The GCA effects differed significantly among the lines and testers during both rainy and postrainy seasons. The estimated GCA effects ranged from -0.07 to 0.08 (rainy season) and from -0.30 to 0.56 (postrainy season) (Table 13; Fig.26).

None of the lines exhibited significant GCA effects during rainy season and only SPSFR 94001A (0.51) in postrainy season exhibited significant positive GCA effects (desirable). The female line found superior during postrainy season was from rainy season-bred resistant female lines.

Among testers, only ICSR 93031 (0.08) exhibited high significant positive GCA effect (desirable) in rainy season, and ICSR 89076 (0.56) and ICSR 93009 (0.23) showed significant positive GCA effects during postrainy season. During rainy season only the postrainy season-adapted landrace was found superior, and among the two male lines selected during postrainy season, one was from susceptible bred restorer and other was from postrainy season-adapted landraces.

The hybrids differed significantly for SCA effects during rainy and postrainy seasons. The estimated SCA effects ranged between -0.34 to 0.59 during rainy season and between -0.87 to 1.55 during postrainy season (Table 16). Significant positive SCA effects (desirable) were noticed for SPSFR 94001A x ICSR 93011 (0.59) and ICSA 90002 x ICSR 90014 (0.35) during rainy season and SPSFR 94002A x ICSR 90005 (1.55), SPSFR 94003A x ICSR 90014 (1.44), SPSFPR 94005A x ICSV 89015 (1.11), SPSFR 94001A x ICSV 712 (1.01), SPSFPR 94002A x ICSV 88088 (0.97), ICSA 89004 X ICSR 93031 (0.81), ICSA 20 x ICSR 93010 (0.74) and SPSFR 94001A

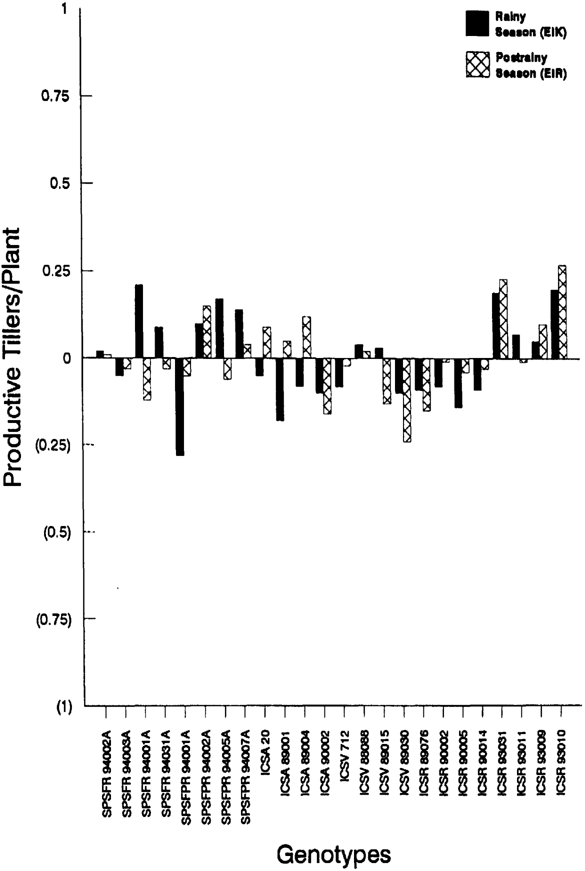


Figure 26. General Combining Ability (GCA) effects of productive tillers/plant for parents in rainy (EIK) and postrainy (EIR) seasons

x ICSR 93010 (0.72) during postrainy season. Among the two hybrids found superior during rainy season, one was developed on rainy season-bred resistant female parent and the other was developed on susceptible bred female line. Of the eight hybrids found superior during postrainy season, four hybrids were based on rainy season-bred resistant female parents, two were developed on postrainy season-bred resistant female lines, and two were developed on susceptible bred female lines.

4.5.12 Yield (UNI)

Lines and testers differed significantly for GCA effects in yield during rainy and postrainy seasons. The estimated effects of GCA ranged from -4.59 to 9.17 in rainy season and from -10.60 to 11.26 in postrainy season (Table 13; Fig.27).

Lines, SPSFR 94002A (3.98), ICSA 89001 (9.17), ICSA 90002 (3.13) in rainy season, and SPSFR 94001A (11.26) in postrainy season exhibited significantly high positive GCA effects (desirable for yield). Of the three lines selected in rainy season, one was from rainy season bred resistant female lines, and two from susceptible bred female lines. In postrainy season, only one rainy season bred resistant female line was found superior.

Among testers, ICSR 89076 (4.30), ICSR 90005 (5.90) in rainy season and ICSV 89030 (6.35), ICSR 93011 (9.09), ICSR 93009 (6.16) in postrainy season exhibited significantly high positive GCA effects (desirable for yield). Both the male lines selected during rainy season were from susceptible bred restorer lines and among the three male lines selected during postrainy season two were from postrainy season-adapted landraces and one from resistant bred restorer lines.

Significant SCA effects were noticed for hybrids during rainy and postrainy seasons.The estimated SCA effects ranged from -18.08 to 37.69 in rainy season, and from -42.66 to 57.03 in postrainy season (Table 16). The hybrids with high significant positive SCA effects (desirable for yield) were SPSFR 94001A x ICSR 93011 (37.69), SPSFPR 94007A x ICSR 90005 (24.03), SPSFR 94001A x ICSR 89076 (16.97), SPSFPR 94005A x ICSR 89076 (14.82), ICSA 20 x ICSR 89076 (13.69), ICSA 89004 x ICSR 93031 (12.75), ICSA 20 x ICSR 93031 (11.54),

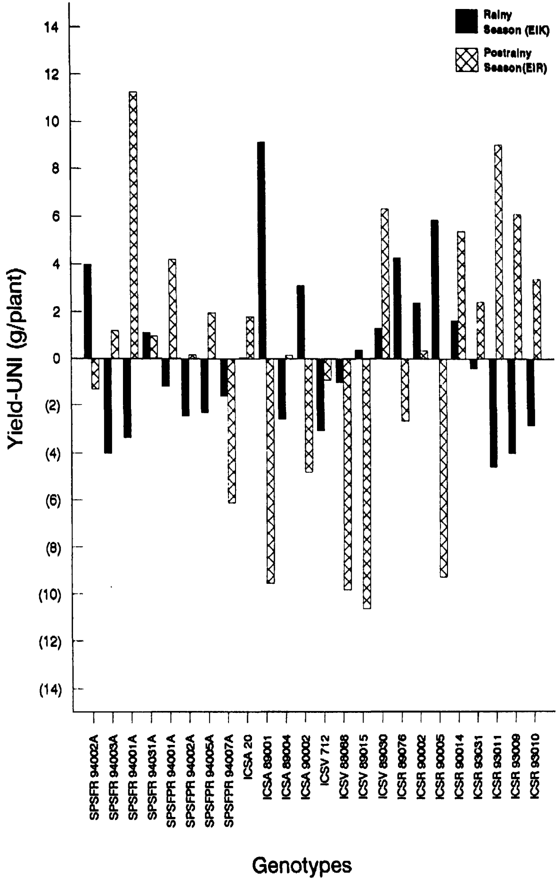


Figure 27. General Combining Ability (GCA) effects of yield-UNI (g/plant) for parents in rainy (EIK) and postrainy (EIR) seasons

SPSFPR 94002A x ICSV 89030 (11.29), SPSFR 94031A x ICSR 89076 (10.67) and ICSA 90002 x ICSV 89015 (10.33) in rainy season and SPSFR 94002A x ICSV 712 (57.03), SPSFR 94003A x ICSR 89076 (47.68), ICSA 90002 x ICSR 90002 (37.19), SPSFPR 94001A x ICSR 90005 (35.98), SPSFPR 94007A x ICSR 93031 (30.45),SPSFPR 94002A x ICSR 93010 (26.66), ICSA 20 x ICSR 90002 (25.73),SPSFPR 94002A x ICSR 89076 (24.89), ICSA 89001 x ICSR 93009 (24.29), SPSFPR 94002A x ICSR 93011 (23.91), SPSFR 94003A x ICSR 93010 (23.15), SPSFR 94002A x ICSR 93011 (22.43), SPSFR 94003A x ICSR 93011 (22.14) and ICSA 90002 x ICSR 93011 (19.97) in postrainy season. Of the ten hybrids found superior in rainy season, three were developed on postrainy season-bred resistant female lines, three were developed on rainy season-bred resistant female lines, and four were developed on susceptible bred female parents. Among the fourteen hybrids selected during postrainy season, five were developed on rainy season-bred resistant female lines, five were developed on postrainy season-bred resistant female lines, and four were developed on susceptible bred female lines.

4.5.13 Yield (I)

The GCA effects were found significant for lines and testers during rainy and postrainy seasons. The estimated GCA effects ranged between -2.98 to 4.68 in rainy season and between -11.17 to 8.98 in postrainy season (Table 13; Fig.28).

Among lines, SPSFR 94002A (4.68), ICSA 89004 (2.45) in rainy season, and SPSFR 94001A (7.93), ICSA 20 (8.98) in postrainy season exhibited significant positive GCA effects (desirable for yield). Among the two lines selected during rainy and postrainy seasons, one was from rainy season-bred resistant female lines and the other was from susceptible bred female lines.

Testers, ICSR 89076 (2.68), ICSR 90005 (3.05) and ICSR 90014 (2.52) in rainy season, and ICSV 89030 (8.87), ICSR 93009 (4.93) in postrainy season exhibited significant positive GCA effects (desirable for yield). All the three testers selected during rainy season were from susceptible bred restorers. During postrainy season, one resistant bred restorer, and one postrainy season-adapted landrace were found superior.

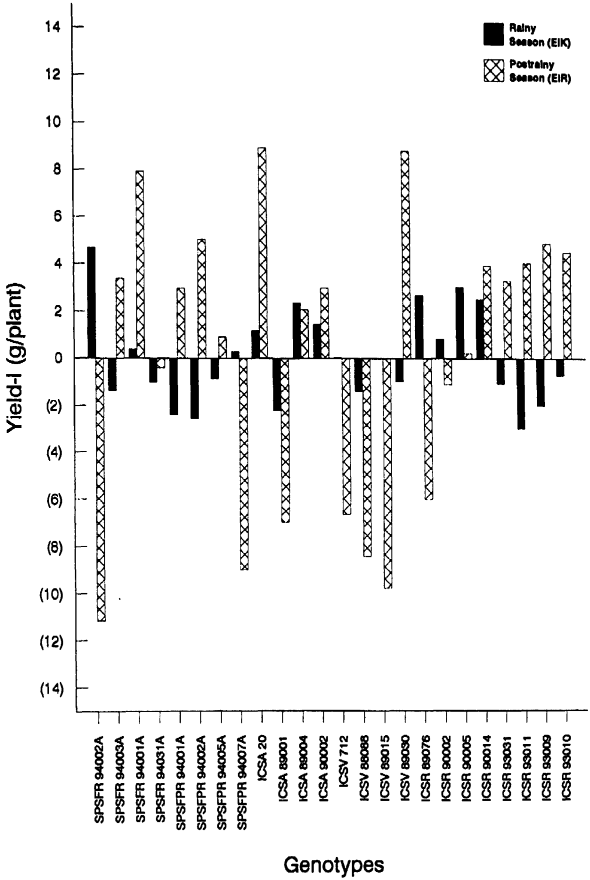


Figure 28. General Combining Ability (GCA) effects for yield-I (g/plant) of parents in rainy (EIK) and postrainy (EIR) seasons

The estimated SCA effects were found significant during rainy and postrainy seasons and they ranged from -9.22 to 13.75 during rainy season and from -40.88 to 40.57 during postrainy season. Among the hybrids, SPSFR 94031A x ICSV 712 (13.75), SPSFPR 94005A x ICSR 89076 (11.42), ICSA 90002 x ICSR 93011 (9.71), ICSA 89001 x ICSV 89030 (9.30), SPSFR 94003A x ICSR 90005 (9.28), SPSFPR 94005A x ICSR 93009 (8.32), SPSFPR 94007A x ICSR 93010 (8.22), SPSFR 94031A x ICSR 89076 (8.18) and SPSFR 94001A x ICSR 93010 (7.26) in rainy season, and ICSA 89004 x ICSR 90002 (40.57), SPSFR 94002A x ICSR 89076 (34.51), ICSA 89004 X ICSR 93031 (34.44), SPSFPR 94005A x ICSR 90014 (33.78), ICSA 90002 X ICSR 93011 (31.68), SPSFR 94003A x ICSR 90005 (31.52), SPSFPR 94007A x ICSR 93031 (31.50), SPSFR 94031A x ICSR 93009 (29.48), SPSFPR 94002A x ICSR 89076 (27.13), ICSA 20 x ICSV 88088 (26.31), SPSFR 94001A x ICSR 93031 (24.76), SPSFR 94002A x ICSV 89015 (23.38), SPSFR 94001A x ICSR 90014 (22.77), ICSA 90002 x ICSV 89030 (22.61) and SPSFR 94031A x ICSV 712 (21.58) in postrainy season showed significantly high positive SCA effects (desirable for yield). Among the nine hybrids selected during rainy season, four were based on rainy season-bred resistant female lines, three were based on postrainy season-bred resistant female lines, and two were developed on susceptible bred female lines. Among the fifteen hybrids selected during postrainy season, seven were developed on rainy season-bred resistant female lines, three were developed on postrainy season-bred resistant female lines, and five were developed on susceptible bred female lines (Table 16).

4.5.14 Days to 50% Flowering

Statistically significant GCA effects were noticed for lines and testers during rainy and postrainy seasons. The estimated GCA estimates ranged from -2.36 to 1.64 in rainy season, and from -3.93 to 2.88 in postrainy season (Table 13; Fig.29).

Among lines, significant positive GCA effects (desirable for early kharif) were SPSFPR 94001A (1.64), SPSFPR 94002A (1.18), SPSFPR 94005A (0.87) and ICSA 89001 (0.94) in rainy season and SPSFR 94002A (2.71) and SPSFPR 94001A (2.62) and SPSFPR 94005A (1.51) in postrainy season. Significant high negative GCA effects (desirable for late kharif) were shown by SPSFPR 94002A (-2.36), SPSFR 94001A (-1.06), ICSA 89004 (-0.86) during rainy season and SPSFR 94031A (-1.12), SPSFPR 94002A (-1.96), ICSA 20 (-3.93) during postrainy season. Of the seven lines selected for rainy season, two were from rainy season-bred resistant female lines, three

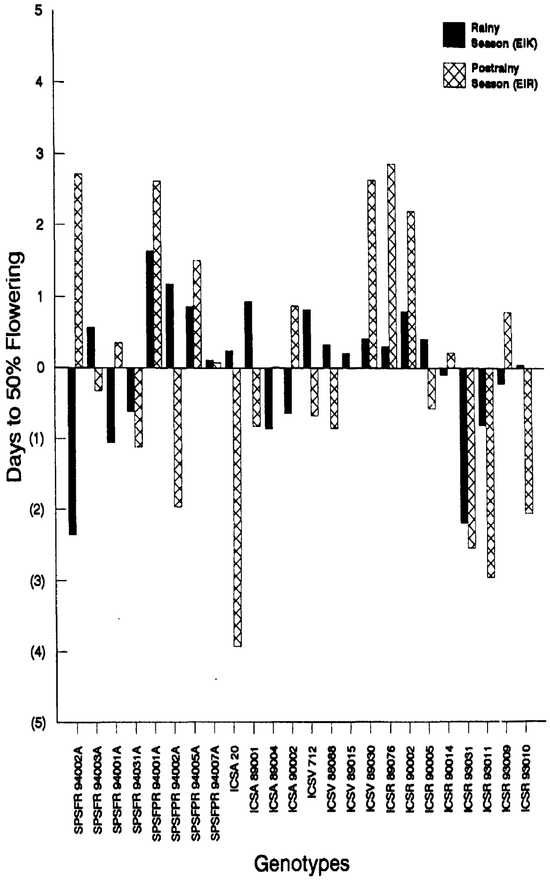


Figure 29. General Combining Ability (GCA) effects of days to 50% flowering for parents in rainy (EIK) and postrainy (EIR) seasons

were from postrainy season-bred resistant female lines and two were from susceptible bred female lines. Similarly in postrainy season, two were selected from rainy season-bred resistant female lines, one was selected from susceptible bred female lines, and three were selected from postrainy season-bred resistant female lines.

Testers, ICSV 712 (0.83) and ICSR 90002 (0.80 in rainy season, and ICSV 89030 (2.65), ICSR 89076 (2.88) and ICSR 90002 (2.21) in postrainy season exhibited significant positive GCA effects (desirable for early kharif). Significant high negative GCA effects (desirable for late kharif) were noticed for ICSR 93031 (-2.19) and ICSR 93011 (-0.81) in rainy season and ICSR 93031 (-2.54), ICSR 93011 (-2.96) and ICSR 93010 (-2.06) in postrainy season. Among the four testers selected during rainy season, one was selected from susceptible bred restorers, two were from postrainy season-adapted landraces and one was from resistant bred restorers. Among the six testers found superior during postrainy season, one was selected from resistant bred restorers, three were from postrainy season-adapted landraces, and two from susceptible bred restorers.

Significant SCA effects were found among the hybrids during rainy and postrainy seasons. Among the hybrids, the SCA effects ranged from -3.67 to 3.66 in rainy season, and from -6.71 to 9.18 in postrainy season. The hybrids with significant positive SCA effects (desirable for early kharif) were SPSFPR 94002A x ICSR 93010 (3.66) and ICSA 89001 x ICSR 93010 (1.02) in rainy season and SPSFPR 94005A x ICSR 89076 (9.18), SPSFPR 94005A x ICSV 89015 (8.74), ICSA 90002 x ICSV 89030 (8.46), ICSA 90002 x ICSR 93010 (7.18), SPSFPR 94002A x ICSV 89015 (6.89), SPSFR 94002A x ICSR 90005 (6.76), ICSA 90002 x ICSV 89015 (5.99), SPSFPR 94005A x ICSR 93031 (5.82), ICSA 89004 X ICSR 90005 (4.93), SPSFR 94001A x ICSV 712 (4.92), SPSFPR 94001A x ICSR 90014 (4.71), SPSFR 94031A x ICSR 89076 (4.40), SPSFPR 94002A x ICSV 88088 (4.32), SPSFPR 94002A x ICSR 93009 (4.26), SPSFR 94031A x ICSR 90002 (4.10), ICSA 20 x ICSR 93011 (4.01) and SPSFR 94001A x ICSR 90014 (3.90) in postrainy season. Significantly high negative SCA effects (desirable for late kharif) were noticed for SPSFR 94002A x ICSR 90002 (-3.67), SPSFPR 94002A x ICSR 93009 (-3.43), SPSFR 94031A x ICSV 89015 (-3.33), ICSA 20 x ICSR 93010 (-3.09), SPSFPR 94002A x ICSR 90014 (-2.95), SPSFR 94002A x ICSR 93031 (-2.85), SPSFR 94031A x ICSR 93010 (-2.81) and SPSFPR 94007A x ICSV 88088 (-0.28) in rainy season and ICSA 89001 x ICSV 712 (-6.71), SPSFR 94002A x ICSR 89076 (-5.93), SPSFPR 94002A x ICSR 90014 (-5.76), SPSFPR 94001A x ICSV 712 (-5.12), SPSFPR 94005A x ICSR 93009 (-4.82), SPSFR 94003A x ICSR 90005 (-4.40), SPSFR 94001A x ICSV 89030 (-4.22) and SPSFPR 94002A x ICSR 90005 (-4.24) in postrainy season (Table 16). Among the ten hybrids selected in rainy season, four hybrids were developed on rainy season-bred resistant female lines, four were developed on postrainy season-bred resistant female lines and two were developed on susceptible bred female lines. In postrainy season, of twenty six hybrids found superior, nine hybrids were developed on rainy season-bred resistant female lines, eleven hybrids were developed on postrainy season-bred resistant female lines and six hybrids were developed on susceptible bred female lines.

4.5.15 Plant Height

The GCA effects were found significant among the lines and testers during rainy and postrainy seasons. The estimated GCA effects for rainy season ranged between -30.12 to 47.25 and for postrainy season between -18.91 to 29.14 (Table 13; Fig.30).

Lines with significant high positive GCA effects (desirable) were SPSFR 94001A (13.25), SPSFR 94031A (11.07), SPSFPR 94005A (8.84) in rainy season and SPSFR 94031A (6.64), SPSFPR 94001A (7.39), SPSFPR 94002A (5.78), SPSFPR 94005A (9.00), ICSA 20 (8.86) and ICSA 89001 (12.39) in postrainy season. Of the three lines found superior during rainy season, two were from rainy season-bred resistant female lines and one was from postrainy season-bred resistant female lines. Among the six lines found superior during postrainy season, three were from postrainy season-bred resistant female lines, one was from rainy season-bred resistant female lines and two were from susceptible bred female lines.

Among testers, ICSR 93031 (41.90), ICSR 93011 (32.31), ICSR 93009 (36.90) and ICSR 93010 (47.25) in rainy season, and ICSR 93031 (20.11), ICSR 93011 (24.42), ICSR 93009 (24.70), ICSR 93010 (29.14) in postrainy season exhibited significant positive GCA effects (desirable). All the four testers selected during rainy and postrainy seasons were from postrainy season-adapted landraces.

Statistically significant SCA effects were exhibited by hybrids during rainy and postrainy seasons. Among the hybrids, the estimated SCA effects ranged from -55.72 to 38.14 and -53.44 to 44.78 during rainy and postrainy seasons respectively. The hybrids, SPSFR 94031A x ICSV 89015 (38.14), SPSFR 94031A x ICSR 90005 (32.60), SPSFPR 94007A x ICSV 88088 (31.50) and SPSFR 94002A x ICSR 93010 (29.63) in rainy season, and

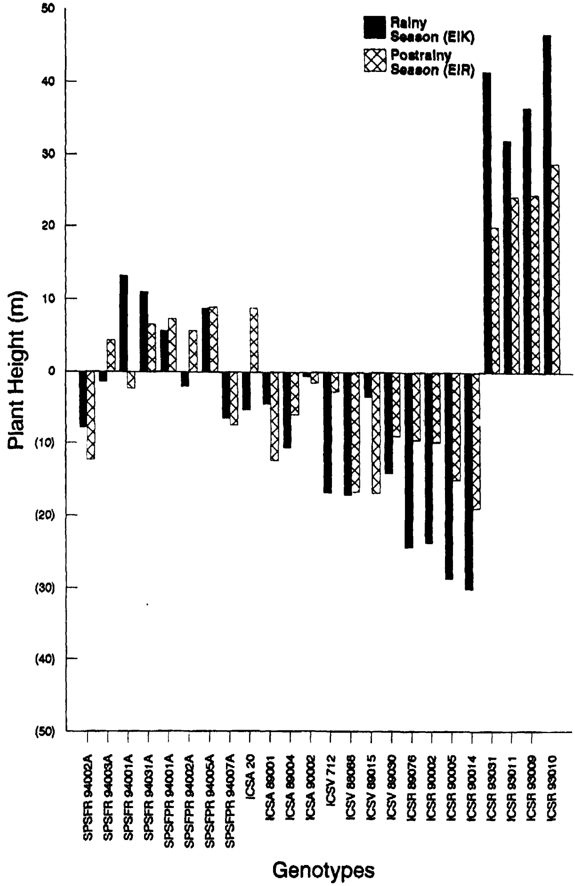


Figure 30. General Combining Ability (GCA) effects of plant height (m) for parents in rainy (EIK) and postrainy (EIR) seasons

SPSFPR 94001A x ICSR 90002 (44.78), SPSFR 94001A x ICSR 93009 (31.69), SPSFPR 94007A x ICSV 88088 (30.19), SPSFR 94003A x ICSR 93010 (28.08), SPSFR 94001A x ICSV 89030 (26.81), ICSA 20 x ICSR 90014 (24.05), SPSFPR 94005A x ICSV 712 (23.36), SPSFPR 94005A x ICSV 89015 (23.31), ICSA 89001 x ICSV 88088 (20.30), ICSA 90002 X ICSR 93009 (17.67) and ICSA 90002 x ICSR 93011 (17.39) in postrainy season exhibited significant positive SCA effects (desirable).Of the four hybrids found superior during rainy season, three were developed on rainy season-bred resistant female lines and one was developed on postrainy season-bred resistant female line. Among the eleven hybrids found superior during postrainy season, three were developed on rainy season-bred resistant female lines, four were developed on postrainy season-bred resistant female lines and four were developed on susceptible bred female lines (Table 16).

4.6. HETEROSIS

The magnitude of heterosis exhibited by 144 hybrids over the mean of mid parent, better parent and check (M 35-1) for 15 selected variables during rainy and postrainy seasons are given in Tables 17 to 19.

4.6.1 Early Seedling Vigour

Heterosis ranged from -60.12 to 156.96 (rainy) and -64.73 to 211.95 (postrainy) over mid parent values, from -55.67 to 375.94 (rainy) and -50.00 to 375.94 (postrainy) over the better parent values and from -55.67 to 144.33 (rainy) and -72.75 to 90.74 (postrainy) over the check values (Table 17).

Negative heterosis is desirable feature for shoot fly resistance as early seedling vigour is scored on 1-9 scale, where 1= most vigorous and quick growing seedling and 9 = least vigorous and slow growing seedling. Only one hybrid, SPSFR 94002A x ICSR 93011 (developed on rainy season-bred resistant female parent) exhibited significant negative heterosis over the mid parent during rainy season. While none of the hybrids showed significant negative heterosis during postrainy season.

S.No.	Genotypes	Total Tillers ($plant^{-1}$)		Productive Tillers ($plant^{-1}$)		Yield-UNI (g $plant^{-1}$)		Yield-I (g $plant^{-1}$)		Days to 50% flowering		Plant height (m)	
		EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR	EIK	EIR
121	SPSFPR 94005A x ICSR 93031	0.24	0.27	0.12	0.30	-7.46	-41.74**	-8.14	-31.97**	0.19	5.82**	11.85	-19.84*
122	SPSFPR 94005A x ICSR 93011	0.31	0.13	0.22	-0.12	3.80	14.70	1.72	8.45	-1.06	-3.49	-7.87	-11.64
123	SPSFPR 94005A x ICSR 93009	-0.17	-1.08	0.10	-0.78*	-0.25	5.72	8.32*	-1.96	1.06	-4.82*	15.77	-1.50
12	SPSFPR 94005A x ICSR 93010	-0.42	0.76	-0.14	0.49	1.28	-7.30	-2.53	0.72	0.28	-1.35	-8.70	-15.53
125	SPSFPR 94007A x ICSR 93031	-0.25	-0.48	0.03	-0.19	-0.03	30.45**	0.58	31.50**	-0.03	-3.09	-0.09	-4.61
126	SPSFPR 94007A x ICSR 93011	0.37	0.36	0.08	0.61	0.37	10.87	1.59	10.10	0.48	1.15	14.49	7.00
127	SPSFPR 94007A x ICSR 93009	-0.56	0.09	-0.10	0.13	-1.19	-13.00	-0.59	-27.67**	1.07	3.01	7.69	3.77
128	SPSFPR 94007A x ICSR 93010	0.20	-0.44	-0.14	-0.23	0.01	0.00	8.22*	6.32	0.22	0.46	3.83	16.83
	S8 cms x PRLR hybrids												
129	ICSA 20 x ICSR 93031	0.44	-0.34	-0.12	-0.51	11.54*	16.49	-3. 3	-2.49	1.09	-1.21	-7.32	-2.75
130	ICSA 20 x ICSR 93011	0.01	0.16	0.11	-0.14	-18.08**	0.01	-1.02	19.12	0.97	4.01*	-14.82	8.50
131	ICSA 20 x ICSR 93009	-0.23	-0.02	-0.12	-0.31	-0.00	-20.32*	-3.08	3.15	-1.17	-0.82	-23.70	8.77
132	ICSA 20 x ICSR 93010	0.05	0.59	-0.03	0.74*	10.01	4.11	-1.65	-15.27	-3.09**	0.32	8.87	10.99
133	ICSA 89001 x ICSR 93031	-0.38	0.51	0.03	-0.09	-8.86	-0.07	-6.55	10.81	1.43	-0.32	-6.83	-9.28
134	ICSA 89001 x ICSR 93011	-0.18	0.50	-0.07	0.16	6.85	-9.85	-3.17	-15.49	0.49	1.37	5.12	2.25
135	ICSA 89001 x ICSR 93009	-0.13	-0.46	-0.05	-0.18	-5.30	24.29*	-2.44	4.46	1.79	-2.30	-27.91	10.72
136	ICSA 89001 x ICSR 93010	0.02	0.54	0.10	0.10	-3.36	10.27	0.31	7.29	1.02**	1.84	24.28	-1.84
137	ICSA 89004 x ICSR 93031	0.59	0.13	0.14	0.81*	12.75*	-4.47	4.36	34.44**	-2.94	-0.85	-5.44	11.29
138	ICSA 89004 x ICSR 93011	-0.65	-0.80	-0.20	-0.45	-3.01	5.22	-1.54	-21.00	-0.45	-0.32	25.81	15.52
139	ICSA 89004 x ICSR 93009	-0.12	0.07	0.01	-0.26	-0.21	-8.01	-2.85	-9.60	0.81	-2.46	-1.83	16.00
140	ICSA 89004 x ICSR 93010	0.17	-0.33	0.17	-0.29	0.20	-0.18	1.25	6.30	-0.46	-1.02	-2.35	-0.94
141	ICSA 90002 x ICSR 93031	0.01	-0.16	-0.14	0.10	7.88	-3.55	2.02	-11.01	-1.23	0.31	-9.33	-25.53**
1 2	ICSA 90002 x ICSR 93011	0.59	-0.40	-0.04	0.13	-6.44	19.97*	9.71**	31.68**	-1.09	0.20	3.17	17.39*
143	ICSA 90002 x ICSR 93009	0.18	-0.18	0.03	0.30	-0.78	-9.31	-3.63	3.00	1.93	-3.63	5.95	17.67*
144	ICSA 90002 x ICSR 93010	-0.11	0.57	0.02	-0.32	0.27	-24.28*	2.53	-40.88**	-1.29	7.18**	-0.65	-53.44**
	SE+ (gi)	0.35	0.57	0.13	0.36	5.23	10.08	3.65	10.90	1.15	1.95	14.41	8.74
	SE+ (gi-gj)	0.50	0.80	0.19	0.51	7.42	14.25	5.16	15.41	1.63	2.76	20.37	12.36

Table 17: Per cent heterosis over mid parent, better parent and check for various traits associated with shoot fly resistance

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x RBR hybrids																
1	SPSFR 94002A x ICSV 712	R	-14.29	50.00	0.00	45.50	78.00	6.80	26.18	81.82	19.76	13.67	13.19*	96.32**	-26.38	-45.77**	-91.51
		PR	0.00	28.76	-18.26	359.28**	359.28**	283.50**	541.51**	639.13**	45.30**	402.28**	595.27**	20.06	-33.21**	-60.04**	-39.10**
2	SPSFR 94002A x ICSV 88088	R	-25.00	0.00	0.00	8.99	33.33	-20.00	22.18	42.73	-5.99	22.78**	34.18**	97.77**	10.36	-174.94	10.33
		PR	26.18	49.81	8.99	242.61**	379.04**	300.00**	214.00**	423.33**	34.19*	380.37**	490.64**	1.99	-38.38**	-64.94	10.33
3	SPSFR 94002A x ICSV 89015	R	-23.18	-9.26	11.00	41.97	144.67	46.80	53.31	100.00	31.74	-3.05	18.31	74.38**	65.20**	-67.02**	-76.84**
		PR	0.00	59.88	-27.25	110.41**	299.40**	233.50**	187.80**	490.00**	51.28**	203.31**	731.03**	43.50*	-76.88**	83.05**	-89.10**
4	SPSFR 94002A x ICSV 89030	R	4.30	37.45	22.33	15.47	66.67	0.00	14.39	75.45	15.57	9.92	33.79**	97.21**	-54.68	64.44**	75.03**
		PR	57.73	87.27	36.24	111.00*	279.04**	216.50**	61.67*	223.33**	-17.33	210.07**	618.82**	24.12	-69.77**	-79.04**	-83.74**
5	SPSFR 94003A x ICSV 712	R	11.00	66.50	11.00	-12.73	7.37	-6.80	31.74	73.23	31.74	10.46	10.96	119.73**	-53.20**	-66.68**	-50.54**
		PR	87.62*	114.57*	36.24	63.49	50.00	100.00	230.00	-71.79**	244.32**	366.48**	-16.67	17.24**	-71.24**	71.24**	35.24**
6	SPSFR 94003A x ICSV 88088	R	-23.71	-11.00	-11.00	-18.73	0.00	-13.20	36.50	47.24	11.98	7.62	15.33	101.55**	16.06	37.68**	-19.55
		PR	17.46	24.72	-9.26	140.00*	200.00*	200.00*	17.50	230.00	-71.79**	17.98	42.19	-74.60**	18.99**	-44.99**	19.86**
7	SPSFR 94003A x ICSV 89015	R	4.30	8.99	33.33	11.99	20.82	53.20	55.92	86.61	41.92	5.42	8.71	117.22**	-	-	-
		PR	71.31	139.52*	8.99	-10.04	50.00	50.00	94.17**	900.00**	-14.53	85.92*	395.52**	-11.48	12.65**	2.58	19.64**
8	SPSFR 94003A x ICSV 89030	R	10.04	37.45	22.33	33.33	41.34	60.00	46.90	67.72	27.54	-1.58	1.28	102.37**	-22.52	-36.63	-60.14**
		PR	88.01*	99.63*	45.23	26.38	100.00	100.00	54.00	670.00**	-34.19**	106.96**	367.24**	-16.54	-24.19**	-24.56**	-40.91**
9	SPSFR 94001A x ICSV 712	R	46.80	83.50	22.33	81.14	138.35	26.80	41.14	72.73	47.90	10.35	17.83*	105.47**	-14.33	-25.54*	10.52
		PR	100.00**	157.51**	63.49*	73.20	159.28	116.50	131.75*	217.39**	-37.61*	150.34**	209.47**	-5.50	38.93**	22.07**	86.00**
10	SPSFR 94001A x ICSV 88088	R	-33.33	-33.33	-33.33	24.00	63.16	-13.20	24.14	25.87	7.78	7.24	7.36	87.21**	-31.34*	-36.67**	-17.85
		PR	-5.36	12.36	-18.26	-36.81	-33.33	0.00	-50.91	-32.50	-76.92**	28.42	78.80	-54.95**	-7.84**	-29.48**	53.43**
11	SPSFR 94001A x ICSV 89015	R	40.03	55.67	55.67	32.20	150.38	33.20	23.13	37.76	17.96	2.46	13.60	98.10**	-45.71**	57.27**	-53.18**
		PR	105.99**	229.34**	49.86	62.50	95.20**	225.00**	238.35**	462.50**	92.31**	178.16**	278.36**	70.13**	-32.23**	-47.22	-39.10**
12	SPSFR 94001A x ICSV 89030	R	29.45	37.45	22.33	52.40	138.35	26.80	13.07	20.98	3.59	2.66	13.56	98.03**	-36.01	-56.33	-52.15**
		PR	36.59	62.17	17.98	4.44	20.12	100.00	38.46	125.00	-23.08	105.49**	146.24**	10.72	-36.88**	-47.22**	-39.10

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
13	SPSFR 94031A x ICSV 712	R	6.80	33.50	-11.00	30.24	66.67	0.00	-11.63	-8.21	13.77	12.67	24.17	104.20	6.89	-11.81	30.90
		PR	-5.21	28.76	-18.26	23.04	59.88	33.50	123.33**	191.30**	-42.74**	8.09	9.81	-66.47**	-7.76**	-30.04**	6.61**
14	SPSFR 94031A x ICSV 88088	R	0.00	0.00	0.00	-8.99	11.33	-33.20	24.32	56.56	37.72	1.53	4.71	72.20**	-29.77*	-38.77**	-20.57
		PR	-10.04	12.36	-18.26	5.82	12.36	50.00	-0.93	43.24	-54.70**	18.75	33.63	-66.33**	-8.04**	-37.37**	36.26**
15	SPSFR 94031A x ICSV 89015	R	-19.94	-11.00	-11.00	-35.40	11.33	-33.20	10.00	24.29	31.74	11.10	27.26	109.29**	9.01	38.12	-13.12
		PR	29.45	19.76	45.50	-36.51	-12.73	16.50	-27.69	27.03	-59.83**	-18.17	41.36	-55.46**	42.27**	29.24**	1.80
16	SPSFR 94031A x ICSV 89030	R	29.45	37.45	22.33	22.33	78.00	6.80	31.09	55.21	51.50	5.58	20.66*	98.43	-50.09*	-64.71**	-65.95
		PR	10.04	37.45	0.00	14.29	49.81	100.00	136.22**	305.41**	28.21	96.46**	194.01**	-7.37	-97.14**	-97.16**	-97.76**
	PRBR cms x RBR hybrids																
17	SPSFPR 94001A x ICSV 712	R	49.93	150.0*	66.67	142.55**	207.37	166.8**	29.41	65.41	31.74	-4.10	-2.52	93.03**	-6.44	-37.04**	-6.54
		PR	56.66	157.51**	63.49*	71.31	379.04**	300.00**	46.05	269.57	-27.35	71.73*	258.66**	9.53	-32.39**	-41.89**	23.17**
18	SPSFPR 94001A x ICSV 88088	R	4.30	22.33	22.33	148.36**	214.75**	173.20**	52.14	60.15	27.54	4.28	13.17	97.77**	-18.73	-43.28**	-26.43
		PR	-33.25	0.00	-27.25	25.02	122.33**	233.50**	1.84	18.57	-29.06	0.11	142.81*	-38.82*	-7.04**	-8.24**	99.65**
19	SPSFPR 94001A x ICSV 89015	R	27.82	45.23	77.67*	104.86**	115.32**	186.80**	61.29	87.97	49.70	7.10	9.13	123.23**	-68.28*	-71.19*	-81.88**
		PR	23.71	159.28	17.98	29.66	71.31	300.00**	-24.73	-24.73	-40.17	-34.34	26.00	-42.75	19.19**	-22.33**	64.66**
20	SPSFPR 94001A x ICSV 89030	R	54.50	112.36*	89.00*	111.04**	129.68**	160.00**	64.19	82.71	45.51	5.69	7.47	119.83**	-55.25	-60.21	-99.57**
		PR	33.25	99.63	45.23	16.67	61.66	250.00**	85.79**	88.89**	45.30**	69.58**	115.80**	35.51	52.77**	4.34**	121.17**
21	SPSFPR 94002A x ICSV 712	R	6.80	33.50	-11.00	38.25	38.25	20.00	-3.90	-2.96	17.96	4.85	6.06	105.30**	6.67*	3.67	10.94
		PR	37.71	57.51	0.00	119.76	191.76	83.50	191.30**	191.30*	-42.74**	38.55	85.29	-43.42*	10.84**	7.55**	63.88**
22	SPSFPR 94002A x ICSV 88088	R	-44.33	-44.33	-44.33	15.21	15.21	0.00	-14.29	2.04	-10.18	4.13	9.73	91.76**	5.51	-23.04	-0.14
		PR	41.09	49.81	8.99	100.00	179.64	133.50	35.48	173.91	-46.15	18.25	79.14	-54.87**	-12.93**	-27.79**	57.13**
23	SPSFPR 94002A x ICSV 89015	R	-10.04	0.00	0.00	2.74	38.25	20.00	30.00	39.55	47.90	0.46	5.32	103.87**	40.13	36.44	-14.18
		PR	71.31	139.52**	8.99	5.05	99.40	66.50	77.59**	347.83**	-11.97	54.43*	94.04	-0.78	-7.34**	-32.87**	-3.79**
24	SPSFPR 94002A x ICSV 89030	R	17.46	24.72	11.00	0.00	15.21	0.00	-23.50	-14.11	-16.17	-1.88	2.64	98.69**	-13.03	-27.33	-56.70**
		PR	76.37**	87.27**	36.24	0.00	79.64	50.00	-16.81	104.35	-59.83**	23.25	37.29	-29.79	-33.43**	-48.70**	-26.47**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm²)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
25	SPSFPR 94005A x ICSV 712	R	6.80	33.50	-11.00	0.00	23.04	6.80	37.14	67.83	43.71	1.57	2.87	103.71	-8.62	-45.71**	-19.41
		PR	-18.14	28.76	-18.26	57.17	119.76	83.50	212.50**	552.17**	28.21	105.66*	197.44**	-9.17	28.51**	146.31**	32.46
26	SPSFPR 94005A x ICSV 88088	R	-11.00	-11.00	-11.00	-6.37	15.21	0.00	19.31	20.98	3.59	6.56	15.20	101.31**	-5.93	-42.83**	-25.84
		PR	-13.17	24.72	-9.26	-11.00	-11.00	33.50	16.08	18.57	-29.06	59.20	162.17**	-33.94	29.06**	-19.52**	75.11**
27	SPSFPR 94005A x ICSV 89015	R	29.84	44.33	44.33	-2.63	5.05	33.20	62.50	81.02	55.69	4.14	6.50	116.31	116.46	56.32	-1.67**
		PR	19.94	139.52	8.99	-30.38	-11.00	33.50	-55.42**	-49.32*	-68.38**	-7.38	8.30	-37.41*	62.52**	-49.18**	-4.02**
28	SPSFPR 94005A x ICSV 89030	R	17.46	24.72	11.00	-5.67	0.00	13.20	17.65	25.87	7.78	-1.50	0.52	104.15**	-4.74	-19.08	-67.65**
		PR	30.38	87.27*	36.24	-18.14	0.00	50.00	38.65	54.79*	-3.42	45.71	52.02	-12.15	-56.29**	-46.61**	-71.29**
29	SPSFPR 94007A x ICSV 712	R	84.74	100.00	33.33	47.00	133.00	-6.80	38.02	49.72	58.68	17.09*	27.12**	114.92**	-4.03	-43.67**	-16.38
		PR	0.19	14.59	-27.25	25.09	67.00	-16.50	191.30*	191.30*	-42.74**	21.83	67.13	-48.96**	63.06**	-18.47**	24.23**
30	SPSFPR 94007A x ICSV 88088	R	-24.95	-14.46	-33.33	5.36	67.00	-33.20	29.63	42.86	25.75	0.33	2.01	72.48**	15.78	-30.59*	-9.96
		PR	-17.81	-12.73	-36.51	-33.50	33.00	-33.50	13.98	130.98	-54.70**	69.81	164.35	-33.40	15.71**	-42.14**	25.89**
31	SPSFPR 94007A x ICSV 89015	R	-22.33	0.00	-22.33	7.07	150.00	0.00	-20.90	-20.90	-16.17	1.38	14.35	93.34**	-87.07*	-90.88**	-94.26**
		PR	-14.35	19.76	-45.50	-17.81	133.00	16.50	89.66**	378.26**	-5.98	-1.76	20.48	-35.85	-110.00**	-100.00**	-100.00**
32	SPSFPR 94007A x ICSV 89030	R	6.80	14.59	-11.00	4.44	100.00	-20.00	4.12	8.59	5.99	8.03	21.57	105.54**	95.70*	61.03	-35.62**
		PR	5.82	12.36	-18.26	24.95	233.00	66.50	6.19	160.87*	-48.72**	1.33	10.42	-41.20*	107.79**	3.90**	-35.62**
	SB cms x RBR hybrids																
33	ICSA 20 x ICSV 712	R	71.31	100.00	33.33	35.97	161.29**	126.80**	28.19	72.46*	113.77**	7.68	15.21**	128.16**	-	-	-
		PR	77.67	128.76	45.23	80.86	179.04**	216.50*	50.74**	565.22**	30.77	60.91*	224.96**	-0.77	10.47**	-44.77**	-15.84**
34	ICSA 20 x ICSV 88088	R	17.46	24.72	11.00	11.99	115.21*	86.80	66.20*	180.95**	147.31**	10.38	26.48**	121.02**	-	-	-
		PR	-36.91	-25.09	-45.50	20.05	66.67	150.00	14.40	104.29**	22.22	71.42**	301.42**	1.14	49.90**	-25.05**	63.08**
35	ICSA 20 x ICSV 89015	R	36.59	62.17	44.33	21.95	63.49**	140.00**	36.62	103.39**	115.57**	2.15	5.38	123.74	-	-	-
		PR	0.00	59.88	-27.25	40.00	49.89	250.00**	2.56	50.54**	19.66	28.13	40.93	9.02	-50.20**	-75.10**	-83.98**
36	ICSA 20 x ICSV 89030	R	24.72	24.72	11.00	40.67	123.67**	153.20**	37.62	116.56**	111.38**	2.63	6.10	124.33**	-100.00	-100.00**	-100.00**
		PR	-47.32	-37.45	-54.50	44.93	61.66	250.00**	13.33	70.00**	30.77	32.01	63.56*	2.71	-78.64**	-89.32**	-91.72**
37	ICSA 89001 x ICSV 712	R	-0.15	66.50	11.00	37.50	1453.46**	120.00**	-31.07	-6.76	15.57	4.02	11.32	120.44**	-85.63**	-85.63**	-78.67**
		PR	14.29	71.67	8.99	117.21**	398.80**	316.50**	135.87**	1043.48**	124.79**	79.67**	284.57**	17.44	-97.06**	-98.53**	-97.76**

Contd..

Contd..

S.No.	Hybrids			Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
				MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
38	ICSA 89001	x ICSV 88088	R	-4.30	22.33	22.33	54.25	184.33**	146.80**	30.80	122.45**	95.81**	8.90	24.80	118.09**	-73.83**	-73.83**	-66.05**
			PR	17.98	62.17	17.98	62.89	144.33**	266.50**	92.59**	271.43**	122.22**	54.36*	284.06**	-3.23	-97.94**	-98.97**	-97.76**
39	ICSA 89001	x ICSV 89015	R	-4.08	8.99	33.33	26.32	63.49**	140.00**	42.26	112.99**	125.75**	4.68	8.00	129.31**	-	-	-
			PR	-36.91	19.76	-45.50	56.14	78.37*	316.50**	118.43**	244.09**	173.50**	50.11*	72.27	33.26	-96.94*	-98.47**	-99.02**
40	ICSA 89001	x ICSV 89030	R	63.49**	124.72**	100.00**	100.23**	206.36**	246.80**	-12.02	39.26	35.93	2.22	5.69	123.46**	-	-	-
			PR	8.99	49.81	8.99	67.86*	100.23*	333.50**	132.41**	274.44**	188.03**	13.88	47.79	-7.20	-100.00**	-110.00**	-100.0**
41	ICSA 89004	x ICSV 712	R	28.48	50.00	0.00	44.44	199.54**	160.00**	-11.31	19.32	47.90	5.26	13.08**	123.93**	43.66*	-28.17**	6.62
			PR	50.09	71.67	8.99	53.40*	359.28**	283.50**	9.01	452.17**	8.55	51.73*	232.53**	1.55	-4.84**	-52.11**	-27.03**
42	ICSA 89004	x ICSV 88088	R	52.73	62.17	44.33	59.33**	230.41**	186.80**	-2.21	65.31	45.51	14.16**	31.38**	129.59**	-55.33**	-77.67**	-71.03**
			PR	-17.81	-12.73	-36.51	0.09	89.00	183.50*	37.86**	175.71**	64.96**	68.91*	305.27**	2.11	-36.57**	-68.14**	-30.68**
43	ICSA 89004	x ICSV 89015	R	26.18	49.81	33.33	4.76	59.86	120.00**	24.10	84.75	95.81*	2.25	5.90	124.85**	-	-	-
			PR	57.17	119.76	0.00	-12.77	21.41	183.50**	-20.79	29.03	2.56	2.92	20.19	-7.03	-50.72**	-74.99**	-83.91**
44	ICSA 89004	x ICSV 89030	R	37.45	37.45	22.33	13.87	94.35**	120.00**	23.59	94.48	89.82	2.69	6.59	125.36**	84.94**	-7.58	-63.05**
			PR	64.73	74.91	27.25	-21.01	15.47	150.00	51.83**	152.22**	94.02**	22.55	62.10*	1.79	-94.02**	-96.97**	-97.65**
45	ICSA 90002	x ICSV 712	R	33.20	66.50	11.00	37.18	168.66**	133.20**	23.85	36.71	69.46	-1.42	4.72	107.37**	-68.46**	-82.10	-73.44**
			PR	-37.34	-28.33	-54.50	35.55	279.04**	216.50*	187.05**	1104.35**	136.75**	18.17	238.33**	3.32	0.84	-47.55**	-20.08**
46	ICSA 90002	x ICSV 88088	R	-11.00	-11.00	-11.00	-17.65	61.29	40.00	71.28*	131.29*	103.59*	8.05	22.87	114.71**	-36.61	-63.42**	-52.56**
			PR	-41.09	-37.45	-54.50	18.65	111.00	216.50*	58.33**	171.43**	62.39**	-1.63	230.93**	-16.62	-40.68**	-49.50**	-33.64**
47	ICSA 90002	x ICSV 89015	R	-0.15	11.00	11.00	13.40	54.50*	126.80**	34.43	62.15	71.86	5.81	8.39	130.13**	-100.00**	-100.00**	-100.00**
			PR	100.00*	179.64**	27.25	29.66	71.31	300.00**	39.16**	96.77**	56.41**	-1.87	40.60	8.76	-82.59**	-90.46**	-93.86**
48	ICSA 90002	x ICSV 89030	R	17.46	24.72	11.00	31.00	112.01**	140.00**	51.57	92.02	87.43	2.70	5.43	122.90**	-100.00*	-100.00**	-100.00**
			PR	52.73	62.17	17.98	27.83	77.14	283.50**	176.92**	300.00**	207.69**	210.85	100.95**	26.18	45.50**	-21.50**	-39.10**
	RBR cms x SBR hybrids																	
49	SPSFR 94002A	x ICSR 89076	R	0.00	33.33	33.33	63.99*	355.33**	173.20**	98.50**	260.91**	137.72	15.12	48.20*	118.44**	-100.00*	-100.00**	-100.00
			PR	24.72	99.40	-9.26	26.60	279.04**	216.50*	62.37**	676.67**	99.15**	52.92*	588.37**	18.87**	-68.43**	-84.21**	-95.27**
50	SPSFR 94002A	x ICSR 90002	R	-11.88	10.21	22.33	37.11	311.33**	146.80**	251.72**	363.64	205.39	17.75*	48.28**	118.56	-	-	-
			PR	52.73	116.50*	17.98	50.00	259.28**	200.00**	107.14**	866.67**	146.86**	31.89	364.34	-19.82	-68.06	-84.03**	-95.21**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
51	SPSFR 94002A x ICSR 90005	R	7.73	27.25	55.67	28.62	300.00**	140.00	60.21	181.82**	85.63	12.47	36.74**	101.55	-80.70	-81.71	-87.15
		PR	146.91**	250.00**	90.74**	75.78*	338.92**	266.50**	39.35**	543.33**	64.96**	44.32*	520.30**	7.11	-85.06**	-92.53**	-97.76**
52	SPSFR 94002A x ICSR 90014	R	-18.44	-8.25	22.33	83.14**	378.00**	186.80**	28.50	133.64**	53.89	18.41**	48.14**	118.35**	-45.35**	-48.35	-61.62**
		PR	-22.33	0.00	-36.51	72.48	279.04**	216.50**	148.43**	823.33**	136.75**	86.61**	627.78**	25.67	-85.19**	-92.59**	-97.78**
53	SPSFR 94003A x ICSR 89076	R	23.71	44.33	44.33	0.00	57.73	100.00	16.55	91.34	45.51	4.44	12.88	125.55**	45.49	-27.25	-54.24**
		PR	57.17	119.76	0.00	9.78	183.50**	183.50**	52.06**	1930.00**	73.50**	21.86	432.29**	-4.92**	40.18**	-29.91**	-45.09**
54	SPSFR 94003A x ICSR 90002	R	18.14	30.03	44.33	34.40	126.18	186.80**	60.91	94.49	47.90	6.67	13.08	125.95**	-100.00**	-100.00**	-100.00**
		PR	73.20	116.50*	17.98	27.97	166.50*	166.50*	-82.31**	130.00	-80.34**	-6.88	218.48**	-43.11**	105.72**	2.86	-19.42**
55	SPSFR 94003A x ICSR 90005	R	4.30	8.99	33.33	12.18	94.64**	146.80**	7.43	70.87	29.94	4.49	7.42	114.64**	-	-	-
		PR	46.80	83.50	0.00	76.93*	283.50**	283.50**	115.56	2670.00	136.75	70.96**	613.14**	27.39	-91.77**	-95.89**	-96.78**
56	SPSFR 94003A x ICSR 90014	R	-16.75	-16.75	11.00	1.68	52.37	93.20	67.87*	175.59**	109.58*	-2.40	2.88	105.56**	-100.00**	-100.00**	-100.00**
		PR	50.09	71.67	8.99	65.06	216.50*	216.50*	100.00*	1930.00**	73.50**	24.52	371.52**	-15.77	-97.49**	-98.75*	-99.02**
57	SPSFR 94001A x ICSR 89076	R	-33.33	-33.33	0.67	-63.24	12.78*	0.17	-63.05	-44.06	0.86	0.14	16.72	41.95**	60.22	-19.89**	-48.51
		PR	74.91	179.64**	27.25	42.88	150.15**	316.50**	73.06**	542.50**	119.66**	13.52	131.21**	3.96	5.55**	-47.22**	-39.10**
58	SPSFR 94001A x ICSR 90002	R	57.98	66.67	66.67	86.86**	520.30**	530.00**	36.22	53.85	31.74	17.85**	345.55**	134.63**	-	-	-
		PR	146.91**	250.00**	90.74**	86.34**	170.27**	350.00**	81.38**	557.50**	124.79**	15.35	91.49*	-13.90	-95.93**	-97.96**	-97.65**
59	SPSFR 94001A x ICSR 90005	R	19.94	33.33	33.33	56.55*	439.10**	186.80**	72.86*	153.85**	117.37*	17.10*	29.40**	125.65**	-	-	-
		PR	52.73	116.50*	17.98	40.00	110.21*	250.00**	65.16**	492.50**	102.50**	61.58**	216.46**	42.29*	5.55**	-47.22**	-39.10**
60	SPSFR 94001A x ICSR 90014	R	33.43	55.67	55.67	91.38**	451.13**	193.20**	29.33	95.80	67.66	12.84	28.05**	123.30**	-82.33**	-82.33**	-80.64**
		PR	11.00	42.92	-9.26	-3.78	30.03	116.50	148.93**	625.00**	147.86**	2.08	84.34*	-17.11	-3.16*	-51.58**	-44.13**
61	SPSFR 94031A x ICSR 89076	R	11.00	11.00	11.00	12.12	211.33*	86.80	27.49	46.64	95.81*	9.45	31.97**	117.03**	-17.70	-58.85**	-60.29**
		PR	17.46	99.40	-9.26	15.09	137.08	216.50*	51.70**	502.70**	90.60**	39.53	275.76	18.39	28.73**	-35.64**	-59.30**
62	SPSFR 94031A x ICSR 90002	R	15.69	22.33	22.33	-18.44	144.67	46.80	-5.71	5.56	13.77	5.93	25.05**	105.65**	22.65	-38.67*	-40.82*
		PR	55.67	133.50	27.25	40.67	137.08*	216.50*	46.34**	467.57**	79.49**	62.15**	249.51**	10.12	455.95**	177.98**	118.97**
63	SPSFR 94031A x ICSR 90005	R	-19.94	-11.00	-11.00	10.83	244.67*	106.80	26.80	42.15	89.82	13.07	29.08**	112.27**	-92.41**	-93.73**	-93.95**
		PR	-11.00	33.50	-27.25	28.48	124.72**	200.00**	-8.45	251.35**	11.11	22.00	214.96**	-0.77	-97.50**	-98.75**	-99.02**
64	SPSFR 94031A x ICSR 90014	R	-14.29	0.00	0.00	-2.17	155.33	53.20	-18.13	-5.83	25.75	9.52	28.48**	111.29**	-39.55*	-39.55*	-41.67*
		PR	-5.21	28.76	-18.26	27.82	99.63	166.50	53.91**	378.38**	51.28**	23.83	192.66**	-7.79	-80.26**	-90.13**	-92.23**

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	PRBR cms x SBR																
65	SPSFPR 94001A x ICSR 89076	R	21.77	55.67	55.67	41.14	155.32**	186.80**	5.44	67.67	33.53	-2.01	4.59	113.94**	188.59**	44.29	-25.91
		PR	52.29	219.16**	45.23	-29.13	-26.08	183.50*	14.29	115.05**	70.94**	-15.74	2.14	-0.90	-42.55**	-71.27**	-39.10**
66	SPSFPR 94001A x ICSR 90002	R	35.97	54.50	89.00	28.49	115.32**	186.80**	46.34**	125.56**	79.64**	5.26	6.92	118.70**	-41.53**	-34.95*	-66.60
		PR	0.14	83.50	0.00	9.57	21.17	283.50**	3.21	90.32**	51.28**	26.29	31.04	27.14	-30.44**	-65.22**	-26.27**
67	SPSFPR 94001A x ICSR 90005	R	35.97	54.50	89.00**	28.49	115.32**	186.80**	56.34	125.56*	79.64	5.26	6.92	118.70**	-41.53	-46.90	-66.60**
		PR	45.43	166.50**	45.23	-6.97	0.00	233.50	-57.06**	-21.51	-37.61*	-47.89**	-38.72*	-40.54*	96.46**	-1.77**	108.23**
68	SPSFPR 94001A x ICSR 90014	R	30.80	41.75	89.00*	31.06	90.09**	153.20**	24.35	97.74	57.49	6.20	10.58	126.18**	117.34**	117.34**	10.60
		PR	30.55	114.59***	36.24	-29.99	-17.64	133.50	-4.20	47.31*	17.09	-33.14*	-26.11	-28.31	93.32**	-3.34**	104.90**
69	SPSFPR 94002A x ICSR 89076	R	77.67*	77.67	77.67	88.89**	291.71**	240.00**	-1.42	19.70	45.51	1.47	11.58	115.98**	-	-	-
		PR	156.96**	259.28**	63.49*	-6.60	179.64	133.50	-47.86**	217.39**	-37.61**	-0.35	84.46*	-5.67	33.16**	-33.42**	-4.57**
70	SPSFPR 94002A x ICSR 90002	R	-5.21	0.00	0.00	34.44	199.54	16.00**	103.66**	116.67**	133.53**	7.12	15.49	123.56**	-99.09	-99.54**	-99.73**
		PR	-60.00	-50.00	-72.75	-8.25	119.76	83.50	-65.57**	104.35	-59.83**	-23.40	16.43	-40.46*	67.84**	-16.08**	20.28**
71	SPSFPR 94002A x ICSR 90005	R	-19.94	-11.00	-11.00	6.60	145.62**	113.20**	2.92	21.67	47.90	12.43	17.49*	127.43**	-100.00**	-100.00**	-100.00**
		PR	-6.80	16.50	-36.51	59.95	299.40**	233.50**	3.70	508.70**	19.66	-28.00	28.34	-34.37	-52.06**	-76.03**	-65.65**
72	SPSFPR 94002A x ICSR 90014	R	33.43	55.67	55.67	56.94	207.37**	166.80**	17.65	42.86	73.65	12.03	20.08*	132.45**	-	-	-
		PR	50.09	71.67	8.99	108.99**	359.28**	283.50**	73.15**	713.04**	59.83**	38.90*	128.91**	17.06	-95.50**	-97.75**	-96.78**
73	SPSFPR 94005A x ICSR 89076	R	22.33	22.33	22.33	16.60	83.91	133.20*	46.42	121.68*	89.82	2.81	10.15	123.72**	-56.81	-78.40	-93.96**
		PR	-19.94	59.88	-27.25	35.39	155.67**	283.50*	49.70**	238.36**	111.11**	17.47	99.18**	15.11	-84.43**	-92.21**	-95.81**
74	SPSFPR 94005A x ICSR 90002	R	15.96	22.33	22.33	12.46	89.27	140.00**	116.72*	144.76**	109.58*	5.52	10.91	125.25**	847.58**	373.64**	32.38
		PR	-14.29	50.00	-18.26	64.42	155.67**	283.50**	15.79	156.16**	59.83	89.34**	165.56**	53.47**	-100.00**	-100.00**	-100.00**
75	SPSFPR 94005A x ICSR 90005	R	10.04	22.33	22.33	30.36*	126.18	186.80**	22.38	79.72	53.89	3.54	5.56	114.38**	-78.09*	-84.14*	-90.05**
		PR	-42.86	0.00	-45.50	65.46*	166.67**	300.00**	154.38**	457.53**	247.86**	45.46**	137.80**	37.43*	-100.00**	-100.00**	-100.00**
76	SPSFPR 94005A x ICSR 90014	R	23.71	44.33	44.33	33.26	99.68**	153.20**	39.95	111.89	81.44	5.18	9.92	123.25	-100.00	-100.00	-100.00
		PR	9.14	71.67	8.99	38.41	100.00	200.00*	20.30	119.18**	36.75*	-21.91	18.37	-31.59	-24.51**	-62.25**	-79.70**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour MP	Early seedling vigour BP	Early seedling vigour CHECK	Glossiness MP	Glossiness BP	Glossiness CHECK	Egg count MP	Egg count BP	Egg count CHECK	Deadhearts (%) MP	Deadhearts (%) BP	Deadhearts (%) CHECK	Trichome density (mm^2) MP	Trichome density (mm^2) BP	Trichome density (mm^2) CHECK
77	SPSFPR 94007A x ICSR 89076	R	0.19	14.59	-11.00	19.28	367.00**	86.80	29.76	71.19	81.44	8.47	28.70**	117.60**	-100.00	-100.00	-100.00**
		PR	100.00*	179.64	27.25	-21.33	267.00	83.50	-52.14**	191.30*	-42.74**	-19.31	45.05	-22.76	-	-	-100.00**
78	SPSFPR 94007A x ICSR 90002	R	17.67	42.92	11.00	37.18	483.00**	133.20**	15.97	16.95	23.95	2.79	19.43*	101.92**	-43.55	-71.77	-92.71**
		PR	60.00	100.00	8.99	-63.71	33.00	-33.50	-53.85**	173.91*	-46.15**	-47.35*	-22.11	-58.52**	-	-	-99.02**
79	SPSFPR 94007A x ICSR 90005	R	11.00	42.92	11.00	24.58	450.00**	120.00**	1.76	25.99	33.53*	15.53*	29.85**	119.54**	-47.72	-63.13*	-76.81**
		PR	86.80	133.50	27.25	30.38	400.00*	150.00	-20.74	365.22**	-8.55	-18.76	40.67	-25.09	-	-	-86.56**
80	SPSFPR 94007A x ICSR 90014	R	15.96	57.51	22.33	13.78	317.00**	66.80	5.78	39.55	47.90	7.34	23.95**	109.57**	-47.71	-47.71	-86.50**
		PR	-12.57	0.00	-36.51	-19.94	167.00	33.50	1.85	378.26**	-5.98	-7.74	47.86	-21.27	-	-	-36.03**
	SB cms x SBR hybrids																
81	ICSA 20 x ICSR 89076	R	5.82	12.36	0.00	2.62	8.10	166.80**	70.94**	88.62**	227.54**	0.18	1.60	129.35**	-100.00	-100.00	-100.00**
		PR	-25.09	19.76	-45.50	17.13	50.09	300.00**	29.52**	57.22**	141.88**	-12.70	8.65	0.83	-	-	-100.00**
82	ICSA 20 x ICSR 90002	R	33.33	49.81	33.33	-4.90	5.35	160.00**	28.30	88.89*	103.59*	0.14	0.57	125.08**	256.58	78.29	-79.57**
		PR	5.82	50.00	-18.26	2.92	12.57	200.00*	-13.02	3.89	59.83**	16.16	23.37	14.49	-	-	-100.00**
83	ICSA 20 x ICSR 90005	R	-5.36	12.36	0.00	-4.71	8.10	166.80**	57.26**	77.98**	195.21**	0.35	3.86	119.15**	-	-	-
		PR	-64.73	-50.00	-72.75	0.00	12.57	200.00*	-63.93**	-57.22**	-34.19*	-26.30	-11.07	-17.47	-	-	-100.00**
84	ICSA 20 x ICSR 90006	R	-10.04	12.36	0.00	-1.28	0.00	146.80**	-13.44	-4.48	65.87	-2.73	-1.78	117.46**	-100.00	-100.00	-100.00**
		PR	-22.33	0.00	-36.51	27.27	31.33	250.00**	32.44**	37.22**	111.11**	19.72	35.60	25.84	-	-	-100.00**
85	ICSA 20 x ICAR 90007	R	47.85	89.00**	89.00**	21.17	31.56	206.80**	-12.91	-3.45	67.66	-3.22	-1.86	121.59**	-	-	-81.62**
		PR	78.86*	239.52**	54.50	25.61	50.00	350.00**	35.67**	55.00**	164.96**	4.41	24.21	24.45	-	-	-97.65**
86	ICSA 89001 x ICSR 90002	R	83.25**	120.12**	144.33**	22.58	40.14**	226.80**	-30.58	2.78	10.78	-2.65	-2.22	118.84**	-	-	-
		PR	-0.15	66.50	-9.26	40.63	44.50	333.50**	15.56**	30.00**	122.22**	19.71	22.18	22.41	-	-	-51.94**
87	ICSA 89001 x ICSR 90005	R	11.99	27.25	55.67	0.00	17.15	173.20**	-24.76	-14.44	41.92	6.91	10.65	133.48**	-100.00**	-100.00**	-100.00**
		PR	40.03	133.50*	27.25	42.07	50.00	350.00**	-32.89**	-25.00**	28.21	33.19*	53.78**	54.07**	-	-	-39.10**
88	ICSA 89001 x ICSR 90014	R	30.80	41.75	89.00**	1.48	5.83	146.80**	-37.79	-31.03	19.76	-2.97	-2.01	116.94**	-	-	-
		PR	23.71	85.84	17.98	19.97	23.46	250.00**	57.76**	60.62**	164.96**	8.51	17.85	18.07	-	-	-96.78**
89	ICSA 89004 x ICSR 89076	R	41.09	49.81	33.33	17.13	17.13	220.00**	6.25	17.24	103.59*	-2.74	-1.74	123.51**	-	-	-
		PR	14.35	19.76	-45.50	-27.97	-27.97	200.00**	19.91**	33.33**	139.32**	-8.76	6.64	10.17	-	-	-

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
90	ICSA 89004 x ICSR 90002	R	0.00	12.36	0.00	-9.28	-4.83	160.00**	4.53	53.89	65.87	-3.88	-3.09	116.89**	-	-	-
		PR	-20.00	0.00	-45.50	22.78	42.18	350.00**	-27.39**	-20.48**	42.74**	27.87	28.49	32.75	-100.00	-100.00	-100.00**
91	ICSA 89004 x ICSR 90005	R	15.77	37.45	22.33	-6.82	0.00	173.20**	20.26	36.10	125.75**	2.90	6.92	125.60**	-96.63**	-98.31**	-98.94**
		PR	133.20*	166.50**	45.23	20.00	34.93	350.00**	-6.78	1.43	82.05**	11.09	26.07	30.25	-100.00	-100.00	-100.00**
92	ICSA 89004 x ICSR 90014	R	10.04	37.45	22.33	11.40	15.80	193.20**	9.37	20.69	109.58**	-6.11	-4.82	110.72**	-	-	-87.56**
		PR	211.95	42.92	-9.26	28.57	58.73	350.00**	9.18	13.99	88.03**	14.14	21.93	25.98	-	-	-
93	ICSA 90002 x ICSR 89076	R	55.67	55.67	55.67	3.80	7.80	173.20**	7.41	16.00	73.65	-6.60	-4.62	112.39**	116.87	8.44	-78.33**
		PR	142.83**	239.52**	54.50	12.50	17.34	350.00**	35.83**	70.59**	147.86**	16.62	19.20	64.73**	-	-	-
94	ICSA 90002 x ICSR 90002	R	26.38	33.33	33.33	-15.69	-7.90	133.20**	92.09*	129.44**	147.31**	0.45	0.71	124.24**	-22.99	-61.50	-92.31**
		PR	-6.80	16.50	-36.51	28.57	42.18	350.00**	-9.52	11.76	62.39**	-3.74	14.71	19.67	-100.00**	-100.00**	-100.00**
95	ICSA 90002 x ICSR 90005	R	10.04	22.33	22.33	-5.79	5.37	166.80**	18.79	25.20	87.43	4.52	7.41	126.63**	88.35*	24.29	-21.82**
		PR	-20.00	0.00	-45.50	-2.37	4.95	250.00**	34.29**	64.71**	139.32**	-16.56	-12.37	14.94	-45.99	-73.00**	-98.34**
96	ICSA 90002 x ICSR 90014	R	-4.86	11.00	11.00	-5.21	-5.21	140.00**	44.44	56.00	133.53**	-0.30	-1.01	121.37**	-100.00	-100.00	-100.00**
		PR	75.23	100.43*	27.25	-10.04	5.82	200.00*	4.68	11.76	62.39**	-26.43*	-18.01	-3.73	-27.00	-63.50**	-97.76**
	RBR cms x PRLR hybrids																
97	SPSFR 94002A x ICSR 93031	R	-57.98	0.00	-55.67	14.29	33.33	-20.00	42.96	75.45	15.57	11.62	38.30	103.85**	-1.09	-1.74	-31.00
		PR	-17.81	16.50	-36.51	130.41	199.40*	150.00*	277.78**	466.67**	45.30**	236.52**	382.07**	-16.76	-100.00**	-100.00**	-100.00**
98	SPSFR 94002A x ICSR 93011	R	-59.90*	-49.85	-44.33	-53.09	-11.33	-46.80	53.80	111.82	39.52	16.16*	43.68**	111.68**	-27.83	-32.87	-52.85**
		PR	20.00	125.56	-18.26	-27.52	-20.36	-33.50	19.66	133.33	-40.17	112.85**	324.43**	-26.71	16.86	4.50	-60.26**
99	SPSFR 94002A x ICSR 93009	R	-33.43	16.50	-22.33	122.00	122.00	33.20	19.17	30.00	-14.37	1.63	19.79	76.56**	-24.52	-25.66	-46.17**
		PR	64.73	133.50*	27.25	135.27*	299.40**	233.50**	779.25**	913.04**	99.15**	148.50	518.92**	6.87**	20.85**	-20.58**	-24.25**
100	SPSFR 94002A x ICSR 93010	R	-60.12	-20.36	-55.67	26.18	33.33	-20.00	56.38	72.73	13.77	26.05**	38.94**	104.79**	5.85	-3.68	-32.35
		PR	20.00	125.56	-18.26	279.04**	279.04**	216.50**	588.89**	623.33**	85.47**	285.43**	502.07**	3.96	0.56**	-24.05**	-39.10**
101	SPSFR 94003A x ICSR 93031	R	50.09	200.75**	33.33	28.82	66.50	33.20	-4.53	7.87	-17.96	-7.72	-3.56	92.70**	17.55	12.12	-22.29
		PR	33.20	66.0	-9.26	14.35	33.50	33.50	-34.29	130.00	-80.34**	38.43	94.00	-65.35**	-26.90**	-43.33**	-19.35**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
102	SPSFR 94003A x ICSR 93011	R	-18.54	-9.91	0.00	-54.50	-57.32	-33.20	26.87	59.84	21.56	1.79	6.24	112.27**	-33.52	-34.84	-59.01**
		PR	-7.62	75.19	-36.51	16.50	16.50	16.50	64.95	700.00**	-31.62	84.28	258.29*	-36.00	-9.67**	-32.91**	-47.44**
103	SPSFR 94003A x ICSR 93009	R	22.33	83.50	22.33	-0.21	55.33	-6.80	110.12**	112.60	61.68	5.09	5.16	110.11**	-44.32	-47.98	-62.33**
		PR	-20.00	0.00	-45.50	0.00	50.00	50.00	324.24**	600.00**	-40.17*	66.10	302.67**	-28.07	-71.01**	-73.60**	-74.82**
104	SPSFR 94003A x ICSR 93010	R	29.45	19.76	-33.33	-17.36	19.76	-20.00	128.46*	133.86*	77.84	13.17	20.27*	113.51**	28.02	22.61	-22.88
		PR	7.62	75.19	-36.51	8.99	19.76	0.00	225.58*	600.00**	-40.17*	84.59	181.81	-49.66**	24.11**	22.68**	-1.64
105	SPSFR 94001A x ICSR 93031	R	7.62	75.19	-22.33	60.36	100.75	6.80	32.01	39.86	19.76	-2.88	9.23	90.47**	-29.00	-42.05**	-36.50*
		PR	-17.81	16.50	-36.51	-22.33	-12.73	16.50	14.00	42.50	-51.28	98.90*	138.30*	-23.26	4.23**	-5.63**	34.30**
106	SPSFR 94001A x ICSR 93011	R	-36.81	-33.33	-33.33	2.91	112.78	13.20	38.69	62.94	39.52	7.15	20.32**	109.81**	-67.71**	-74.95**	-72.55**
		PR	-6.80	75.19	-36.51	12.57	50.00	50.00	46.46	132.50**	-20.51	77.48*	90.48*	-14.31	37.23**	-8.77**	5.26**
107	SPSFR 94001A x ICSR 93009	R	-20.00	0.00	-33.33	41.34	50.38	-20.00	51.65	59.23	23.95	3.62	11.25	93.99**	33.64**	10.98	21.60
		PR	-17.81	16.50	-36.51	-9.14	0.00	66.50	176.19**	278.26**	-25.64	-47.49	-33.60	-70.14**	34.51**	22.85**	41.74**
108	SPSFR 94001A x ICSR 93010	R	-28.48	0.00	-44.33	44.67	63.16	-13.20	68.84	75.19	39.52	21.83**	22.93**	114.36**	-23.68	-41.79**	-36.22
		PR	-33.20	25.56	-54.50	6.80	59.88	33.50	72.60	90.91	-46.15**	10.44	22.91	-54.92**	4.00**	11.86**	1.69
109	SPSFR 94031A x ICSR 93031	R	-22.86	25.56	-44.33	14.29	33.33	-20.00	-6.01	12.50	7.78	-4.39	11.13	82.75**	-2.03	-15.84	-18.79
		PR	-22.33	16.50	-36.51	87.27	87.27	150.00	23.71	62.16	-48.72**	55.99	57.72	-50.31**	-10.38**	-30.38**	-0.93
110	SPSFR 94031A x ICSR 93011	R	-57.98	-55.67.	-55.67	-53.09	-11.33	-46.80	-13.46	-6.74	7.78	6.66	23.78*	103.57**	-5.54	-23.20	-25.90
		PR	0.19	100.75	-27.25	57.17	83.50	83.50	1.61	70.27	-46.15**	7.39	41.63	-55.38**	-1.68	-27.11**	-42.58**
111	SPSFR 94031A x ICSR 93009	R	33.20	66.50	11.00	22.00	22.00	-26.80	7.65	46.15	13.77	4.00	15.27	89.56**	-13.20	-39.79**	-41.90**
		PR	0.00	50.00	-18.26	49.93	87.27	150.00	56.67	104.35	-59.83**	-14.98	35.26	-57.38**	55.59**	42.05**	35.48**
112	SPSFR 94031A x ICSR 93010	R	-14.35	19.76	-33.33	26.18	33.33	-20.00	30.90	75.19	39.52	17.83*	22.51*	101.48**	26.17	0.73	-2.80
		PR	-24.95	50.38	-45.50	84.33	139.52	100.00	22.86	30.30	-63.25	29.29	39.90	-55.92**	36.62**	35.42**	8.57
	PRBR cms x PRLR hybrids																
113	SPSFPR 94001A x ICSR 93031	R	44.33	225.56**	44.33	106.38*	175.00**	120.00**	125.26**	148.12*	97.60*	8.73	12.26	129.63**	-32.55	-20.76	-59.31**
		PR	-27.15	33.50	-27.25	-16.25	62.17	116.50	0.65	28.33	-34.19*	1.76	104.17	-34.25	11.050**	-7.20**	96.72**
114	SPSFPR 94001A x ICSR 93011	R	0.00	20.12	33.33	37.87	55.26	106.80*	10.43	35.34	7.78	-9.61	-6.80	90.64**	9.09	0.90	-39.04*
		PR	90.09**	375.94**	72.48*	-3.41	133.50	133.50	-33.33	-31.03	-48.72**	-0.14	43.82	-25.79	24.56**	-26.55**	55.71**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
115	SPSFPR 94001A x ICSR 93009	R	29.84	116.50*	44.33	107.04*	233.33**	100.00	80.23	82.31	41.92	2.02	3.17	106.41**	61.16*	37.71	-0.27
		PR	36.43	150.00	36.24	-37.10	-8.25	83.50	89.66**	378.26**	-5.98	6.42	28.31	-11.79	-74.40**	-81.44**	-60.66**
116	SPSFPR 94001A x ICSR 93010	R	26.18	139.52*	33.33	80.00	169.46*	80.00	85.71	85.71	47.90	-0.05	7.56	90.94**	88.57**	78.35**	2.71
		PR	-9.91	125.56	-18.26	49.89	319.16**	250.00**	90.48**	263.64**	2.56	-5.48	72.26	-36.82*	8.29**	-25.38**	58.18**
117	SPSFPR 94002A x ICSR 93031	R	7.62	75.19	-22.33	19.90	25.00	0.00	55.92	76.87	69.46	0.46	6.76	106.66**	24.08	15.38	-20.04
		PR	46.80	83.50	0.00	130.41	199.40	150.00	124.10**	304.35**	-20.51	63.14	111.09*	-32.02	-57.12**	-57.27**	-38.76**
118	SPSFPR 94002A x ICSR 93011	R	-36.81	-33.33	-33.33	-42.27	-15.67	-26.80	-0.51	2.07	17.96	2.46	8.73	110.46**	25.57	24.71	-24.66
		PR	53.81	150.38	-9.26	8.99	19.76	0.00	50.91	260.87**	-29.06	54.96	55.66	-20.40	21.58**	-23.08**	10.25**
119	SPSFPR 94002A x ICSR 93009	R	-6.80	16.50	-22.33	54.22	88.67	13.20	-29.73	-10.00	-29.94	1.54	3.25	99.86**	-13.68	-21.33	-43.03**
		PR	60.00	100.00	8.99	41.09	139.52	100.00	321.74**	321.74**	-17.09	18.49	38.89	-28.97	0.02	-16.72**	19.37**
120	SPSFPR 94002A x ICSR 93010	R	-43.04	-20.36	-55.67	-4.69	9.58	-26.80	-8.93	15.04	-8.38	4.51	9.24	93.92**	32.45	30.23	-22.40
		PR	-22.86	25.56	-54.50	-20.36	-20.36	-33.50	-28.57	-13.04	-82.91	-64.28	-57.24	-84.31**	25.06**	-2.49**	39.76**
121	SPSFPR 94005A x ICSR 93031	R	-7.62	50.38	-33.33	-16.05	8.50	-13.20	12.21	18.88	1.80	-5.30	-1.86	99.32**	25.10	-12.22	-39.17*
		PR	-42.86	0.00	-45.50	-29.45	-25.09	0.00	-35.34	-28.33	-63.25**	2.04	42.58	-54.08	-10.17**	-38.11**	-11.92**
122	SPSFPR 94005A x ICSR 93011	R	-36.81	-33.33	-33.33	-59.13	-52.68	-40.00	42.86	67.83	43.71	-2.44	0.96	105.04**	63.26	19.40	-27.87
		PR	-57.98	0.00	-63.76	-33.20	-16.50	-16.50	-3.75	5.48	-34.19*	-17.67	-12.73	-54.97**	104.01**	74.14**	-6.35**
123	SPSFPR 94005A x ICSR 93009	R	33.20	66.50	11.00	42.61	122.00	33.20	2.56	7.69	-16.17	6.94	7.75	115.58**	5.38	-26.98	-47.12**
		PR	-4.86	66.50	-9.26	-4.86	11.00	66.50	60.42	234.78**	-34.19*	24.47	36.27	-21.25	22.74**	-4.03**	-8.47**
124	SPSFPR 94005A x ICSR 93010	R	-0.21	39.52	-22.33	3.31	49.70	0.00	30.43	35.34	7.78	10.74	18.72	110.75**	12.84	-16.19	-51.74**
		PR	-36.81	50.38	-45.50	128.27*	219.16*	166.50	-30.19	12.12	-68.38**	0.95	30.01	-52.31**	8.92**	-9.01**	-27.05**
125	SPSFPR 94007A x ICSR 93031	R	-8.74	25.56	-44.33	-11.33	33.00	-46.80	24.63	31.25	25.75	7.31	22.79*	107.60**	39.97	-3.94	-33.43*
		PR	-33.20	-16.50	-54.50	-27.52	33.00	-33.50	37.35	147.83	-51.28**	92.16*	154.94**	-17.90	12.04**	-43.98**	-20.28**
126	SPSFPR 94007A x ICSR 93011	R	6.01	28.76	0.00	-16.05	117.00	-13.20	28.11	33.90	41.92	5.33	20.33*	103.45**	-80.51	-86.09**	-91.60**
		PR	-22.86	25.56	-54.50	11.33	67.00	-16.50	-40.00	43.48	-71.79**	-2.09	-0.53	-48.67**	21.40**	-39.30**	-76.92**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
127	SPSFPR 94007A x ICSR 93009	R	53.81	66.50	11.00	86.40	133.00	-6.80	60.91	90.00	47.90	17.61*	28.39**	117.08**	-82.04*	-87.82**	-91.18**
		PR	-33.20	-16.50	-54.50	-33.20	67.00	-16.50	-347.83**	347.83**	-11.97	-4.46	9.33	-41.78*	-44.95**	-72.48**	-73.75**
128	SPSFPR 94007A x ICSR 93010	R	0.00	19.76	-33.33	62.55	117.00	-13.20	104.52**	138.35**	89.82**	25.93**	29.07**	118.23**	-73.89**	-81.09**	-89.11*
		PR	23.33	100.75	-27.25	74.53	133.00	16.50	292.86**	378.26**	-5.98	110.59**	158.16**	-5.31	-79.02**	-89.51**	-91.59**
	SB cms x PRLR hybrids																
129	ICSA 20 x ICSR 93031	R	83.50	175.94	22.33	10.16	125.00	80.00	0.78	60.62	53.89	-2.54	-0.78	-116.17**	-83.27*	-90.25**	-93.24**
		PR	64.73	133.50	27.25	91.75*	187.27**	283.50**	44.17**	188.33**	47.86**	104.46**	296.83**	27.80	-91.97**	-95.98**	-94.28**
130	ICSA 20 x ICSR 93011	R	-11.00	0.00	-11.00	0.00	23.98	106.80**	14.18	60.62	85.63	-0.77	1.17	119.78**	-27.29	-56.75*	-73.87**
		PR	-33.20	25.56	-54.50	-45.43	0.00	0.00	27.34*	95.40**	45.30**	43.19	100.36	3.39	-69.17**	-84.59**	-94.14**
131	ICSA 20 x ICSR 93009	R	42.61	66.50	11.00	38.98	255.33**	113.20**	61.25	197.69**	131.74**	4.14	10.82	121.73**	-100.00**	-100.00**	-100.00**
		PR	-29.45	0.00	-45.50	-21.33	-8.25	83.50	25.12	452.17**	8.55	9.69	28.88	-11.40	-93.24**	-96.62**	-96.78**
132	ICSA 20 x ICSR 93010	R	53.46	99.40	11.00	82.91**	329.34**	186.80**	43.69	160.90**	107.78**	9.42	24.28**	120.62**	-75.82	-85.51**	-91.65**
		PR	-33.20	25.56	-54.50	62.00	239.52*	183.50*	71.83**	454.55**	56.41**	46.16	157.98**	-5.38	-45.19**	-72.59**	-78.03**
133	ICSA 89001 x ICSR 93031	R	111.00**	375.94**	111.00**	117.11**	325.00**	240.00**	-2.53	56.25	49.70	-11.86**	-10.25	95.56**	-100.00**	-100.00**	-100.00**
		PR	-30.13	16.50	-36.51	46.02	137.08*	216.50**	63.85**	255.00**	82.05	114.91**	341.73**	42.26*	-93.35**	-96.67**	-95.27**
134	ICSA 89001 x ICSR 93011	R	8.25	30.03	44.33	50.00**	79.86**	200.00**	5.13	48.70	71.86	-8.16	-6.35	103.45**	-100.00**	-100.00**	-100.00**
		PR	11.00	150.38	-9.26	41.75	183.50*	183.50*	116.03**	256.32**	164.96**	48.24*	118.03**	12.50	-100.00**	-100.00**	-100.00**
135	ICSA 89001 x ICSR 93009	R	59.82	116.50**	77.67**	109.28**	411.33**	206.80**	*24.22	40.77	9.58	-6.78	-0.79	98.50**	-	-	-
		PR	-10.04	50.00	-18.26	46.60	83.25	266.50	126.91**	1000.00**	116.24*	44.13*	77.08*	21.74	27.70**	-36.15**	-39.10**
136	ICSA 89001 x ICSR 93010	R	57.73	199.40**	66.67	86.67**	319.16**	180.00**	26.34	130.83*	83.83	7.17	21.74**	116.12**	34.23	34.23**	-22.70**
		PR	-22.33	75.19	-36.51	91.13*	338.92**	266.5**	94.85**	587.88**	94.02**	21.29	126.30**	-17.00	-100.00**	-100.00**	-100.00**
137	ICSA 89004 x ICSR 93031	R	50.00	125.56	0.00	9.40	141.50**	93.20*	41.18	125.00**	115.57	3.69	5.98	130.88**	-49.23**	-74.62**	-82.41**
		PR	-33.20	-16.50	-54.50	-15.09	74.91	133.50	3.70	133.33**	19.66	68.52**	254.57**	17.19	-42.09**	-70.85**	-58.51**

Contd..

Contd..

S.No.	Hybrids		Early seedling vigour			Glossiness			Egg count			Deadhearts (%)			Trichome density (mm^2)		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
138	ICSA 89004 x ICSR 93011	R	22.43	37.45	22.33	12.18	47.96	146.80**	27.81	79.79	107.78**	-3.66	-1.39	114.22**	-50.99	-75.50**	-85.20**
		PR	84.76	200.75**	8.99	61.28*	316.50**	316.50**	59.60**	172.41**	102.56**	77.95**	167.13	37.84*	-83.48**	-91.53**	-96.78**
139	ICSA 89004 x ICSR 93009	R	156.96**	200.00**	100.00**	56.06**	333.33**	160.00**	-35.42	19.23	-7.19	-12.19**	-6.18	87.71**	-	-	-
		PR	-20.00	0.00	-45.50	-13.54	33.25	166.50	151.50**	1173.91**	150.43**	19.36	49.37	2.69	-10.45**	-54.76**	-56.85**
140	ICSA 89004 x ICSR 93010	R	99.54	159.28	44.33	48.94	279.04**	153.20**	31.26	138.35	89.82	7.39	22.50**	117.46**	-90.75	-4.40**	-97.34**
		PR	-7.62	50.38	-45.50	-20.00	139.52	100.00	1.23	272.73**	5.13	-6.02	79.36	-34.21	-100.00**	-100.00**	-100.00**
141	ICSA 90002 x ICSR 93031	R	23.33	100.75	-11.00	-3.96	100.00	60.00	79.02	129.38**	119.76*	-0.78	0.31	118.54**	-92.05**	-23.22**	-96.45**
		PR	60.00	100.00	8.99	67.70*	224.72**	333.50**	27.83	145.00**	25.64	54.95**	324.67**	36.76*	-95.66**	-97.74**	-96.78**
142	ICSA 90002 x ICSR 93011	R	36.81	44.33	44.33	-1.52	23.98	106.80**	30.93	50.26	73.65	-0.75	0.49	118.30**	-78.36*	-85.60**	-91.30**
		PR	115.70*	251.13**	27.25	30.92	216.50*	216.50*	24.51	83.91**	36.75**	30.62	147.97**	27.95	-100.00**	-100.00**	-100.00**
143	ICSA 90002 x ICSR 93009	R	60.00	100.00	33.33	10.60	188.67	73.20	159.47**	279.23**	195.21**	7.32	13.38**	126.84**	-91.17**	-94.37**	-95.92**
		PR	6.80	33.50	-27.25	-25.79	8.25	116.50	135.23**	886.96**	94.02**	-7.14	43.90	-1.07	-95.37**	-97.54**	-97.54**
144	ICSA 90002 x ICSR 93010	R	-0.21	39.52	-22.33	16.75	179.64**	86.80	73.89	150.38*	99.40*	6.77	20.34**	113.63**	-99.09*	-99.39**	-99.65**
		PR	23.33	100.75	-27.25	78.37*	398.80**	316.50**	74.38**	436.36**	51.28**	34.81	232.61**	22.00	-22.17**	-58.11**	-66.41**

MP : Mid parent; BP : Better parent

* Significant at 5 per cent level; ** Significant at 1 per cent level

4.6.2 Glossiness

The heterosis ranged from -63.24 to 148.36 (rainy) and -63.71 to 359.28 (postrainy) over mid parent value, from -52.68 to 1453.46 (rainy) and -33.33 to 398.80 (postrainy) over better parent value and from -46.80 to 246.80 (rainy) and from -33.50 to 350.00 (postrainy) over check. In case of glossiness also negative heterosis is desirable feature for shoot fly resistance. Glossiness was scored on 1-9 scale, where 1= completely glossy and 9=non glossy. None of the hybrids exhibited significant negative heterosis during both seasons (Table 17).

4.6.3 Egg Count

The heterosis ranged from -63.05 to 251.72 (rainy) and -347.83 to 779.25 (postrainy) over mid parent value, from -44.06 to 363.64 (rainy) and -71.79 to 2670 (postrainy) over better parent value, and from -29.94 to 227.54 (rainy) and -80.34 to 247.86 (postrainy) over check (Table 17).

In the case of egg count negative heterosis is desirable as genotypes with negative heterosis recorded fewer number of eggs plant^{-1}. None of the hybrids had significant negative heterosis during rainy season. During postrainy season, significant negative heterosis was shown by eleven hybrids over mid parent; five hybrids over better parent and thirty five hybrids over check. Among these hybrids, significant high negative heterosis of ≤-65.00 showed by SPSFPR 94002A x ICSR 90002 and SPSFPR 94007A x ICSR 93009 (developed on postrainy season-bred resistant female lines) over mid parent; SPSFR 94003A x ICSV 712 (developed on rainy season-bred resistant female line) over better parent; SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 88088, SPSFR 94003A x ICSR 90002, SPSFR 94003A x ICSR 93031 and SPSFR 94003A x ICSR 90002, (developed on rainy season-bred resistant female lines), SPSFPR 94005A x ICSV 89015, SPSFPR 94005A x ICSR 93010 and SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female lines) over check.

Thus, three hybrids showed significant high heterosis (≤-65.00) over mid parent, one hybrid over better parent and seven hybrids over check (M 35-1)in postrainy season.

4.6.4 Deadhearts %

During rainy season the heterosis ranged from -12.19 to 26.05 over mid parent value, from -10.25 to 345.55 over better parent value and from -116.17 to 133.48 over check. During postrainy season the heterosis ranged from -47.89 to 402.28 over mid parent, from -57.24 to 731.03 over better parent, and from -84.31 to 70.13 over check (Table 17).

In case of deadheart %, negative heterosis is desirable for shoot fly resistance as genotypes with negative heterosis produced fewer deadhearts. During rainy season, only one hybrid exhibited significant negative heterosis over mid parent and check. None of the hybrids showed significant negative heterosis over better parent. During postrainy season, four hybrids over mid parent; one hybrid over better parent; and twenty eight hybrids over check showed significant negative heterosis. Among these hybrids, significantly high negative heterosis of ≤-50.00 over check were exhibited by SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 712, SPSFR 94031A x ICSV 88088, SPSFR 94031A x ICSV 89015, SPSFR 94003A x ICSR 93031, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93009, SPSFR 94031A x ICSR 93010 and SPSFR 94001A x ICSR 93009 (developed on rainy season-bred resistant female parent), and SPSFPR 94002A x ICSV 88088, SPSFPR 94007A x ICSR 90002, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93011 and SPSFPR 94005A x ICSR 93010 (developed on postrainy season-bred resistant female parent).

Thus, during rainy season none of the hybrids showed significantly high heterosis (≤-50.00) over mid parent, better parent and check. In postrainy season, none of the hybrids showed significantly high negative heterosis of ≤-50.00 either over mid parent or better parent. But sixteen hybrids recorded significantly high heterosis (≤-50.00) over check
(M 35-1).

4.6.5 Trichome Density

During rainy season, the heterosis ranged from -100.00 to 847.58 over mid parent value, from -100.00 to 373.64 over better parent value and from -100.00 to 75.03 over check. During postrainy season, the heterosis ranged from -110.00 to 455.95 over mid parent, from -100.00 to 177.98 over better parent, and from -100.00 to 121.17 over check (Table 17).

For trichome density, positive heterosis is desirable for shoot fly resistance as number of trichomes on leaf surface influences the oviposition of shoot fly and subsequent larval movement. During rainy season, significant positive heterosis was recorded by eleven hybrids over mid parent; six hybrids over better parent and one hybrid over check, and during postrainy season by forty three hybrids over mid parent; fifteen hybrids over better parent; and thirty hybrids over check.

Among these hybrids, significantly high positive heterosis of ≥100.00 was exhibited by SPSFPR 94001A x ICSR 89076, SPSFPR 94001A x ICSR 90014, SPSFPR 94005A x ICSR 90002 and SPSFPR 94005A x ICSV 89015 (developed on postrainy season bred resistant female parent), ICSA 20 x ICSR 90002, ICSA 90002 x ICSR 89076 (developed on susceptible female lines) over mid parent; SPSFPR 94001A x ICSR 90014, SPSFPR 94005A x ICSR 90002, (developed on postrainy season-bred resistant female parent) over better parent in rainy season and SPSFR 94003A x ICSR 90002, SPSFR 94031A x ICSR 90002 (developed on rainy season-bred resistant female lines), SPSFPR 94005A x ICSR 93011, SPSFPR 94007A x ICSV 89030 (developed on postrainy season-bred resistant female lines) over mid parent; SPSFR 94031A x ICSR 90002 (developed on rainy season-bred resistant female line), SPSFPR 94005A x ICSV 712 (developed on postrainy season-bred resistant female line) over better parent; SPSFR 94031A x ICSR 90002 (developed on rainy season-bred resistant female line), SPSFPR 94001A x ICSR 90005, SPSFPR 94001A x ICSR 90014, SPSFPR 94001A x ICSV 88088, SPSFPR 94001A x ICSV 89030 (developed on postrainy season-bred resistant female lines) over check in postrainy season.

Thus, significantly high positive heterosis of ≥100.00 exhibited by six hybrids over mid parent; two hybrids over better parent in rainy season and none of the hybrids showed high positive heterosis over check. In postrainy season, four hybrids over mid parent; two hybrids over better parent and five hybrids over check (M 35-1) showed significantly high positive heterosis (≥100.00).

4.6.6 Leaf Parameters

Correlation studies revealed significant negative correlation of leaf parameters- 5th leaf length, 5th leaf width and 5th leaf droopiness with shoot fly parameters- egg count plant^{-1} and deadheart %. Hence for shoot fly resistance, positive heterosis is the desirable feature in case of 5th leaf length, 5th leaf width and 5th leaf droopiness (Table 18).

4.6.6.1 5th Leaf Length

During rainy season the heterosis ranged from -44.02 to 55.19 over mid parent and from -55.57 to 43.16 over better parent, and from -60.37 to 49.76 over check. In postrainy season, the heterosis ranged from -60.36 to 25.16 over mid parent, from -63.92 to 12.47 over better parent, and from -69.37 to 37.11 over check (Table 18).

In rainy season, none of the hybrids recorded significant positive heterosis over mid parent, better parent and check. In postrainy season, significant positive heterosis was exhibited by three hybrids over mid parent and ten hybrids over check. In postrainy season, a significant high positive heterosis of ≥25.00 was exhibited by SPSFR 94031A x ICSV 88088 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 90002 (developed on postrainy season-bred resistant female parent) over mid parent; SPSFR 94001A x ICSR 93009 (developed on rainy season-bred resistant female lines), SPSFPR 94002A x ICSR 93031, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93010, SPSFPR 94002A x ICSR 90002, SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female parent) over check.

Thus, during rainy season none of the hybrids exhibited significant positive heterosis over mid parent, better parent and check. During postrainy season significantly high positive heterosis of ≥25.00 was exhibited by two hybrids over mid parent and six hybrids over check. None of the hybrids showed significant positive heterosis over better parent.

Table 18: Per cent heterosis over mid parent, better parent and check for leaf parameters and recovery traits

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x RBR hybrids																
1	SPSFR 94002A x ICSV 712	R	20.62	7.87	-0.81	3.21	-3.28	-98.94	24.19	11.00	-90.17	15.96	22.33	-53.13	27.39	36.05	-98.17
		PR	1.33	-6.93	-6.15	26.41	12.11	10.36	5.61	-8.79	-10.33	135.97**	159.28**	44.33	25.65	42.01	-26.61
2	SPSFR 94002A x ICSV 88088	R	-32.98	-41.94	-47.31	-11.28	-16.43	-18.78	-34.65**	-42.81**	-47.65**	0.00	12.36	-25.00	1.76	17.69	8.13
		PR	2.19	-8.38	2.51	17.65	0.00	8.81	5.81	-9.00	-9.63	66.50	66.50	11.00	53.80	58.12	-22.63
3	SPSFR 94002A x ICSV 89015	R	0.96	-4.24	-36.33**	-12.11	-15.23	-21.60	1.77	-1.49	-32.35*	0.00	20.12	0.00	-3.74	22.45	12.50
		PR	-9.68	-20.24	-12.13	3.21	-14.98	0.00	-2.79	-18.69	-13.60	50.00	50.00	0.00	2.02	49.70	-22.63
4	SPSFR 94002A x ICSV 89030	R	-3.92	2.20	-32.05*	-8.11	-16.39	-28.17	0.30	0.00	-30.92	-4.86	0.00	-16.75	31.85	40.82	29.37
		PR	-9.03	-11.30	-21.21	9.68	4.29	-11.92	1.11	-4.90	-22.84	50.00	50.00	0.00	27.78	49.70	-22.63
5	SPSFR 94003A x ICSV 712	R	-7.24	-19.83	-42.30**	-9.73	-20.48	-21.60	-6.63	-21.71**	-37.45**	10.04	22.33	-8.25	11.98	11.98	16.87
		PR	-12.05	-20.21	-19.54	-13.66	-19.55	-8.29	-16.00	-30.00*	-31.18**	53.46	99.40	11.00	-15.79	-4.19	-51.07*
6	SPSFR 94003A x ICSV 88088	R	-26.56	-34.15*	-40.25**	-26.62	-27.14	-28.17	-27.74	-32.33	-38.06	-5.36	12.36	-25.00	-3.89	3.59	8.13
		PR	7.99	-4.33	1.80	6.98	4.55	19.17	5.66	-12.30	-12.91	-0.21	16.50	-22.33	38.84	41.87	-30.58
7	SPSFR 94003A x ICSV 89015	R	-19.77	-26.64	-47.20**	-5.16	-8.10	-9.39	-22.15	-29.76	-43.88**	27.82	45.23*	33.25*	-8.63	7.78	12.50
		PR	-9.05	-20.62	-12.55	-19.46	-20.70	-6.74	-0.96	-19.91	-14.90	114.13**	150.00**	66.67*	21.46	79.64	-8.26
8	SPSFR 94003A x ICSV 89030	R	-17.67	-22.06	-43.91**	1.67	-12.86	-14.08	-21.92	-27.20	-41.84**	17.98	17.98	8.25	43.71**	43.71*	50.00*
		PR	-6.66	-10.17	-20.21	-7.57	-19.55	-8.29	-2.10	-11.51	-28.20*	42.61	66.50	11.00	5.08	23.95	-36.70
9	SPSFR 94001A x ICSV 712	R	5.01	-13.95	-29.38*	26.32	9.09	12.68	9.93	-10.36	-23.16	5.21	11.00	-16.75	-21.76	-20.36	-16.87
		PR	-34.79**	-38.17**	-37.66**	-32.82	-34.01	-32.64	-13.82	-22.22	-23.54*	199.40**	199.40**	66.67*	50.23	50.23	-2.14
10	SPSFR 94001A x ICSV 88088	R	-22.38	-26.09*	-32.93*	-0.23	-3.18	0.00	-22.05	-24.53	-30.92*	0.00	12.36	-25.00	-8.74	-3.47	4.37
		PR	-7.29	-14.27	-8.79	-17.94	-20.48	-13.47	-9.07	-18.30	-18.87	100.00*	119.76*	22.33	17.96	37.50	-32.72
11	SPSFR 94001A x ICSV 89015	R	-19.60	-30.58*	-43.03**	-19.90	-24.09	-21.60	-25.17	-34.52	-43.88**	-16.75	0.00	-16.75	16.50	34.68	45.62
		PR	-60.36**	-63.92**	-60.25**	-57.55**	-60.35**	-53.37**	-44.30**	-51.40*	-48.36**	281.47**	319.16**	133.33**	48.15	87.79*	22.32
12	SPSFR 94001A x ICSV 89030	R	-15.00	-24.21	-37.80**	-4.32	-19.55	-16.90	-14.70	-22.98	-33.98*	14.29	20.12	0.00	10.00	11.98	16.87
		PR	-17.81	-18.52	-26.36*	-1.67	-10.15	-8.29	-17.35	-18.36	-33.76**	190.46**	219.16**	77.67	58.18	63.38	6.42

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
13	SPSFR 94031A x ICSV 712	R	3.31	-11.46	-34.98	13.33	10.00	-12.21	-2.81	-18.68	-34.69	-15.64	-11.00	-33.25	4.37	9.15	4.37
		PR	-4.89	-12.45	-11.72	-1.91	-5.26	-6.74	-5.06	-13.84	-15.29	-0.21	39.52	-22.33	49.11	62.78	-10.40
14	SPSFR 94031A x ICSV 88088	R	1.94	-7.78	-16.32	-2.92	-11.59	-14.08	-1.78	-7.80	-15.61	-33.33	-25.09	50.00**	15.61	30.72	25.00
		PR	25.16*	12.47	19.67	6.98	-1.43	7.25	20.97	9.30	8.54	-6.80	16.50	-22.33	-5.88	0.00	-51.07*
15	SPSFR 94031A x ICSV 89015	R	31.26	18.93	-12.66	21.53	13.20	4.69	29.43	16.52	-6.43	-50.00*	-39.94*	-50.00**	-30.00	-13.07*	-16.87
		PR	2.27	-9.49	-0.29	-2.48	-13.22	2.07	-0.91	-13.08	-7.65	-33.20	-16.50	-44.33	-0.20	40.56	-22.63
16	SPSFR 94031A x ICSV 89030	R	-3.13	-9.17	-33.30	14.38	7.65	-14.08	-1.64	-8.51	-26.53	4.86	10.21	-8.25	41.87*	48.37*	41.87
		PR	-9.40	-11.45	-21.34	-4.12	-7.91	-15.54	-3.94	-4.53	-22.54	-20.00	0.00	-33.33	31.20	48.33	-18.35
	PRBR cms x RBR hybrids																
17	SPSFPR 94001A x ICSV 712	R	13.96	13.05	-40.72**	8.79	4.37	-21.60	10.03	9.31	-40.10**	22.95	77.67**	33.25*	-2.00	10.53	-8.13
		PR	-5.32	-17.63	-16.95	23.32	21.05	19.17	-16.42	-28.79*	-29.99*	80.00*	169.46**	50.00	27.09	33.68	-21.10
18	SPSFPR 94001A x ICSV 88088	R	-28.53	-43.95**	-49.14**	-3.95	-17.87	-20.19	-30.26	-44.26**	-48.98**	19.90	87.27**	25.00	10.43	35.34	12.50
		PR	-4.62	-18.88	-13.68	6.87	0.00	8.81	-5.36	-19.70	-20.26	24.95	66.50	11.00	28.61	41.87	-30.58
19	SPSFPR 94001A x ICSV 89015	R	-13.36	-19.20	-51.81**	-1.16	-13.71	-20.19	-22.88	-28.57	-54.08**	9.67	21.41	41.75*	26.11	70.68	41.87*
		PR	-23.14*	-35.35**	-29.00**	-10.73	-19.38	-5.18	-21.56	-35.23**	-31.18**	24.95	66.50	11.00	18.08	59.07	-6.12
20	SPSFPR 94001A x ICSV 89030	R	-11.15	-19.92	-48.52**	3.03	2.00	-28.17	-13.84	-22.75	-46.63**	21.41	54.50**	41.75*	38.00	55.64	29.37
		PR	-31.54**	-37.02**	-44.06**	-20.81	-25.14	-29.02	-33.03*	-37.94**	-49.65**	50.09	100.00	33.33	36.67	48.70	-12.23
21	SPSFPR 94002A x ICSV 712	R	-11.86	-25.86	-43.03**	-10.36	-18.78	-24.88	-5.83	-18.40	-39.80	-12.57	0.00	-41.75*	-3.36	11.98	16.87
		PR	-2.40	-8.01	-7.24	6.10	5.26	3.63	-3.54	-11.82	-13.31	50.00	79.64	0.00	4.48	9.39	-28.75
22	SPSFPR 94002A x ICSV 88088	R	-24.15	-29.96*	-18.78**	-14.36	-16.43	-32.96	-18.89	-26.76	-41.75	-6.80	0.00	8.13**	-16.22	-10.36	-7.00
		PR	4.06	-4.33	1.80	5.79	0.00	8.81	1.10	-8.00	-8.64	38.57	50.00	0.00	-1.78	20.62	-40.98
23	SPSFPR 94002A x ICSV 89015	R	4.40	-7.29	-28.76*	-8.63	-8.63	-15.49	10.42	3.32	-23.78	-33.43	0.00	-41.75**	13.20	15.00	58.12**
		PR	-11.16	-19.60	-11.42	-8.21	-16.30	-1.55	-12.17	-22.43*	-17.58	38.57	50.00	0.00	-11.79	6.01	-24.46
24	SPSFPR 94002A x ICSV 89030	R	15.79	6.33	-18.29	15.27	1.52	-6.10	24.71	20.75	-10.92	-11.00	14.59	-33.25*	-3.36	11.98	16.87
		PR	-1.17	-1.41	-12.01	12.57	5.35	2.07	3.48	3.29	-15.89	38.57	50.00	0.00	39.13	40.97	-2.14

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
25	SPSFPR 94005A x ICSV 712	R	-1.04	-21.14	-30.37	-4.76	-13.71	-20.19	3.50	-17.78	-24.49	-11.00	-11.00	-33.25	-5.65	0.00	4.37
		PR	-0.25	-7.34	-6.57	11.11	5.26	3.63	-3.16	-11.82	-13.31	5.82	79.64	0.00	-16.47	0.00	-34.86
26	SPSFPR 94005A x ICSV 88088	R	-19.19	-20.28	-27.66*	-5.94	-8.21	-10.80	-19.87	-20.00	-26.53	-17.81	-12.73	-41.75**	-5.26	-3.74	12.50
		PR	-2.69	-11.80	-6.15	-6.84	-15.71	-8.29	1.49	-8.00	-8.64	44.33	116.50	44.33	-3.72	37.50	-32.72
27	SPSFPR 94005A x ICSV 89015	R	-2.70	-18.48	-28.03	11.68	11.68	3.29	6.80	-9.22	-16.63	-4.30	22.33	-8.25	-13.04	-3.74	12.50
		PR	-16.04	-25.07	-17.45	-2.77	-14.98	0.00	-21.40**	-30.84**	-26.51	22.83	83.50	22.33	2.56	7.74	-2.14
28	SPSFPR 94005A x ICSV 89030	R	-18.61	-29.67*	-37.91**	-3.75	-15.23	-21.60	-20.00	-30.00	-35.71*	-10.04	0.00	-25.00	31.64	39.52	-45.62*
		PR	-17.76	-18.84	-27.91*	-20.12	-21.76	-31.09	-11.66	-11.87	-28.50**	44.33	116.50*	44.33	6.87	23.35	-14.37
29	SPSFPR 94007A x ICSV 712	R	15.28	-6.80	-20.78	39.32	38.04	5.63	22.08	1.63	-17.35	28.48	79.64*	-25.00	-6.25	-1.96	-6.25
		PR	5.23	4.32	6.99	10.99	8.95	7.25	4.00	1.01	-0.70	-7.83	19.76	-33.33	-21.70	-9.39	-40.95
30	SPSFPR 94007A x ICSV 88088	R	18.38	14.64	4.02	22.70	9.66	6.57	27.51	20.40	10.20	7.37	39.52	-41.75*	19.65	35.27	-29.37
		PR	0.42	-1.42	4.90	0.25	-6.19	2.07	2.12	-1.30	-1.99	-28.48	-16.50	-44.33	-5.91	29.37	-36.70
31	SPSFPR 94007A x ICSV 89015	R	10.30	-6.16	-20.23	12.78	3.05	-4.67	18.71	6.27	-13.57	-5.36	79.64	-25.00	-15.79	4.58	0.00
		PR	-5.84	-9.12	0.13	2.44	-7.49	8.81	-7.14	-13.08	-7.65	-0.21	16.50	-22.33	-20.92	-14.29	-26.61
32	SPSFPR 94007A x ICSV 89030	R	25.15	9.90	-6.59	42.49	36.81	4.69	32.97	22.96*	0.00	0.00	59.88	-33.25	-8.13	-3.92	-8.13
		PR	10.08	2.73	5.31	25.43	18.58	12.44	13.49	6.43	-1.39	14.35	33.50	-11.00	-13.21	-3.08	-32.72
	SB cms x RBR hybrids																
33	ICSA 20 x ICSV 712	R	3.77	2.02	-44.64**	26.21	14.38	-14.08	6.67	5.66	-42.86**	24.10	100.00**	50.00*	-15.69	7.78**	12.50
		PR	-14.47	-17.39	-10.59	7.22	1.58	0.00	-15.73	-15.86	-17.28	47.32	179.64**	55.67	87.45**	131.46**	50.76*
34	ICSA 20 x ICSV 88088	R	-23.95	-39.23**	-44.86**	10.98	-9.66	-12.21	-21.95	-38.35**	-43.57**	14.13	99.63**	33.25*	-26.27*	-13.47	4.37
		PR	2.42	1.55	9.92	3.68	-6.19	2.07	0.35	-0.30	-0.99	-10.04	-50.00	0.00	-9.94	-33.13	-34.86
35	ICSA 20 x ICSV 89015	R	13.27	8.16	-35.49**	2.14	-15.23	-21.60	16.52	6.35	-31.63*	5.82	28.48*	50.00**	-20.74	-14.98*	20.62
		PR	-2.30	-3.15	6.69	-5.79	-17.62	-3.11	1.41	-2.52	3.57	-40.03	0.00	-33.33	-8.44	-6.39	-10.40
36	ICSA 20 x ICSV 89030	R	6.17	-2.11	-37.07**	30.71	22.00	-14.08	0.75	-10.93	-38.47**	9.67	54.50**	41.75*	-15.69	7.78*	12.50
		PR	4.88	-4.52	3.35	9.91	7.65	-5.18	13.41	3.65	1.59	40.03	133.50**	55.67	-13.70	2.64	-28.75

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
37	ICSA 89001 x ICSV 712	R	1.65	-5.30	-50.35**	-6.48	-14.38	-35.68	5.80	-1.89	-46.94**	20.00	100.00**	50.00**	1.69	7.78	12.50
		PR	-7.96	-12.86	-12.13	13.73	6.84	5.18	-13.29	-23.23	-24.53*	79.91**	259.28**	100.00**	16.13	-69.01	10.09
38	ICSA 89001 x ICSV 88088	R	5.30	-21.09	-28.39**	33.53	9.66	6.57	-3.26	-27.20	-33.37**	10.24	99.63**	33.25*	33.16*	35.29	58.12**
		PR	-11.97	-18.72	-13.51	-0.80	-10.95	-3.11	-11.17	-21.70	-22.24	42.86	150.00**	66.67*	50.62	166.88**	30.58
39	ICSA 89001 x ICSV 89015	R	10.92	-2.45	-41.82**	10.91	-7.11	-14.08	8.40	-6.83	-40.10**	-2.83	21.41	41.75*	-14.01	-4.81	11.25
		PR	-8.90	-17.20	-8.79	0.00	-13.22	2.07	-7.26	-20.56	-15.59	-14.29	50.00	0.00	-18.26	-8.26	-8.26
40	ICSA 89001 x ICSV 89030	R	-30.53	-40.81	-61.95**	-8.13	-13.33	-38.97	-37.17	-47.56**	-63.78**	56.14**	126.98**	108.25**	42.94*	51.50*	58.12**
		PR	-4.44	-5.11	-14.52	13.33	11.98	-3.11	-7.97	-11.02	-27.81**	14.29	100.00	33.33	47.32*	105.73**	42.81
41	ICSA 89004 x ICSV 712	R	-5.52	-8.58	-52.07**	-5.04	-9.60	-24.88	-8.43	-11.89	-52.35**	13.40	89.00**	41.75*	0.00	7.78	12.50
		PR	-16.48	-18.38	-17.70	-3.49	-5.26	-6.74	-19.39	-22.93	-24.23*	0.00	79.64	0.00	40.36	46.95	-4.28
42	ICSA 89004 x ICSV 88088	R	-27.23	-43.95**	-49.14**	-2.60	-9.66	-12.21	-26.46	-43.14*	-47.96**	17.27	112.36**	41.75*	34.72	34.72	62.50*
		PR	-18.77	-22.65	-17.70	-18.58	-23.81	-17.10	-16.24	-20.30	-20.85	26.38	100.00*	33.33	46.06	79.37	-12.23
43	ICSA 89004 x ICSV 89015	R	11.99	2.02	-39.15**	5.35	0.00	-7.51	13.04	0.48	-35.41**	8.48	35.55*	58.25**	-10.95	-3.11	16.87
		PR	-15.26	-20.62	-12.55	-18.54	-26.43	-13.47	-20.93*	-27.10*	-22.54	-5.21	50.00	0.00	7.14	28.76	-8.26
44	ICSA 89004 x ICSV 89030	R	-18.18	-27.89	-53.64**	-8.26	-15.25	-29.58	-25.79	-36.04	-55.82**	-12.46	27.25	16.75	11.11	19.76	25.00
		PR	-8.98	-12.48	-15.77	-7.51	-12.57	-17.10	-5.00	-9.52	-18.87	57.98	150.00*	66.67*	62.17*	64.32	14.07
45	ICSA 90002 x ICSV 712	R	-5.76	-11.28	-47.31**	2.28	-1.87	-26.29	-7.30	-13.18	-46.22**	25.00	66.67*	25.00	38.76	52.14*	33.13
		PR	9.12	2.49	3.35	4.76	-1.58	-3.11	13.48	3.33	1.59	-15.77	59.88	-11.00	-28.28	6.57	-30.58
46	ICSA 90002 x ICSV 88088	R	-5.78	-22.06	-16.90*	0.00	-14.49	-28.88	-7.31	-22.30	-41.75	-39.24	-12.73	8.13*	3.90	23.57	-7.00
		PR	16.87	7.08	13.93	0.80	-9.52	-1.55	17.71	6.70	5.96	-40.03	0.00	-33.33	-33.45	20.62	-40.98
47	ICSA 90002 x ICSV 89015	R	-6.98	-7.18	-14.64**	6.40	-7.11	-14.08	-14.79	-16.35	-46.22**	-3.41	0.00	16.75	-12.81	14.29	0.00
		PR	-16.21	-24.42*	-16.74	-3.55	-16.30	-1.55	-18.53	-28.32*	-23.83*	40.03	133.50**	55.67	-21.55	-10.40	-10.40
48	ICSA 90002 x ICSV 89030	R	-10.47	-13.89	-44.64**	29.97	28.67	-9.39	-15.42	-19.79	-44.59**	-15.34	0.00	-8.25	12.70	23.57	8.13
		PR	-19.10	-19.22	-28.24*	-18.18	-19.16	-30.05	-15.95	-16.16	-31.98**	79.91**	200.00**	100.00**	7.88	53.74	6.73

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x SBR hybrids																
49	SPSFR 94002A x ICSR 89076	R	16.69	-0.55	-33.88*	26.13	14.75	-1.41	17.66	-2.97	-33.37*	14.26	60.06**	33.25*	61.15**	72.11*	58.12**
		PR	1.67	-6.85	-5.56	18.69	5.26	3.63	8.68	-5.45	-8.64	60.00	100.00	33.33	83.96**	144.38**	26.30
50	SPSFR 94002A x ICSR 90002	R	-14.12	-20.36	-47.05**	-4.32	-5.35	-16.90	-19.24	-27.64	-50.31**	42.98	100.30**	66.75**	28.62	36.05	25.60
		PR	-21.86	-31.74**	-69.37*	-11.89	-26.91	-98.71	-11.39	-22.36	-90.35*	153.20**	216.50**	-111.01**	81.82**	148.52**	-96.49
51	SPSFR 94002A x ICSR 90005	R	-13.16	-26.64	-51.23**	-2.79	-14.21	-26.29	-11.05	-24.67	-48.27**	6.60	-60.06	33.25*	37.50*	49.66	37.50
		PR	-23.94*	-30.37**	-29.29*	-16.17	-25.13	-27.46	-22.58	-32.47**	-35.15**	125.14**	200.00**	100.00**	20.97	77.51	-8.26
52	SPSFR 94002A x ICSR 90014	R	-2.61	-10.84	-40.72**	-9.57	-11.92	-20.19	-0.16	-6.84	-36.02**	22.56*	90.09**	58.25**	22.77	44.90	33.13
		PR	-10.68**	-27.19*	-2.51	-5.42*	-31.83	17.62	-7.41**	-28.40**	-6.36	115.70	133.50	55.67	50.83	61.54	-16.51
53	SPSFR 94003A x ICSR 89076	R	-17.89	-32.23**	-51.23**	-22.22	-33.33	-34.27	-37.70	-51.47	-61.22**	10.24	45.23*	33.25*	27.54	27.54	33.13
		PR	-10.62	-19.11	-17.99	-7.32	-13.64	-1.55	-7.29	-22.20	-24.83*	76.37*	87.27*	66.67*	57.94	111.38	7.95
54	SPSFR 94003A x ICSR 90002	R	-14.20	-23.23	-44.75**	-7.81	-12.86	-14.08	-13.83	-27.59	-42.14**	44.78**	90.74**	75.00**	20.85	21.95	25.00
		PR	-34.51**	-43.44**	-36.11**	-33.63*	-34.08	-23.83	-31.11*	-41.80**	-44.69**	41.09	49.81	33.33	-15.22	16.77	-40.37
55	SPSFR 94003A x ICSR 90005	R	-3.54	-21.05	-43.18**	6.86	-10.95	-12.21	-9.28	-27.59	-42.14**	22.44	72.46**	58.25**	-10.00	-8.38	-4.38
		PR	-6.01	-15.00	-13.68	1.72	-5.91	7.25	-2.52	-17.99	-21.25	0.00	12.36	0.00	5.26	55.69	-20.49
56	SPSFR 94003A x ICSR 90014	R	-19.30	-28.67	-48.66**	-30.52	-33.33	-34.27	-27.82	-37.04	-49.69**	-6.28	36.24*	25.00	-19.89	-11.98	-8.13
		PR	-6.72	-10.97	-19.54	-5.85	-12.27	0.00	4.01	-3.01	-26.51	11.00	24.72	11.00	-0.23	27.54	-34.86
57	SPSFR 94001A x ICSR 89076	R	-42.09	-54.53	-12.22	-8.11	-22.73	-62.68	-45.18*	-58.33**	-20.19**	-57.13*	-39.94*	-64.29*	-41.18*	-40.12*	-50.00
		PR	-28.56*	-32.44**	-31.51**	-37.98	-39.09	-37.82	-18.64	-26.00*	-28.50*	156.96**	259.28**	100.00	166.13**	207.98**	100.61**
58	SPSFR 94001A x ICSR 90002	R	-	-	-	-	-	-	-	-	-	71.49**	140.24**	100.00**	-10.98	-8.54	-6.25
		PR	-28.81*	-35.93**	-27.62*	-20.48	-25.11	-13.47	-22.81	-29.26*	-32.77**	128.27**	219.16**	77.67*	104.74**	143.19**	58.41*
59	SPSFR 94001A x ICSR 90005	R	-18.36	-36.38*	-47.79**	1.67	-16.82	-14.08	-15.38	-34.17	-43.57**	20.00	80.18**	50.00*	11.56	11.56	20.62
		PR	-8.00	-13.06	-11.72	14.58	11.68	13.99	-13.04	-20.68	-23.83*	86.80*	179.64**	55.67	-1.11	25.35	-18.35
60	SPSFR 94001A x ICSR 90014	R	-11.91	-26.30	-39.52**	-6.54	-12.27	-9.39	-15.67	-28.57	-38.78*	41.92**	120.12**	83.25**	0.27	8.09	16.87
		PR	-1.25	-1.25	-10.75	-1.81	-3.55	-1.55	8.59	6.27	-15.89	60.00	139.52**	33.33	23.89	37.56	-10.40

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
61	SPSFR 94031A x ICSR 89076	R	0.21	-17.94	-39.74**	10.62	4.12	-16.90	2.94	-19.95	-35.71**	-7.18	30.03	8.25	12.50	17.65	12.50
		PR	-15.19	-22.12	-21.05	-1.91	-5.26	-6.74	-19.89	-26.72*	29.20*	77.67**	77.67**	77.67**	85.65**	137.22**	30.58
62	SPSFR 94031A x ICSR 90002	R	2.64	-8.97	-33.15*	-12.04	-16.04	-26.29	8.03	-9.40	-27.24	14.26	60.06**	33.25*	17.98	22.22	16.87
		PR	-6.62	-18.26	-7.66	-18.50	-26.91	-15.54	-1.36	-9.09	-13.60	22.33	22.33	22.33	6.98	40.56	-22.63
63	SPSFR 94031A x ICSR 90005	R	4.29	-15.30	-37.80**	-5.16	-13.53	-30.99	0.48	-19.95	-35.71*	-20.00	20.12	0.00	30.67	39.22	33.13
		PR	9.56	0.54	2.09	20.88	17.65	13.99	8.57	-0.41	-4.37	-5.21	0.00	0.00	18.34	66.67	-8.26
64	SPSFR 94031A x ICSR 90014	R	24.14	8.77	-20.12	21.21	13.99	3.29	30.36	13.47	-8.88	-35.53	0.00	-16.75	-1.98	13.07	8.13
		PR	-6.23	-9.12	-17.87	-5.72	-8.95	-10.36	-4.08	-6.69	-25.22*	15.96	22.33	22.33	-15.00	3.89	-42.81
	PRBR cms x SBR hybrids																
65	SPSFPR 94001A x ICSR 89076	R	9.81	4.75	-45.96**	3.03	2.00	-28.17	14.99	4.28	-42.86**	14.31	17.64	66.75**	-11.33	0.00	-16.87
		PR	-16.79	-27.78*	-26.78*	-1.88	-3.68	-5.18	-32.10*	-41.73**	-43.69**	68.40*	77.67*	77.67*	74.63**	113.99**	26.30
66	SPSFPR 94001A x ICSR 90002	R	3.48	-1.29	-43.91**	-8.38	-18.18	-28.17	-3.36	-3.72	-47.24**	2.83	5.82	50.00**	16.50	30.08	8.13
		PR	-15.37	-29.74**	-20.63	-2.96	-11.66	2.07	-9.31	-21.63*	-25.52*	36.81	44.33	44.33	31.69	65.80	-2.14
67	SPSFPR 94001A x ICSR 90005	R	9.88	-14.89	-56.09**	-0.35	-2.72	-32.86	-14.34	-19.93	-56.12**	13.45	23.46*	75.00**	30.72	50.38	25.00
		PR	15.44	-26.66*	-25.52*	-8.11	-9.09	-11.92	-18.63	-29.99*	-32.77**	60.06*	60.06*	77.67*	-12.69	17.62	-30.58
68	SPSFPR 94001A x ICSR 90014	R	-10.75	-13.71	-52.32**	-19.41	-29.02	-35.68	-12.50	-15.95	-50.00**	-5.29	5.82	50.00**	48.35*	85.71**	54.38*
		PR	-6.16	-14.35	-22.59	7.24	5.26	3.63	-4.11	-8.26	-30.49	70.27**	70.27*	89.00**	14.79	34.72	-20.49
69	SPSFPR 94002A x ICSR 89076	R	-0.41	-19.86	-38.42**	19.31	5.08	-2.82	12.07	-10.10	-33.67*	68.07**	200.43**	75.00**	24.03	43.71*	50.00*
		PR	-3.12	-8.91	-7.66	4.51	3.68	-2.07	-3.29	-10.89	-13.90	87.62**	114.59**	66.67*	40.35	54.51	10.09
70	SPSFPR 94002A x ICSR 90002	R	-22.97	-33.00*	-48.52**	-4.69	-7.11	-14.08	-13.54	-24.90	-44.59**	27.97	128.76**	33.25*	-13.02	1.83	4.37
		PR	25.10*	11.96	26.49*	2.44	-5.83	8.81	27.97*	18.81	12.91	-37.34	-28.33	-44.33	26.62	42.92	1.83
71	SPSFPR 94002A x ICSR 90005	R	-7.55	-26.19	-43.29**	6.82	-8.63	-15.49	-8.07	-24.34	-44.18	18.44	128.76**	33.25*	-1.78	11.56	20.62
		PR	-10.53	-15.95	-14.64	-3.74	-3.74	-6.74	-15.28	-21.72	-24.83	-5.65	14.59	-11.00	4.64	25.75	-10.40
72	SPSFPR 94002A x ICSR 90014	R	-8.42	-21.29	-39.52**	6.15	5.08	-2.82	-1.53	-11.07	-34.39*	42.98*	186.27**	66.75**	27.14	33.50	66.88**
		PR	4.22	3.56	-6.40	25.73	24.74	22.80	5.24	1.59	-17.28	41.34	71.67	33.33	45.23	53.65	9.48

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
73	SPSFPR 94005A x ICSR 89076	R	-15.52	-35.35*	-42.92**	17.00	3.05	-4.69	-10.25	-33.33	-38.78	18.44	77.67	33.25	12.99	19.76	25.00
		PR	7.66	-0.25	1.13	-0.00	-5.26	-6.74	16.13	6.58	2.98	-14.29	0.00	0.00	34.14	38.21	18.35
74	SPSFPR 94005A x ICSR 90002	R	-32.27*	-44.34**	-50.86**	-2.60	-5.08	-12.21	-22.82	-38.56**	-43.57**	33.33**	100.00**	50.00**	-1.42	5.49	8.13
		PR	0.15	-11.59	-0.13	11.96	-1.35	13.99	10.40	2.09	-2.98	52.29*	77.67**	77.67**	26.44	27.30	14.07
75	SPSFPR 94005A x ICSR 90005	R	-25.10	-43.10**	-49.76**	5.04	-10.15	-16.90	-24.36	-42.56*	-47.24**	24.10	100.00**	50.00**	-15.00	-11.56	-4.38
		PR	0.15	-11.59	5.98	11.96	-1.35	-15.54	10.40	2.09	1.99	52.29	77.67	-11.00	26.44	27.30	10.09
76	SPSFPR 94005A x ICSR 90014	R	-2.63	-20.85	-30.11	-1.03	-2.03	-9.39	-5.19	-21.89	-28.27	13.40	89.00	41.75	17.31	21.39	41.87
		PR	8.35	6.02	-4.18	-9.44	-14.21	-15.54	19.67	15.99	-6.36	27.42	40.24	55.67	10.23	18.08	-6.12
77	SPSFPR 94007A x ICSR 89076	R	8.63	-15.76	-28.39**	21.41	16.56	-10.80	16.69	-9.66	-26.53	-21.77	79.64*	-25.00	0.00	4.58	0.00
		PR	-18.74	-19.18	-17.15	-15.82	-17.37	-18.65	-27.91**	-29.39*	-31.78**	88.01**	99.63**	77.67*	118.93**	118.93**	87.46**
78	SPSFPR 94007A x ICSR 90002	R	-18.32	-31.86*	-42.08**	-4.57	-10.70	-21.60	-15.79	-29.74	-42.86**	21.77	179.64**	16.75	-11.67	-8.05	-12.50
		PR	-4.74	-9.15	2.64	6.90	-2.69	12.44	4.76	3.45	-1.69	64.73*	74.91**	55.67	-34.73	-33.21	-42.81
79	SPSFPR 94007A x ICSR 90005	R	-14.60	-34.27*	-44.13**	20.79	12.27	-14.08	-9.81	-28.48	-41.84**	27.82	219.16**	33.25*	6.13	13.07	8.13
		PR	3.88	3.39	5.98	9.73	8.56	5.18	5.26	3.41	-0.70	55.67	74.91	55.67	-5.44	2.50	-12.23
80	SPSFPR 94007A x ICSR 90014	R	-10.41	-26.09	-37.18**	-2.81	-10.36	-18.78	-13.48	-25.09	-39.08*	-15.34	119.76**	-8.25	13.31	30.72	25.00
		PR	-0.35	-6.24	-3.89	-24.93	-26.32	-27.46	3.42	-6.00	-12.91	-11.00	0.00	-11.00	-28.52	-25.77	-40.98
	SB cms x SBR hybrids																
81	ICSA 20 x ICSR 89076	R	49.11	38.91	-24.62*	45.00	35.33	-4.69	69.28	55.77	-17.35	-10.50*	-5.50	41.75	-21.78	0.00	4.37
		PR	3.91	0.62	8.91	18.33	12.11	10.36	1.33	0.61	-1.39	-13.17	11.00	11.00	12.31	18.93	1.83
82	ICSA 20 x ICSR 90002	R	44.47	41.21	-19.76	24.29	5.35	-7.51	58.97	57.04	-14.59	-5.29	0.00	50.00**	63.68**	111.59*	116.88**
		PR	0.36	-1.74	11.00	13.49	0.00	15.54	11.11	9.42	7.25	-13.17	11.00	11.00	18.81	22.87	10.09
83	ICSA 20 x ICSR 90005	R	55.19	43.16	-22.32	53.33	47.86	-2.82	70.82	62.12	-13.98	-20.09*	-20.09*	33.25*	32.56*	65.90**	79.37**
		PR	15.96	12.37	21.63	10.36	5.35	2.07	18.42	17.22	14.90	-16.75	0.00	11.00	-27.19	-25.56	-28.75
84	ICSA 20 x ICSR 90014	R	-8.45	-9.27	-49.87**	-11.46	-25.91	-32.86	-19.67	-24.01	-54.80**	-7.39	-5.10	58.25**	-30.43*	-20.00	0.00
		PR	3.64	-4.91	2.93	15.00	8.95	7.25	3.20	-8.51	-10.33	0.00	20.12	33.33	18.67	30.77	3.98

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
85	ICSA 89001 x ICSR 89076	R	-10.77	-12.27	-58.91**	1.06	-4.67	-32.86	-16.18	-17.66	-61.94**	-2.62	5.50	58.25**	14.69	21.56	26.87
		PR	-22.51*	-26.83*	-25.82*	4.76	-1.58	-3.11	-25.46*	-33.50**	-35.75**	58.25**	111.00**	111.00**	14.41	40.36	20.18
86	ICSA 89001 x ICSR 90002	R	6.81	-4.06	-45.48**	-3.13	-17.11	-27.23	49.09	37.90	-25.00	15.38	25.00	87.50**	29.34	38.41	41.87
		PR	-3.98	-13.70	-2.51	16.41	1.79	17.62	7.79	-3.13	-7.94	-25.00	0.00	0.00	-0.86	18.43	6.12
87	ICSA 89001 x ICSR 90005	R	0.40	-0.24	-54.26**	4.76	2.14	-32.86	-3.70	-5.14	-54.80**	7.24	9.90	83.25**	15.00	19.65	29.37
		PR	-31.88**	-35.72**	-34.73**	-3.95	-9.09	-11.92	-33.76**	-40.74**	-43.10**	12.12	40.24	55.67	5.45	18.35	18.35
88	ICSA 89001 x ICSR 90014	R	13.80	3.51	-42.81**	2.45	-13.47	-21.60	11.39	-1.03	-41.12**	-4.71	-4.71	66.75**	34.37*	39.04*	62.50**
		PR	5.73	5.56	-4.60	2.52	-3.68	-5.18	24.90	24.90	-5.36	44.06*	80.18**	100.00**	17.84	51.15	20.18
89	ICSA 89004 x ICSR 89076	R	28.47	25.60	-38.42**	2.14	-5.65	-21.60	35.28	27.96	-36.02**	-2.62	5.50	58.25**	18.33	27.54	33.13
		PR	5.86	3.18	4.60	12.60	10.53	8.81	9.06	5.14	1.59	18.14	44.33	44.33	55.95*	71.67*	22.32
90	ICSA 89004 x ICSR 90002	R	13.38	5.60	-39.99**	-6.59	-9.09	-20.19	26.49	21.39	-33.98*	-23.08	-16.67	25.00	0.84	9.76	12.50
		PR	0.92	-6.56	5.56	1.97	-7.17	7.25	14.30	11.08	5.56	18.14	44.33	44.33	44.49	63.09	16.21
91	ICSA 89004 x ICSR 90005	R	13.92	10.22	-45.96**	9.15	-2.26	-18.78	17.03	14.29	-42.86**	-17.04	-14.99	41.75*	67.76**	77.46**	91.87**
		PR	-1.54	-4.12	-2.64	6.49	5.35	2.07	-1.93	-5.17	-8.94	-21.67	-9.91	0.00	14.29	37.34	-2.14
92	ICSA 89004 x ICSR 90014	R	-0.84	-6.42	-48.30**	-6.49	-10.36	-18.78	3.08	-5.15	-43.57**	-19.00	-19.00*	41.75*	-1.78	0.00	20.62
		PR	-5.07	-7.96	-11.42	-1.88	-3.68	-5.18	-10.32	-17.28	-25.82*	-39.16	-30.03	-22.33	24.54	31.76	-6.12
93	ICSA 90002 x ICSR 89076	R	10.23	-1.42	-41.46**	-5.72	-6.67	-34.27	20.69	3.79	-35.71*	-3.09	6.60	33.25*	21.82	33.57	16.87
		PR	-38.77**	-42.63**	-41.84**	-31.09	-35.26	-36.27	-31.35*	-37.00**	-39.13**	47.85*	89.00**	89.00**	-8.57	14.29	-2.14
94	ICSA 90002 x ICSR 90002	R	27.02	24.28	-26.20**	15.57	3.21	-9.39	28.07	20.26	-25.51	-3.09	6.60	33.25*	66.45**	80.71**	58.12
		PR	-8.66	-18.52	-7.95	-14.36	-25.11	-13.47	-2.49	-9.82	-14.30	-13.17	11.00	11.00	-30.72	-15.70	-24.46
95	ICSA 90002 x ICSR 90005	R	5.49	-6.53	-44.49**	16.38	13.61	-21.60	6.70	-5.70	-41.53**	-25.79	-13.40	8.25	-2.24	9.29	-4.38
		PR	12.98	5.77	7.41	16.95	10.70	7.25	18.76	9.31	4.97	-41.75	-30.03	-22.33	-33.87	-24.46	-24.46
96	ICSA 90002 x ICSR 90014	R	8.52	4.74	-37.80**	15.88	2.07	-7.51	4.71	2.64	-36.43*	-11.17	6.60	33.25*	-10.00	9.29	-4.38
		PR	-8.02	-8.94	-17.70	-4.76	-10.53	-11.92	-0.13	-3.20	-21.85*	-16.75	0.00	11.00	-35.29	-15.38	-32.72

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x PRLR hybrids																
97	SPSFR 94002A x ICSR 93031	R	16.35	8.58	-16.68	30.00	25.38	15.96	13.28	3.70	-14.29	-52.29*	-49.85*	-58.25**	-6.37	0.00	-8.13
		PR	-10.08	-27.19**	-2.51	-5.42	-31.83*	17.62	-7.41	-28.40**	-6.36	115.70**	133.50**	55.67	50.83	61.54	-16.51
98	SPSFR 94002A x ICSR 93011	R	14.40	12.82	-24.99	27.43	21.86	4.69	13.83	11.89	-23.16	-58.25**	-49.85*	-58.25 *	10.09	22.45	12.50
		PR	4.73	-14.45	13.93	-5.23	-17.26	-15.54	1.12	-22.21*	3.28	20.12	50.38	-33.33	57.14	65.36	-22.63
99	SPSFR 94002A x ICSR 93009	R	-15.67	-25.33	-35.60**	-9.35	-12.57	-24.88	-20.30	-31.40	-34.69	-4.18	10.21	-8.25	35.93*	54.42	41.87
		PR	-13.08	-30.50**	-2.09	6.04	-11.06	0.00	-13.08	-34.39**	-7.94	128.27**	166.50**	77.67*	75.93	81.66	-6.12
100	SPSFR 94002A x ICSR 93010	R	3.53	-15.91	-10.46	17.95	11.11	7.98	1.99	-18.82	-5.82	24.95	66.50*	-16.75	6.62	9.29	-4.38
		PR	-9.66	-26.56**	-0.96	20.34	2.90	10.36	-13.49	-34.61**	-8.64	166.50**	166.50**	77.67*	60.46	65.68	-14.37
101	SPSFR 94003A x ICSR 93031	R	13.34	9.82	-15.73	1.72	-1.43	-2.82	7.60	5.80	-12.55	0.00	0.00	-8.25	-8.38	-8.38	-4.38
		PR	-4.71	-23.12**	2.93	-34.90*	-45.95**	-6.74	-4.60	-28.40**	-6.36	20.00	28.76	0.00	18.33	27.54	-34.86
102	SPSFR 94003A x ICSR 93011	R	4.45	-0.86	-28.65**	-8.22	-17.62	-18.78	3.28	-5.49	-24.49	-28.06	-18.26	25.00	-7.78	-4.19	0.00
		PR	-4.51	-22.81**	2.80	-15.11	-19.55	-8.29	-2.55	-27.23**	-3.38	50.00	125.56	0.00	33.13	39.22	-34.86
103	SPSFR 94003A x ICSR 93009	R	15.63	6.07	-8.53	17.37	6.19	4.69	18.07	8.57	3.37	-8.25	0.00	-8.25	24.29	31.74	37.50
		PR	-2.06	-22.48**	-5.00	-0.69	-1.36	103.20	6.80	-21.66**	12.86	12.36	12.36	-4.00	34.29	39.52	-10.43
104	SPSFR 94003A x ICSR 93010	R	-12.24	-26.46	-21.70	2.16	1.43	0.00	-11.15	-24.98	-12.96	-17.81	16.50	-41.75	4.23	14.29	0.00
		PR	4.01	-16.32	12.85	-3.04	-5.91	7.25	8.08	-20.61*	10.92	14.35	33.50	-11.00	26.80	31.74	-32.72
105	SPSFR 94001A x ICSR 93031	R	1.71	-1.60	-19.25	2.16	-3.18	0.00	5.82	3.93	-10.92	-42.86*	-39.94*	-50.00	-17.65	-16.17	-12.50
		PR	-6.60	-21.78*	4.73	-10.57	-28.83*	22.80	-6.62	-25.06**	-1.99	50.00	79.64	0.00	18.23	24.35	-26.61
106	SPSFR 94001A x ICSR 93011	R	6.50	-4.73	-21.81	15.25	1.36	4.69	20.81	7.14	-8.16	-25.00	-9.91	-25.00	-1.98	0.00	8.13
		PR	-7.65	-22.49**	3.22	15.23	15.23	17.62	-6.56	-25.43	-0.99	144.67	175.94**	22.33	81.97*	117.65**	1.83
107	SPSFR 94001A x ICSR 93009	R	-3.17	-5.52	-18.51	11.28	-1.36	1.88	-2.20	-7.07	-11.53	-47.78	-39.94*	-50.00**	-15.00	-11.56	-4.38
		PR	9.54	-10.10	26.65*	12.56	7.37	20.73	11.58	-12.74	22.44	7.37	39.52	-22.33	10.43	20.56	-33.64
108	SPSFR 94001A x ICSR 93010	R	0.52	-11.00	-5.23	27.87	24.09	28.17	-5.61	-17.94	-4.80	-24.95	0.00	-50.00**	-6.07	5.00	-8.13
		PR	5.89	-11.57	19.25	12.38	9.66	17.62	4.99	-17.77	14.90	-8.99	0.00	-44.33	15.52	26.11	-30.58

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
109	SPSFR 94031A x ICSR 93031	R	1.22	-0.95	-24.00	56.40*	45.69	34.74	0.56	-0.86	-18.06	-62.00**	-60.06**	-66.75**	-12.50	-8.50	-12.50
		PR	0.75	-17.72	10.17	-18.82	-37.84	7.25	2.35	-17.46	7.94	-24.95	-14.16	-33.33	17.96	22.22	-32.72
110	SPSFR 94031A x ICSR 93011	R	1.06	-4.98	-30.22*	20.47	19.41	-4.69	-6.75	-14.87	-31.63*	-58.25**	-49.85**	-58.25**	8.11	17.65	12.50
		PR	-4.03	-21.46*	4.60	-16.04	-20.30	-18.65	-10.73	-28.42**	-4.97	7.62	75.19	-22.33	27.93	39.22	-34.86
111	SPSFR 94031A x ICSR 93009	R	0.50	-6.96	-19.76	10.00	10.00	-12.21	1.98	-6.00	-10.51	-21.67	-9.91*	-25.00	-17.65	-8.50	-12.50
		PR	-24.36*	-39.41**	-14.64	16.75	5.99	19.17	-2.70	-23.57**	7.25	5.82	12.36	0.00	81.67*	81.67	0.00
112	SPSFR 94031A x ICSR 93010	R	-24.75	-36.43**	-32.31*	-11.41	-19.32	-21.60	-26.20	-37.55**	-27.55	-37.34	-16.50	-58.25**	18.09	23.57	8.13
		PR	5.26	-14.27	15.61	4.17	-3.38	3.63	-4.52	-24.88**	4.97	46.80	83.50	22.33	40.56	40.56	-22.63
	PRBR cms x PRLR hybrids																
113	SPSFPR 94001A x ICSR 93031	R	-22.44	-35.15	-50.24**	-12.79	-23.86	-29.58	-22.79	-35.80	-46.94**	0.00	-27.25	16.75	6.67	20.30	0.00
		PR	3.67	-19.29**	8.08	-12.02	-31.83*	17.62	5.56	-19.29*	5.56	6.01	28.76	0.00	34.72	34.72	-20.49
114	SPSFPR 94001A x ICSR 93011	R	28.61	15.62	-25.25	21.02	13.77	-10.80	38.67	26.62	-16.02	-9.67	0.00	16.75	-10.54	5.26	-12.50
		PR	-5.76	-26.48*	-2.09	6.84	3.05	5.18	-11.50	-32.69	-10.63	100.43**	251.13**	55.67	31.21	48.37	-30.58
115	SPSFPR 94001A x ICSR 93009	R	-27.10	-41.75**	49.76*	-13.56	-19.41	-35.68	-36.05	-49.62	-52.04	-20.00	-7.62	0.00	4.37	25.56	4.37
		PR	-22.06*	-40.39**	-16.03	-16.50	-23.04	-13.47	-24.17*	-43.38**	-20.56	0.00	12.36	0.00	10.99	15.00	-36.70
116	SPSFPR 94001A x ICSR 93010	R	-25.00	-44.33**	-40.72**	-13.56	-26.09	-28.17	-23.54	-43.71**	-34.69*	4.30	100.00**	0.00	75.82**	80.45**	50.00
		PR	-17.95*	-22.71**	-17.10	-28.71	-46.70	-25.52	-24.95*	-39.94**	-33.33	28.69	33.33	-26.61	71.67	100.00	42.86
117	SPSFPR 94002A x ICSR 93031	R	-24.23	-24.29	-41.82**	-5.08	-5.08	-12.21	-22.11	-26.30	-39.08*	-22.33	0.00*	-41.75**	-20.93	-8.38	-4.38
		PR	12.77	-6.03	25.82*	-2.69	-24.02	31.09	1.36	-17.77*	7.55	42.92	42.92	11.00	44.13	59.07	-6.12
118	SPSFPR 94002A x ICSR 93011	R	-19.47	-25.86	-43.03**	22.53	13.20	4.69	-15.95	-20.19	-41.12**	-42.86	-74.46	-50.00**	-46.50**	-99.02*	-33.12
		PR	-5.57	-21.14*	5.02	9.37	6.60	8.81	-12.84	-29.69**	-6.65	45.90	100.75	-11.00	24.35	56.86	-26.61
119	SPSFPR 94002A x ICSR 93009	R	-5.77	-10.90	-23.16*	5.18	-2.03	-9.37	1.45	-9.97	-14.29	10.21	57.51	-8.25	14.50	24.60	45.62*
		PR	-18.07	-33.09	-5.73	0.50	-6.45	5.18	-11.06	-29.72**	-1.39	60.00	71.67	33.33	45.28	66.67	-8.26
120	SPSFPR 94002A x ICSR 93010	R	-16.85	-28.42*	-23.78	20.30	17.39	14.08	-10.75	-27.00	-15.31	7.62	16.50**	-41.75	-33.33	-14.29	-25.00
		PR	8.29	-10.02	21.34	8.12	2.90	10.36	10.19	-12.79	21.85	-53.81	-50.00	-66.67*	-35.59	-26.11	-59.33*

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
121	SPSFPR 94005A x ICSR 93031	R	17.83	10.11	-2.78	28.43	28.43	18.78	16.96	11.11	2.04	-30.13	-22.33	-41.75**	9.04	15.57	20.62
		PR	8.11	-11.03	19.12	-7.36	-30.03	20.73	7.70	-12.91	13.90	-15.64	14.59	-11.00	8.98	38.54	-18.35
122	SPSFPR 94005A x ICSR 93011	R	-19.62	-30.38*	-38.53**	-2.75	-10.15	-16.90	-19.61	-30.78*	-36.43*	-21.77	0.00	-25.00	8.99	11.11	25.00
		PR	20.65*	-0.50	32.51**	3.54	-3.55	-1.55	12.56	-9.50	20.16	-50.09	0.00	-55.67	-25.78	9.15	-48.93*
123	SPSFPR 94005A x ICSR 93009	R	-22.31	-23.21	-32.20*	19.89	11.68	3.29	-23.95	-25.29	-28.88	-27.15	-11.00*	-33.25*	-28.88	-28.88	-16.87
		PR	-1.47	-20.49*	12.01	-3.36	-13.82	-3.11	-6.83	-26.61**	2.98	10.04	37.45	22.33	17.40	55.56	-14.37
124	SPSFPR 94005A x ICSR 93010	R	-8.59	-16.39	-10.98	33.66	30.43	26.76	-14.87	-23.75	-11.53	-33.20	-16.50	-58.25**	2.14	19.27	4.37
		PR	17.20	-3.82	29.71**	7.69	-1.93	5.18	13.78	-10.23	25.42	-33.33	0.00	-33.33	-4.82	26.11	-30.58
125	SPSFPR 94007A x ICSR 93031	R	-1.49	-6.28	-20.34	22.22	11.68	3.29	-1.31	-2.10	-19.08	-12.73	39.52	-41.75*	-8.13	-3.92	-8.13
		PR	-8.07	-18.84	8.66	-19.77	-37.84**	7.25	-11.11	-24.07**	-0.70	-20.00	-14.16	-33.33	-23.87	-6.74	-44.95
126	SPSFPR 94007A x ICSR 93011	R	-1.08	-12.91	-25.98**	4.85	3.59	-18.78	6.43	-3.39	-21.43	26.18	139.52**	0.00	36.34	48.37	41.87
		PR	6.52	-5.75	25.52*	15.79	11.68	13.99	7.49	-8.75	21.15	16.50	75.19	-22.33	53.81	117.65*	1.83
127	SPSFPR 94007A x ICSR 93009	R	-44.02**	-44.42**	-52.07**	24.32	21.76	-2.82	-41.04**	-45.34**	-47.96**	11.00	59.88*	-33.25*	17.65	30.72	25.60
		PR	-3.73	-16.84*	17.15	-8.50	-15.67	-5.18	4.60	-13.16	21.85	0.00	0.00	-11.00	-16.09	7.22	-40.98
128	SPSFPR 94007A x ICSR 93010	R	-18.10	-26.36	-21.59	6.49	-4.83	-7.51	-18.30	-30.52	-19.39	45.50	59.88	-33.25*	27.65	33.57	16.87
		PR	-7.63	-18.71*	9.62	7.69	1.45	8.81	-15.38	-29.64**	-1.69	14.35	33.50	-11.00	-33.48	-15.00	-53.21*
	SB cms x PRLR hybrids																
129	ICSA 20 x ICSR 93031	R	-16.20	-28.47	-45.12**	-8.26	-23.86	-29.58	-19.85	-34.20	-45.61**	16.05	63.49**	50.00**	9.13	39.52	45.62**
		PR	13.25	2.41	20.11**	-3.38	-27.03	25.91	15.71	1.21	32.37**	-33.43	0.00	-22.33	45.06	90.16*	12.23
130	ICSA 20 x ICSR 93011	R	15.08	5.83	-31.58*	25.93	11.98	-12.21	21.37	9.23	-27.55	-11.82	7.07*	25.00	-36.36	-22.22	-12.50
		PR	2.01	-7.54	23.14*	-3.54	-10.15	-8.29	0.09	-13.01	15.49	-33.33	50.38	-33.33	8.58	65.36	-22.63
131	ICSA 20 x ICSR 93009	R	-15.10	-30.84	-40.36**	38.00	21.76	-2.82	-22.92	-39.98**	-42.86**	-3.09	23.09	33.25*	16.33	39.04*	62.50
		PR	-1.34	-12.77	22.89*	-0.26	-11.06	0.00	-8.08	-21.94	9.53	-36.51	-12.73	-22.33	2.64	40.56	-22.63
132	ICSA 20 x ICSR 93010	R	-41.13	-55.57**	-52.69**	-15.13	-30.92	-32.86	-42.06**	-57.78**	-51.02**	30.80*	183.50**	41.75*	3.50	47.86	29.37
		PR	3.27	-6.92	23.52*	9.81	0.00	7.25	4.18	-11.37	23.83*	-10.04	50.00	0.00	-10.75	22.22	-32.72

Contd..

Contd..

S.No.	Hybrids		5th Leaf Length (cm)			5th Leaf Width (cm)			5th Leaf Droopiness (cm)			Uniformity in recovery			Total tillers		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
133	ICSA 89001 x ICSR 93031	R	-35.03	-48.35**	-60.37**	1.21	-15.23	-21.60	-47.27	-58.89**	-66.02**	43.77**	108.99**	91.75**	66.10**	76.05**	83.75**
		PR	-13.21	-27.41**	-2.80	-24.00	-42.94*	-1.55	-15.10	-32.95**	-12.31	45.43	128.76**	77.67	-2.33	51.81	-10.40
134	ICSA 89001 x ICSR 93011	R	36.95	16.41	-24.73	28.67	15.57	-9.39	46.33	24.15	-17.65	2.83	28.43*	50.00**	12.81	15.00	29.37
		PR	-6.30	-21.46*	4.60	9.89	1.52	3.63	-6.95	-26.93**	-2.98	-5.21	125.56	0.00	54.64*	183.01**	32.42
135	ICSA 89001 x ICSR 93009	R	-21.54	-40.18	-48.41**	7.59	-4.12	-23.47	-26.41	-45.34**	-47.96**	35.39	77.14**	91.75**	28.34	28.34	50.00**
		PR	-5.91	-22.87**	8.66	14.58	1.38	13.99	-8.36	-29.44**	-0.99	12.91	62.17	44.33	27.09	107.22	14.07
136	ICSA 89001 x ICSR 93010	R	-14.30	-38.93	-34.98**	11.76	-8.21	-10.80	-18.62	-43.10**	-33.98**	33.33	-14.29**	50.00**	75.54	53.48**	79.37**
		PR	7.14	-10.64	20.50	19.25	7.73	15.54	5.71	-18.48	13.90	14.29	100.00	33.33	-9.03	48.33	-18.35
137	ICSA 89004 x ICSR 93031	R	12.48	-7.82	-29.27**	3.21	-2.03	-9.39	14.92	-7.78	-23.78	-18.84	17.98	8.25	-11.11	-4.19	0.00
		PR	-5.82	-19.06*	8.37	-21.32	-39.04	5.18	-0.90	-16.48	9.24	-19.82	14.59	-11.00	28.17	41.45	-16.51
138	ICSA 89004 x ICSR 93011	R	24.43	9.39	-29.27**	12.21	9.04	-9.39	18.07	3.54	-31.33**	-2.83	21.41	41.75**	35.66**	40.56**	58.12**
		PR	-26.43**	-36.63**	-15.61	-10.53	-13.71	-11.92	-26.79**	-38.67**	-18.57	53.00	225.56**	44.33	82.90**	130.72**	7.95
139	ICSA 89004 x ICSR 93009	R	-15.61	-33.81	-42.92**	-2.02	-3.95	-20.19	-14.27	-34.62*	-37.76*	11.74	46.19**	58.25**	3.68	5.35	23.13
		PR	-3.90	-19.13*	13.93	-3.50	-11.06	0.00	-3.54	-20.95*	10.92	-23.71	0.00	-11.00	48.67	70.56	-6.12
140	ICSA 89004 x ICSR 93010	R	-38.21*	-54.88**	-51.96**	0.52	-6.76	-9.39	-37.68*	-55.41	-48.27**	33.33	200.00**	50.00*	36.34*	62.14*	41.87
		PR	-1.14	-15.30*	14.23	124.10	111.11	126.42	-4.76	-21.82**	9.24	-15.64	33.50	-11.00	16.22	33.33	-26.61
141	ICSA 90002 x ICSR 93031	R	-13.44	-23.22	-41.09**	0.58	-12.18	-18.78	-10.66	-21.85	-35.41*	-30.80	-18.26	-25.00	-8.79	0.00	-12.50
		PR	-17.13	-31.16**	-7.82	-26.80	-45.05**	-5.18	-23.66*	-36.27**	-19.27	23.71	85.84*	44.33	39.31	121.24**	30.58
142	ICSA 90002 x ICSR 93011	R	-21.36	-24.56	-51.23**	-10.83	-16.17	-34.27	-33.65	-35.85	-57.45**	-17.27	-14.35	0.00	-4.38	9.29	-4.38
		PR	-10.45	-25.45**	-0.71	13.74	5.08	7.25	-9.49	-27.23**	-3.38	22.33	175.94*	22.33	7.16	100.65	-6.12
143	ICSA 90002 x ICSR 93009	R	-30.30	-41.15**	-49.25**	21.77	13.53	-9.39	-37.66	-48.55**	-51.02**	-7.18	0.00	8.25	14.37	33.57	16.87
		PR	3.32	-15.86	18.54	13.02	0.00	12.44	2.70	-19.11	13.51	8.99	-49.81	33.33	11.00	85.00	1.83
144	ICSA 90002 x ICSR 93010	R	-29.41*	-45.02**	-41.46**	7.34	-8.21	-10.80	-30.39*	-46.61**	-38.06*	4.86	83.50*	-8.25	14.29	14.29	0.00
		PR	-23.48**	-36.61**	-14.52	-18.18	-26.09	-20.73	-28.83**	-43.85**	-21.55	79.91**	200.00**	100.00**	-6.67	55.56	-14.37

MP : Mid parent; BP : Better parent
* Significant at 5 per cent level; ** Significant at 1 per cent level

4.6.6.2 5th Leaf Width

The heterosis ranged from -30.52 to 56.40 (rainy) and -57.55 to 124.10 (postrainy) over mid parent and from -33.33 to 47.86 (rainy) and -60.35 to 111.11 (postrainy) over better parent, and from -98.94 to 34.74 (rainy) and -53.37 to 126.42 (postrainy) over check. During rainy season significant positive heterosis over mid parent was exhibited by only one hybrid SPSFR 94031A x ICSR 93031 (developed on rainy season-bred resistant female parent). In postrainy season, none of the hybrids showed significant positive heterosis over mid parent, better parent and check (Table 18).

4.6.6.3 5th Leaf Droopiness

The heterosis ranged from -45.18 to 70.82 (rainy) and -44.30 to 27.97 (postrainy) over mid parent, and from -58.89 to 62.12 (rainy) and -51.40 to 24.90 (postrainy) over better parent, and from -90.17 to 3.37 (rainy) and -90.35 to 32.37 (postrainy) over check (Table 18).

Significant positive heterosis was exhibited by only one hybrid over better parent in rainy season; one hybrid over mid parent; three hybrids over check in postrainy season. During rainy season, none of the hybrids showed significantly high positive heterosis of ≥25.00 over mid parent, better parent and check. During postrainy season, SPSFPR 94002A x ICSR 90002 (developed on postrainy season-bred resistant female line) over mid parent, SPSFR 94031A x ICSR 89076 (developed on rainy season-bred resistant female parent), ICSA 20 x ICSR 93031 (developed on susceptible female parent) over check exhibited significant positive heterosis (≥25.00)

Thus, none of the hybrids exhibited significantly high positive heterosis of ≥25.00 in rainy season and in postrainy season, only one hybrid over mid parent and two hybrids over check exhibited significantly high positive heterosis.

4.6.7 Uniformity in Recovery

The heterosis ranged from -62.00 to 71.49 (rainy) and -53.81 to 281.47 (postrainy) over mid parent, from -74.46 to 219.16 (rainy) and -50.00 to 319.16 (postrainy) over better parent, and from -64.29 to 108.25 (rainy) and -111.01 to 133.33 (postrainy) over check value (Table 18).

For uniformity in recovery, negative heterosis is a desirable feature as the trait is scored on 1-9 scale (where 1 was given for healthy, undamaged plants with good recovery in growth of all plants over the plot, while 9 was given for heavily damaged plants in entries with no tillers). Significant negative heterosis was exhibited by seven hybrids over mid parent; eight hybrids over better parent, and twelve hybrids over check in rainy season, and two hybrids over check in postrainy season.

Significantly high negative heterosis of ≤-50.00 was exhibited by SPSFR 94031A x ICSV 89015, SPSFR 94001A x ICSR 89076, SPSFR 94002A x ICSR 93031, SPSFR 94002A x ICSR 93011, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011 (developed on rainy season-bred resistant female parent) over mid parent; SPSFR 94002A x ICSR 93031, SPSFR 94002A x ICSR 93011, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011 (developed on rainy season-bred resistant female parent) over better parent; SPSFR 94031A x ICSV 89015, SPSFR 94001A x ICSR 89076, SPSFR 94002A x ICSR 93031, SPSFR 94002A x ICSR 93011, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parents), SPSFPR 94002A x ICSR 93011, SPSFPR 94005A x ICSR 93010 (developed on postrainy season-bred resistant female lines) over check in rainy season. During postrainy season, none of the hybrids showed significant negative heterosis over mid parent and better parent. The hybrids, SPSFR 94002A x ICSR 90002 (developed on rainy season-bred resistant female parent) and SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female parent) showed significantly high negative heterosis over the check value.

Thus, significantly high negative heterosis of ≤-50.00 was exhibited by six hybrids over mid parent, four hybrids over better parent, and twelve hybrids over check in rainy season. In postrainy season, none of the hybrids recorded significantly high negative heterosis (≤50.00) over either mid parent or better parent, whereas two hybrids showed high negative heterosis over check.

4.6.8 Total Tillers plant^{-1}

The heterosis over mid parent ranged from -46.50 to 75.82 (rainy) and -35.59 to 166.13 (postrainy), over better parent from -40.12 to 111.59 (rainy) and -69.01 to 207.98 (postrainy), and over check value from -98.17 to 116.88 (rainy) and -96.49 to 100.61 (postrainy) (Table 18).

Significant positive heterosis (desirable for recovery resistance) was exhibited by seventeen hybrids over mid parent, twenty hybrids over better parent, twenty hybrids over check in rainy season, and fifteen hybrids over mid parent; eighteen hybrids over better parent; and five hybrids over check in postrainy season.

During rainy season significantly high positive heterosis of ≥50.00 was exhibited by the hybrids, SPSFR 94002A x ICSR 89076 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 93010 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSR 90002, ICSA 89004 x ICSR 90005, ICSA 90002 x ICSR 90002 (susceptible female lines) over mid parent, SPSFR 94002A x ICSR 89076 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 90014, SPSFPR 94001A x ICSR 93010 (developed on postrainy season-bred resistant female lines), ICSA 89001 x ICSV 89030, ICSA 90002 x ICSV 712, ICSA 20 x ICSR 90002, ICSA 20 x ICSR 93005, ICSA 89001 x ICSR 90014, ICSA 89004 x ICSR 90005, ICSA 90002 x ICSR 90002, ICSA 89001 x ICSR 93031, ICSA 89001 x ICSR 93010 (developed on susceptible female lines) over better parent; SPSFR 94003A x ICSV 89030 and SPSFR 94002A x ICSR 89076 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 90014, SPSFPR 94002A x ICSR 89076, SPSFPR 94002A x ICSR 90014, SPSFPR 94001A x ICSR 93010, SPSFPR 94002A x ICSV 89015 (developed on postrainy season-bred resistant female lines), ICSA 89001 x ICSV 88088, ICSA 89001 x ICSV 89030, ICSA 20 x ICSR 90002, ICSA 20 x ICSR 90005, ICSA 89001 x ICSR 90014, ICSA 89004 x ICSR 90005,ICSA 89001 x ICSR 93031, ICSA 89001 x ICSR 93009, ICSA 89004 x ICSV 88088, ICSA 89001 x ICSR 93010 and ICSA 89004 x ICSR 93011 (developed on susceptible female lines) over check.

During postrainy season significantly high positive heterosis (≥80.00) was exhibited by SPSFR 94002A x ICSR 89076, SPSFR 94002A x ICSR 90002, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSR

90002, SPSFR 94031A x ICSR 89076, SPSFR 94001A x ICSR 93011 and SPSFR 94031A x ICSR 93009 (developed on rainy season-bred resistant female lines), ICSA 20 x ICSV 712 (developed on susceptible female lines), SPSFPR 94001A x ICSR 89076 and SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female lines) over mid parent; SPSFR 94001A x ICSV 89015, SPSFR 94002A x ICSR 89076, SPSFR 94002A x ICSR 90002, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSR 90002, SPSFR 94031A x ICSR 89076, SPSFR 94001A x ICSR 93011 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 89076, SPSFPR 94007A x ICSR 89076 and SPSFPR 94007A x ICSR 93011 (developed on postrainy season-bred resistant female lines), ICSA 90002 x ICSR 93031, ICSA 89004 x ICSR 93011, ICSA 20 x ICSV 712, ICSA 89001 x ICSV 88088, ICSA 89001 x ICSV 89030, ICSA 20 x ICSR 93031 and ICSA 89001 x ICSR 93011 (developed on susceptible female lines) over better parent; and ICSA 89004 x ICSV 88088 and ICSA 20 x ICSV 712 (developed on susceptible female lines), SPSFR 94001A x ICSR 89076 (developed on rainy season-bred resistant female line) over check.

Thus, during rainy season significantly high positive heterosis (≥50.00) was exhibited by six hybrids over mid parent, twelve hybrids over better parent, and eighteen hybrids over check. During postrainy season significantly high positive heterosis (≥80.00) was recorded by ten hybrids over mid parent; sixteen hybrids over better parent; and two hybrids over check.

4.6.9 Productive Tillers plant^{-1}

In rainy season, the heterosis ranged from -47.00 to 73.33 (over mid parent), -47.00 to 67.74 (over better parent) and -47.10 to 56.00 (over check). During postrainy season the heterosis ranged from -49.81 to 303.03 (over mid parent), -66.50 to 303.00 (over better parent) and -52.14 to 298.51 (over check) (Table 19).

Significantly positive heterosis (desirable for recovery resistance) was exhibited by four hybrids over mid parent, three hybrids over better parent, and one hybrid over check in rainy season; eighteen hybrids over mid parent, nine hybrids over better parent, and eight hybrids over check in postrainy season.

During rainy season, none of the hybrids exhibited significantly high positive heterosis of ≥100.00. During postrainy season significantly high positive heterosis (≥100.00) was exhibited by SPSFR 94003A x ICSV

Table 19: Per cent heterosis over mid parent, better parent and check for yield parameters & plant characters

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x RBR hybrids																
1	SPSFR 94002A x ICSV 712	R	18.37	0.00	-13.00	215.78**	215.78**	502.12**	35.00	33.79	407.12*	7.28	-7.96	-42.14**	-3.85	-3.19	0.24
		PR	11.33	0.00	19.29	147.27**	105.36**	191.60**	154.04**	132.26**	-6.43	8.82	-2.64	-26.00**	-2.73	2.38	-6.96
2	SPSFR 94002A x ICSV 88088	R	8.75	-13.00	-13.00	1127.95**	1127.75**	737.71**	315.23**	149.60**	829.21**	16.79	8.11	-42.86**	-1.59	0.92	2.60
		PR	-0.37	20.36	-5.00	29.47	15.85	37.71	124.04*	112.00*	-4.30	6.87	-1.40	-30.00**	-2.27	2.87	-6.52
3	SPSFR 94002A x ICSV 89015	R	13.73	-6.45	-13.00	5.36	5.36	482.63**	17.21	-16.40	211.24	28.79	23.19	-39.28**	-3.09	-2.76	0.00
		PR	25.09	0.00	19.29	25.56	14.09	31.02	36.93*	2.52	-16.96	28.13*	20.59	-18.00*	-1.82	3.34	-6.09
4	SPSFR 94002A x ICSV 89030	R	16.25	-7.00	-7.00	235.34**	235.34**	631.78**	69.59	-8.55	240.45	3.89	-12.09	-42.86**	-2.29	-2.29	1.18
		PR	0.00	-40.12	-28.57	83.80**	63.31*	97.26**	48.51*	21.00	-22.56	5.48	-10.47	-23.00**	-6.43	-4.09	-8.27
5	SPSFR 94003A x ICSV 712	R	-8.05	-8.05	-20.00	89.86	69.10	312.71	5.74	-12.65	231.09	13.21	2.27	-35.71**	-	-	-
		PR	20.48	203.03	-28.57	4.96	28.77	25.79	186.98*	306.60	-25.96	21.38*	27.54	-12.00	4.01	-60.00	-4.36
6	SPSFR 94003A x ICSV 88088	R	6.95	0.00	0.00	22.39	-21.70	91.10	-47.27	-65.61	-14.98	15.87	13.52	-40.00**	-2.00	-0.68	4.26
		PR	50.38	0.00	28.57	-11.55	-19.43	-4.23	55.84	9.38	-50.63*	14.28	12.68	-20.00**	-1.66	-0.49	-9.57**
7	SPSFR 94003A x ICSV 89015	R	18.89	15.05	7.00	-	-	-	-23.43	-37.12	55.43	52.86**	50.71**	-23.57*	-1.01	-3.29	4.26
		PR	100.00	33.00	-5.00	51.33	40.03	60.81	23.26	-24.51	-38.85	9.49	8.70	-25.00**	7.80*	9.09*	-0.87
8	SPSFR 94003A x ICSV 89030	R	-14.44	-20.00	-20.00	-66.45	-68.23	-22.46	42.28	-20.45	96.63	22.22	8.79	-29.58**	-2.63	-2.63	4.96
		PR	303.03*	303.00*	-5.00	23.87	12.02	35.31	140.12**	54.25*	-1.29	22.58**	10.47	-5.00	-2.30	0.93	-7.83
9	SPSFR 94001A x ICSV 712	R	-33.33*	-35.48*	-40.00*	317.16**	245.78**	559.32**	64.42	5.04	298.13	-1.68	-3.30	-37.14	-1.57	-1.35	3.55
		PR	-11.33	20.36	-5.00	64.17*	36.90**	94.40**	312.61**	303.18**	-32.00	23.81*	0.95	22.00**	-0.01	-8.27	-8.27*
10	SPSFR 94001A x ICSV 88088	R	3.63	0.00	0.00	296.50	206.08	283.90	125.73	93.59	103.75	46.67**	32.97*	-13.57	-7.19*	-6.99*	-2.37
		PR	-0.37	-20.36	-5.00	26.88	14.05	35.56	112.65*	81.35	-18.14	32.33**	0.00	-20.00**	-0.95	-1.87	-9.13**
11	SPSFR 94001A x ICSV 89015	R	-6.45	-6.45	-13.00	-34.54	-59.85	122.03	91.77	59.43	153.18	21.25	6.59	-30.71	-3.27	-2.07	0.71
		PR	124.72**	79.64**	114.29**	-	-	-	28.36	-10.58	-27.57	1.70	17.22	-40.00**	16.12**	15.03**	6.52
12	SPSFR 94001A x ICSV 89030	R	-3.63	-7.00	-7.00	262.52**	185.44*	522.88	478.27*	269.40	288.76**	3.30	3.30	-32.85**	-2.69	-2.69	2.60
		PR	33.00	-20.36	-5.00	-	-	-	126.26**	69.43	8.43	11.77	8.45	-24.00**	6.70*	5.00*	0.43

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
13	SPSFR 94031A x ICSV 712	R	19.76	14.94	0.00	-	-	-	-4.51	-50.79	86.52	21.21	13.64	-28.57	1.86	2.28	5.43
		PR	33.00	0.00	-5.00	23.58	-2.86	37.94	35.25	12.51	-43.43**	31.94**	24.99**	-5.00	-0.47	-0.94	-9.13
14	SPSFR 94031A x ICSV 88088	R	-3.33	-13.00	-13.00	-4.38	-45.16	154.66	8.62	-37.31	-52.81	49.67**	46.75**	-19.27**	0.46	0.45	3.55
		PR	19.76	-33.00	-52.14	-21.20	-33.67	-21.15	45.53*	38.08	-30.57	10.79	2.38	-23.00	1.90	1.42	-6.96
15	SPSFR 94031A x ICSV 89015	R	7.51	0.00	-7.00	53.77	41.46	682.20**	350.11	141.51	283.52	21.92	15.58	-36.43**	-2.64	-2.52	0.24
		PR	59.28	33.00	-5.00	2.78	-12.25	0.77	15.57	-6.35	-24.14	5.89	1.91	-28.00**	1.43	0.95	-7.40*
16	SPSFR 94031A x ICSV 89030	R	-11.11	-20.00	-20.00	35.57	-0.36	362.71*	2562.39**	1760.26**	443.45	13.09	4.39	-32.14**	0.45	0.45	3.55
		PR	100.00	49.25	-28.57	74.53**	45.96	76.30*	107.02**	84.84	18.29	16.89*	2.37	-10.00	0.24	-1.81	-6.09
	PRBR cms x RBR hybrids																
17	SPSFPR 94001A x ICSV 712	R	-11.11	-13.98	-20.00	-	-	-	-68.87	-76.48	-10.86	28.57	2.27	-35.71**	-	-	-
		PR	12.78	12.78	7.14	-55.39**	-61.24*	-44.97	114.39*	70.28**	-3.43	25.18**	14.47	-13.00	8.89**	11.24**	1.08*
18	SPSFPR 94001A x ICSV 88088	R	-24.35	-27.00	-27.00	234.16	234.16	127.97	-27.30	-49.52	-2.25	46.03**	24.32	-34.29	-	-	-
		PR	-14.16	-24.81	-28.57	37.89	29.68	54.15	66.23*	49.27	-15.34	22.39*	15.50	-18.00*	-3.99	-1.92	-10.88**
19	SPSFPR 94001A x ICSV 89015	R	0.00	0.00	-7.00	-	-	-	-27.52	-34.04	27.72	95.04**	71.02**	-15.71**	5.48	6.21	9.22*
		PR	-14.16	-24.81	-28.57	4.17	-0.42	14.35	-3.52	-17.99	-33.57	16.04	11.77	-24.00**	0.70	2.87	-6.52**
20	SPSFPR 94001A x ICSV 89030	R	3.63	0.00	0.00	-20.00	-20.00	74.58	78.15	2.51	98.50	28.66	1.09	-34.29**	-	-	-
		PR	20.48	-24.81	-28.57	25.91	17.54	41.97	55.74*	46.88	-6.00	4.70	-9.30	-22.00**	7.30	7.79	2.17
21	SPSFPR 94002A x ICSV 712	R	3.33	0.00	-7.00	32.67	-5.56	325.00	-18.05	-27.77	173.78	13.90	-2.28	-38.57**	-0.34	0.00	4.96
		PR	14.16	0.00	-5.00	32.10	14.92	63.18	81.49*	37.10	-10.42	8.70	-1.32	-25.00**	-2.60	-1.44	-10.43**
22	SPSFPR 94002A x ICSV 88088	R	-3.63	-7.00	-7.00	119.62	26.46	469.07**	-23.54	-51.81	39.33	5.11	-2.70	-48.57**	-0.34	0.00	4.96
		PR	0.00	0.00	-28.57	-33.03	-36.92	-25.01	66.57*	40.82	-7.99	8.27	1.41	-28.00**	-3.08	-1.92	-10.88**
23	SPSFPR 94002A x ICSV 89015	R	0.00	0.00	-7.00	-22.86	-30.04	286.86	22.74	-4.92	174.91	75.75**	68.11**	-17.14**	0.68	2.07	4.96
		PR	33.00	33.00	-5.00	-31.75	-34.65	-24.96	18.13	6.71	-13.56	49.24**	42.65**	-3.00	3.08	4.31	-5.22
24	SPSFPR 94002A x ICSV 89030	R	-9.84	-13.00	-13.00	74.38	29.47	482.63	-57.65	-76.68	-32.58	18.18	0.00	-35.00**	-0.67	-0.67	4.96
		PR	50.38	0.00	-28.57	60.96*	50.49	81.76*	72.11*	70.35	11.30	10.82	-4.65	-18.00	-2.30	-0.93	-7.83**
25	SPSFPR 94005A x ICSV 712	R	0.00	-8.05	-20.00	-	-	-	-67.45	-69.37	16.10	4.25	-2.00	-30.00	-	-	-
		PR	-24.81	-24.81	-28.57	-29.88	-30.70	-1.60	65.59	19.48	-9.99	20.83	14.47	-13.00	-2.52	1.44	-7.83**

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
26	SPSFPR 94005A x ICSV 88088	R	-7.51	-20.00	-20.00	-	-	-	-	-	-	19.54	4.00	-25.71**	-	-	-
		PR	14.16	0.00	-5.00	-13.23	-19.42	11.72	76.83*	41.40	6.51	6.48	4.23	-26.00	2.07	6.22	-3.48
27	SPSFPR 94005A x ICSV 89015	R	4.82	-6.45	-13.00	-51.33	-54.28	187.71	-52.92	-65.29	16.10	8.28	-8.50	-34.64	0.57	1.61	4.50
		PR	71.67*	50.38	42.86	-19.36	-26.29	2.20	-4.90	-8.23	-25.66	23.53*	23.53*	-16.00*	4.37	8.61**	-1.30
28	SPSFPR 94005A x ICSV 89030	R	15.61	0.00	0.00	-44.50	-62.63	135.17	-15.96	-54.31	52.81	5.75	1.00	-27.86**	0.00	0.00	4.96
		PR	60.24	0.00	-5.00	68.88**	58.00**	119.07**	78.42*	65.00*	24.29	15.58	3.49	-11.00	4.04	5.45	0.86
29	SPSFPR 94007A x ICSV 712	R	3.45	3.45	-10.00	-76.71	-84.71**	-6.78	-33.96	39.72	176.78	8.07	-1.14	-37.86**	2.32	5.50	4.26
		PR	-11.33	-20.36	-5.00	3.76	-12.26	24.59	25.28	2.73	-46.43	7.24	-2.64	-26.00**	-2.13	-0.96	-10.00**
30	SPSFPR 94007A x ICSV 88088	R	6.95	0.00	0.00	40.50	-21.89	316.27	-57.81	-75.45	12.73	-0.68	-1.35	-47.85**	0.69	3.82	2.60
		PR	-49.81	-59.88	-52.14	-18.98	-26.05	-12.09	-38.33	-42.47	-70.00**	3.76	-2.81	-31.00**	-0.71	0.47	-8.70**
31	SPSFPR 94007A x ICSV 89015	R	3.33	0.00	-7.00	-18.88	-22.65	371.61	42.06	-4.40	338.95	9.86	6.85	-44.28**	3.64	5.74	4.50
		PR	-25.09	-40.12	-28.57	3.81	-3.73	10.55	3.33	-15.07	-31.20	-9.23	-13.24	-41.00**	-0.24	0.95	-8.27**
32	SPSFPR 94007A x ICSV 89030	R	6.95	0.00	0.00	2.25	-30.58	323.31	-39.26	-67.70	48.31	18.90	7.14	-30.36**	5.25	5.25	4.01
		PR	0.00	-40.12	-28.57	72.58**	56.40*	88.91**	83.03*	66.09	6.29	14.87	-1.16	-15.00*	-2.30	-0.93	-7.83**
	SB cms x RBR hybrids																
33	ICSA 20 x ICSV 712	R	24.29	0.00	-13.00	-	-	-	79.58	31.23	397.38**	20.00	5.68	-33.57**	-1.12	-0.68	4.26
		PR	55.33	39.52	66.43*	14.94	5.19	49.37	66.46*	38.31	-30.24	31.08**	27.63**	-3.00	3.60	3.85	-6.09
34	ICSA 20 x ICSV 88088	R	21.57	-7.00	-7.00	-70.61	-84.11	33.05	182.04	101.71	252.81	13.47	8.11	-42.86**	-0.45	-0.00	4.96
		PR	-25.09	-40.12	-28.57	25.75	25.25	48.89	57.74*	49.46	-24.62	17.48	16.67	-16.00*	-3.12	-2.88	-12.18**
35	ICSA 20 x ICSV 89015	R	9.59	-13.98	-20.00	-31.00	-42.71	379.66	84.74	76.23	208.24	44.11**	42.03	-30.00**	0.12	1.61	4.50
		PR	-25.09	-40.12	-28.57	23.02	21.41	43.17	27.61	3.53	-16.13	12.86	9.72	-21.00**	-3.12	-2.88	-12.18**
36	ICSA 20 x ICSV 89030	R	30.72	0.00	0.00	-51.18	-69.23*	157.63	307.34'	137.69	315.73	15.19	0.00	-35.00**	-1.79	-1.79	4.01
		PR	33.00	-20.36	-5.00	31.74	30.18	57.23	151.18**	124.56**	43.72	18.99*	9.31	-6.00	-3.73	-0.95	-10.43**
37	ICSA 89001 x ICSV 712	R	-8.05	-8.05	-20.00	-70.66	-78.69	-10.17	-83.14*	-86.52*	-14.61	8.64	0.00	-37.14**	-1.02	-0.68	3.55
		PR	20.12	0.00	42.86	54.99*	-60.58**	-44.03	-22.49	-47.35	-50.99*	4.00	1.44	-22.00**	1.19	0.95	-8.27**

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
38	ICSA 89001 x ICSV 88088	R	-28.34	-33.00*	-33.00*	-	-	-	-69.04	-82.68**	9.74	17.57	17.57	-37.86**	0.34	0.58	4.96
		PR	55.33*	16.50	66.43*	-52.48*	-54.91	-46.40	16.23	-13.70	-19.00	-8.26	7.21	-34.00**	6.95*	6.69	-3.05
39	ICSA 89001 x ICSV 89015	R	-25.56	-27.96	-33.00*	-	-	-	-71.55	-82.21**	12.73	41.26**	36.49*	-27.86**	2.29	2.29	5.91
		PR	-33.33	-50.00	28.57	-41.94	-43.99	-35.68	24.90*	16.80	8.73	1.41	-2.70	-28.00**	-1.68	-1.92	-10.88**
40	ICSA 89001 x ICSV 89030	R	-0.53	-7.00	-7.00	-	-	-	-63.73	-81.03**	20.22	-11.51	-19.78	-47.85**	-	-	-
		PR	71.67*	0.00	42.86	-66.70**	-68.64*	-62.12	-43.75*	-52.54*	-55.82*	-22.50*	16.22**	-38.00**	1.40	-1.36	-5.66
41	ICSA 89004 x ICSV 712	R	16.25	6.90	-7.00	35.97	6.71	257.20	53.79	41.40	435.96*	7.32	0.00	-37.14**	0.00	0.00	4.96
		PR	-14.16	-24.81	-28.57	-7.65	-15.71	45.00	52.44*	8.78	-15.00	-2.64	-2.64	-26.00**	0.00	3.34	-6.09*
42	ICSA 89004 x ICSV 88088	R	-7.51	-20.00	-20.00	27.23	-23.42	156.36	-18.48	-49.59	60.30	4.00	2.63	-44.28**	-0.68	-0.68	4.26
		PR	0.00	0.00	-28.57	14.65	-3.06	66.75	64.62*	29.86	1.47	-4.76	11.48	-30.00**	7.87*	4.49**	1.30
43	ICSA 89004 x ICSV 89015	R	12.05	0.00	-7.00	54.46	23.98	585.59**	140.69	80.45	473.78**	32.41*	26.31	-31.43**	-1.71	-0.69	2.13
		PR	0.00	0.00	-28.57	-31.73	-43.08*	-2.09	-18.50	-19.94	-35.14	2.78	1.44	-26.00**	-1.85	-4.92	-7.83**
44	ICSA 89004 x ICSV 89030	R	15.61	0.00	0.00	179.23**	130.63**	672.03**	65.48	-9.66	187.27	14.97	5.49	-31.43**	-3.15	-3.15	1.66
		PR	50.38	0.00	-28.57	-6.27	-20.23	37.22	62.42*	47.78	15.43	-18.52*	13.16**	-34.00**	8.80**	8.07**	4.77
45	ICSA 90002 x ICSV 712	R	-14.44	-20.00	-20.00	-49.95	-67.47	106.78	-84.65	-89.56	9.74	18.01	7.95	-32.14**	0.22	0.45	4.96
		PR	-20.12	-33.50	-5.00	-16.65	-26.86	3.86	22.09	-16.24	-24.86	35.61**	30.26**	-1.00	-6.66	-2.87	-11.74**
46	ICSA 90002 x ICSV 88088	R	-7.00	-7.00	-7.00	171.88**	50.53	856.78**	-34.69	-65.00**	267.79	33.33*	32.43*	-30.00**	-0.68	-0.46	4.01
		PR	-11.33	-33.50	-5.00	-8.75	-13.23	3.14	0.00	-24.84	-32.57	16.31	15.50	-18.00*	-6.21	-2.40	-11.31**
47	ICSA 90002 x ICSV 89015	R	-24.35	-27.00	-27.00	-	-	-	-43.03	-67.21	-44.57	46.47**	42.46**	-25.71**	-1.48	-0.69	2.13
		PR	-33.33	-50.00*	-28.57	-35.63	-37.76	-28.53	-21.91	-25.70	-33.34	8.70	7.14	-25.00**	1.61	5.74	-3.91
48	ICSA 90002 x ICSV 89030	R	-47.00**	-47.00**	-47.10**	41.34	-5.07	503.39**	-78.57**	-88.99**	-	14.63	3.30	-32.85**	-0.23	-0.23	-
		PR	-42.49	-66.50	-52.14	-	-	-	89.61**	62.43*	45.72	-12.82	-20.93*	-32.00**	12.57**	14.10**	9.13**

Contd..

Contd

S No	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x SBR hybrids																
49	SPSFR 94002A x ICSR 89076	R	42 86*	25 00	0 00	411 34**	411 34**	740 68**	51 31	51 31	463 30**	17 57	2 35	-37 86**	-4 55	-4 11	-0 71
		PR	42 74	0 00	19 29	-	-	-	79 07**	27 11	32 03	17 15	2 51	-18 00	-3 17	1 42	-6 96
50	SPSFR 94002A x ICSR 90002	R	14 96	8 96	-27 00	-	-	1152 12**	288 04**	115 49*	702 25	24 55	15 65	-39 28**	-0 45	-0 45	3 08
		PR	13 68	-20 36	-5 00	-38 92	-53 32**	-17 10	-12 75	-40 86	-33 00	14 70	2 63	-22 00**	7 28	9 46	5 65
51	SPSFR 94002A x ICSR 90005	R	32 86	16 25	-7 00	-	-	1448 31**	144 83**	127 22**	888 01**	29 23	25 37	-40 60**	-3 85	-3 19	0 24
		PR	-11 33	-20 36	-5 00	16 67	7 22	20 07	-68 60*	-77 01**	-80 06**	3 94	-1 50	-34 00**	11 41**	15 28**	8 26**
52	SPSFR 94002A x ICSR 90014	R	26 53	6 90	-7 00	105 02*	105 02*	643 64**	124 22*	80 68	572 66**	23 81	23 81	-44 28**	-4 34	-4 34	-0 95
		PR	25 09	0 00	19 29	-6 09	-21 45	9 58	-34 93	-50 75	-16 37**	16 39	14 52	-29 00**	3 75	5 85	2 17
53	SPSFR 94003A x ICSR 89076	R	19 76	14 94	0 00	-64 11	-69 97	-26 69	-43 79	-43 79	38 95	7 69	-1 18	-40 00	-6 46	-4 98	-0 71
		PR	100 00	49 25	-28 57	-16 14	-27 54	-2 80	14 81	-31 70	-34 42	4 70	-2 50**	-22 00**	1 65	2 37	-6 09
54	SPSFR 94003A x ICSR 90002	R	29 87	14 94	0 00	-	-	-	-43 12	-66 82	-17 98	16 26	14 29	-40 00**	0 00	0 00	7 80
		PR	166 00*	98 51	-5 00	-0 83	-23 15	36 51	-40 69	-65 57**	-61 00*	-3 45	-7 89	-30 00**	6 89*	8 89	1 30
55	SPSFR 94003A x ICSR 90005	R	28 14	22 99	7 00	-	-	-	-15 65	-33 85	187 64	30 43	26 76	-35 71**	-1 33	0 00	4 96
		PR	60 24	0 00	-5 00	21 82	14 04	27 70	130 78**	39 64	21 09	17 64	15 94	-20 00	-3 72	-4 17	-10 00
56	SPSFR 94003A x ICSR 90014	R	6 90	6 90	-7 00	84 78	54 56	460 59**	125 39	116 52	435 21*	4 48	-1 40	-50 00**	-3 29	-3 29	4 26
		PR	50 38	0 00	-28 57	21 80	3 55	44 45	148 32**	53 01	20 01	17 56	11 59	-23 00**	-5 04	-6 76	-10 00
57	SPSFR 94001A x ICSR 89076	R	15 61	7 53	0 00	-	-	-	230 96	230 96	248 37	-1 14	-4 40	-37 06**	-	-	-
		PR	241 88**	139 52**	185 71**	-	-	-	-45 91	-63 98*	-65 42**	20 00*	-2 50	-22 00**	15 57**	16 12**	6 52
58	SPSFR 94001A x ICSR 90002	R	25 00	7 53	0 00	-	-	-	-	-	-	42 25**	28 57*	-16 43	-	-	-
		PR	128 21**	59 88*	298 51**	-	-	-	73 45*	11 11	295 16	25 40*	3 95	58 01**	2 07	0 00	4 23
59	SPSFR 94001A x ICSR 90005	R	0 58	-6 45	-13 00	83 45	83 45	130 08	15 81	-28 08	212 73	5 06	-8 80	-40 71**	-1 57	-1 35	3 55
		PR	-33 33	-40 12	-28 57	-	-	-	94 48**	32 96	15 29	35 05**	17 91	-21 00**	-3 03	-2 35	-9 57**
60	SPSFR 94001A x ICSR 90014	R	11 11	7 53	0 00	14 58	-22 90	179 66	171 32	98 36	351 69	5 19	-10 99	-42 14	2 46	-2 46	2 84
		PR	-0 37	-20 36	-5 00	22 61	2 97	43 65	72 80*	21 49**	-4 71	28 58*	16 13	-28 00**	-3 90	-1 87	-9 13**

Contd

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
61	SPSFR 94031A x ICSR 89076	R	33.75	33.75	7.00	157.14**	74.09*	708.47**	3219.35*	3219.35*	285.39	-4.94	-9.42	-45.00**	1.59	2.28	5.43
		PR	198.51**	198.51**	42.86	57.95*	26.81	70.10*	-20.26	-39.25	-41.68	10.82	0.95	-18.00	0.95	0.95	7.40*
62	SPSFR 94031A x ICSR 90002	R	26.53	16.25	-7.00	58.67	58.67	636.86**	305.67	160.00	7.12	1.00	-1.29	-45.71**	-1.61	-1.61	1.42
		PR	98.51	98.51	-5.00	-41.47	-57.35**	-24.24	-3.57	-30.39	-21.14	11.11	7.59	-20.00**	4.86	2.26	-1.30
63	SPSFR 94031A x ICSR 90005	R	33.75	33.75	7.00	107.48*	107.48*	863.56**	68.79	-13.35	276.78	16.67	9.09	-40.00**	1.36	2.28	5.43
		PR	33.00	0.00	-5.00	48.19	27.85	43.17	118.80**	72.84**	49.87*	25.93*	-1.89*	-15.00*	-3.04	-4.17	-10.00**
64	SPSFR 94031A x ICSR 90014	R	11.38	6.90	-7.00	63.32	45.44	575.42**	254.62	86.35	324.34	37.14**	24.68**	-31.43**	-0.47	-0.47	2.60
		PR	19.76	0.00	-28.57	85.52**	46.68*	104.77**	39.18*	14.21	-10.42	23.08*	17.65*	-20.00**	-3.00	-5.41	-8.70**
	PRBR cms x SBR hybrids																
65	SPSFPR 94001A x ICSR 89076	R	7.51	0.00	-7.00	-	-	-	88.01	88.01	264.04	37.23**	10.59	-32.85**	-	-	-
		PR	133.00**	75.19*	66.43*	139.38**	113.13**	185.88**	-19.91	-36.30	-38.85	20.28*	7.50	-14.00	12.83**	14.70**	5.22
66	SPSFPR 94001A x ICSR 90002	R	0.00	-13.98	-20.00	-	-	-	126.16	37.14	165.54	52.99**	30.61	-31.43**	-	-	-
		PR	33.00	0.00	-5.00	20.49	-4.23	70.10*	54.46*	15.89	31.29	35.25**	23.68*	-6.00	5.00	5.96	0.43
67	SPSFPR 94001A x ICSR 90005	R	0.58	-6.45	-13.00	-	-	-	-95.23	-96.55	-35.02	56.30**	38.80**	-33.57**	0.34	0.68	4.96
		PR	-24.81	-24.81	-28.57	-30.95	-33.19	-25.19	-27.97	-40.43	-48.35	13.84	10.44	-26.00**	4.61	5.10	-1.30
68	SPSFPR 94001A x ICSR 90014	R	-11.11	-13.98	-20.00	6.54	6.54	286.44	-17.51	-23.68	73.78	33.91	22.22	-45.00**	0.68	0.68	4.96
		PR	-42.49	-49.02	-52.14	-54.02*	-59.75*	-43.85	-26.86	-36.98	-50.57*	12.00	11.11	-30.00**	5.45	6.41	0.86
69	SPSFPR 94002A x ICSR 89076	R	15.61	7.53	0.00	12.83	-22.98	246.61	19.04	19.04	244.19	10.81	-3.53	-41.43**	0.56	1.13	5.67
		PR	59.28	33.00	-5.00	-30.68	-38.19	-17.10	-29.78*	-41.00	-43.36	-12.68	-22.50*	-38.00**	5.42	6.17	-2.61
70	SPSFPR 94002A x ICSR 90002	R	8.75	-6.45	-13.00	-	-	-	25.17	-28.50	106.74	6.96	-0.68	-47.85**	0.67	0.67	6.38
		PR	100.00*	67.00	19.29	-16.91	-33.88	17.44	-8.49	-27.86	-18.28	59.42**	44.73**	10.00	-5.50	-3.73	-10.43
71	SPSFPR 94002A x ICSR 90005	R	7.51	0.00	-7.00	18.83	18.83	434.75*	-64.30	-70.28	29.21	13.84	10.44	-47.14**	-0.34	0.00	4.96
		PR	43.35	25.56	19.29	-17.23	-19.79	-10.18	58.24*	38.73	20.30	2.33	-1.50	-34.00**	-3.72	-3.27	-10.00**
72	SPSFPR 94002A x ICSR 90014	R	3.33	0.00	-7.00	61.63	45.95	556.78**	1.59	-9.20	162.55	17.46	17.46	-47.14**	0.67	0.67	0.38
		PR	100.00*	100.00*	42.86	60.14**	40.37	95.83**	146.65**	126.05**	77.30**	9.68	9.68	-32.00**	-7.34*	-5.61	-12.18**

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
73	SPSFPR 94005A x ICSR 89076	R	13.73	8.75	-13.00	-56.54	-72.59	72.46	100.90	100.90	571.91**	-0.54	-8.00	-34.29**	0.22	0.45	4.96
		PR	0.00	-24.81	-28.57	21.74	19.75	66.04*	60.66*	43.36	37.63	8.11	0.00	-20.00**	-1.59	1.91	-6.52
74	SPSFPR 94005A x ICSR 90002	R	32.86	27.40	-7.00	-	-	-	17.25	-34.15	120.22	1.44	-12.00	-37.14**	-	-	-
		PR	100.00*	50.38	42.86	60.90**	43.25*	154.43**	19.07	-0.88	12.29	11.11	5.26	-20.00**	4.02	4.96	1.30
75	SPSFPR 94005A x ICSR 90005	R	30.72	25.00	0.00	192.39**	192.39**	1739.83**	31.16	16.02	404.49*	-4.20	-20.00	-42.86**	-1.35	-1.35	3.55
		PR	-24.81	-24.81	-28.57	-16.09	-24.16	5.15	8.27	1.17	-12.27	21.48*	20.59	-18.00*	-4.98	-2.78	-8.70*
76	SPSFPR 94005A x ICSR 90014	R	8.75	0.00	-13.00	8.24	-14.68	436.86	90.14	59.80	434.46	7.98	-12.00	-37.14	-0.68	-0.68	4.26
		PR	43.35	25.56	19.29	-10.94	-11.21	23.87	33.24	30.60	2.43	16.93	11.77	-24.00**	4.91	5.85	2.17
77	SPSFPR 94007A x ICSR 89076	R	19.76	14.94	0.00	57.64	0.07	510.17**	-26.10	-26.10	239.33	8.86	1.17	-38.57**	1.86	4.78	3.55
		PR	184.62**	99.40**	137.86**	-69.00**	-73.68**	-64.69	10.90	-14.43	-17.85	-2.81	-13.75	-31.00**	9.66**	10.44**	1.30
78	SPSFPR 94007A x ICSR 90002	R	3.90	-8.05	-20.00	-	-	-	52.84	-16.72	282.40	7.85	7.49	-43.57**	6.22	6.22	4.96
		PR	13.68	-20.36	-5.00	-66.47**	-73.97**	-53.77	-70.65**	-78.57**	-75.72**	-18.84*	-26.32**	-44.00**	8.26**	10.29	2.61**
79	SPSFPR 94007A x ICSR 90005	R	11.38	6.90	-7.00	-29.26	-29.26	331.36	-41.52	-43.07	161.42	4.29	0.00	-47.85**	3.01	6.22	4.96
		PR	-11.33	-20.36	-5.00	-43.54	-47.03	-40.68	46.30	17.14	1.58	14.73	10.44	-26.00**	3.72	4.21	-3.05
80	SPSFPR 94007A x ICSR 90014	R	0.00	0.00	-13.00	-47.97	-58.51	152.97	-8.83	-31.81	213.11	31.62	22.60	-36.07**	5.74	5.74	4.50
		PR	-25.09	-40.12	-28.57	47.55	25.68	75.33*	21.73	1.33	-20.52	16.13	16.13	-28.00**	0.46	2.34	-4.79
	SB cms x SBR hybrids																
81	ICSA 20 x ICSR 89076	R	39.85	16.25	-7.00	186.13**	71.15**	1333.05**	182.23*	182.23	393.63**	13.13	1.17	-38.57**	-0.23	0.45	4.96
		PR	13.68	-20.36	-5.00	-8.27	-13.81	15.61	48.49*	13.25	8.73	18.42*	12.50	-10.00	-1.66	-0.95	-10.43**
82	ICSA 20 x ICSR 90002	R	88.33	68.66	13.00	-	-	-	46.97	-9.21	58.80	29.54	23.81	-35.00**	-1.57	-1.57	4.26
		PR	-14.53	-40.12	-28.57	45.10*	20.71	114.41**	80.03**	34.43	52.29*	16.21	-2.39	-14.00	-5.57	-8.55	-11.74**
83	ICSA 20 x ICSR 90005	R	30.83	8.75	-13.00	-59.51**	-59.51**	238.98	50.61	5.60	359.18*	41.78**	41.78**	-32.14**	-1.80	-1.35	3.55
		PR	-33.33	-40.12	28.57	-2.19	-4.65	12.44	31.05	3.64	-10.13	23.74**	19.44	-14.00	-6.60*	-8.33	-13.92**
84	ICSA 20 x ICSR 90014	R	4.29	-16.09	-27.00	6.78	-23.48	540.68**	37.30	21.38	176.40	13.84	10.44	-47.14**	-4.47	-4.47	1.18
		PR	-0.37	-20.36	-5.00	0.37	-7.40	29.19	55.19*	27.50	0.00	19.40*	0.49	-20.00**	-2.78	-5.85	-9.13**

Contd..

Contd..

S.No.	Hybrids		Productive tillers MP	Productive tillers BP	Productive tillers CHECK	Yield (UNI) MP	Yield (UNI) BP	Yield (UNI) CHECK	Yield (I) MP	Yield (I) BP	Yield (I) CHECK	Plant height MP	Plant height BP	Plant height CHECK	Days to 50% flowering MP	Days to 50% flowering BP	Days to 50% flowering CHECK
85	ICSA 89001 x ICSR 89076	R	19.76	14.94	0.00	-	-	-	-72.46**	-72.46**	74.53	22.02	14.12	-30.71**	-	-	-
		PR	49.81	0.00	42.86	-	-	-	-55.12*	-55.80*	-57.57*	3.90	4.33	-20.00	3.58	2.84	-5.66
86	ICSA 89001 x ICSR 90002	R	-12.99	-22.99	-33.00*	-	-	-	13.98	-39.30	284.64	15.26	14.87	-39.28**	2.04	2.04	6.38
		PR	25.09	-16.50	19.29	-1.97	-21.54	39.37	-19.42	-26.60	-16.85	-2.66	0.97	-27.00**	-2.32	-5.41	-8.70**
87	ICSA 89001 x ICSR 90005	R	-4.19	-8.05	-20.00	-	-	-	-26.04	-37.65	275.13	2.13	-2.70	-48.57**	-	-	-
		PR	-39.94	-50.00	-28.57	49.67	46.16	63.66	-56.29*	-57.79*	-60.71*	-14.89	1.44	-40.00**	-0.47	-2.32	-8.27**
88	ICSA 89001 x ICSR 90014	R	6.90	6.90	-7.00	-	-	-	-91.22	-94.03	-62.17	21.17	12.16	-40.71**	-	-	-
		PR	-11.33	-33.50	-5.00	85.77**	63.93**	128.70**	3.33	-4.81	-11.38	5.89	1.44	-28.00**	-1.86	-4.96	-8.27**
89	ICSA 89004 x ICSR 89076	R	-4.58	-8.75	-27.00	148.73	85.44	520.76**	17.90	17.90	274.91	6.83	1.17	-38.57**	0.67	0.90	5.43
		PR	59.28	33.00	-5.00	-	-	-	10.10	-0.14	-4.13	5.13	7.89	-18.00*	1.85	-0.89	-3.91
90	ICSA 89004 x ICSR 90002	R	24.29	19.18	-13.00	-37.72	-37.72	108.47	126.69	28.03	307.12	-1.01	-2.64	-47.14**	-1.35	-1.35	3.55
		PR	100.00*	67.00	19.29	-0.78	-2.35	73.44*	-12.09	-25.73	-15.86	-10.53	-5.85	-32.00**	-6.06	-6.27	-9.13**
91	ICSA 89004 x ICSR 90005	R	13.73	8.75	-13.00	-59.37	-59.37	36.02	76.22	52.54	563.30**	13.28	6.58	-42.14**	-1.35	-1.35	3.55
		PR	-14.16	-24.81	-28.57	-31.85*	-43.74	-3.23	4.68	-0.49	-13.72	6.29	13.43	-24.00**	-5.69	-7.17	-10.00**
92	ICSA 89004 x ICSR 90014	R	33.75	22.99	7.00	30.26	25.23	354.24*	93.96	66.43	429.21**	22.30	11.84	-39.28**	-4.50	-4.50	0.24
		PR	0.00	0.00	-28.57	32.92	20.36	107.03**	48.74*	48.46	16.44	7.24	-6.31	-26.00**	-6.52*	-6.73*	-9.57**
93	ICSA 90002 x ICSR 89076	R	3.33	-7.00	-7.00	-	-	-	-	-	-	-8.86	-15.30	-48.57**	-0.91	-0.91	3.55
		PR	49.81	0.00	42.86	-	-	-	35.88*	31.43	26.18	18.66*	11.25	-11.00	8.92**	5.31**	3.47
94	ICSA 90002 x ICSR 90002	R	-4.19	-20.00	-20.00	-29.13	-29.13	350.42	-12.55	-54.56**	377.53*	22.87	22.45	-35.71**	-4.98	-4.98	-0.71
		PR	-0.37	-33.50	-5.00	-18.20	-34.41	16.50	4.86	-6.05	6.43	12.33	-6.76	-18.00*	-7.59*	-8.40	-10.00**
95	ICSA 90002 x ICSR 90005	R	3.33	-7.00	-7.00	12.40	12.40	614.41**	-40.11	-57.66**	344.94	28.57	23.28	-35.71**	-2.49	-2.27	2.13
		PR	-39.94	-50.00	-28.57	13.26	10.85	24.13	46.24*	43.80	29.01	31.38**	-4.63**	-10.00	-6.78*	-8.84	-10.43**
96	ICSA 90002 x ICSR 90014	R	35.83	27.00	27.00	22.67	-3.67	512.29**	-38.20	-62.40**	295.13	36.76	27.39	-35.57**	-0.91	-0.91	3.55
		PR	-33.33	-50.00*	-28.57	15.87	2.46*	42.94	53.61*	43.95	29.14	18.18	-4.96	-22.00**	-5.81	-6.64	-8.27**

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
	RBR cms x PRLR hybrids																
97	SPSFR 94002A x ICSR 93031	R	30.72	7.53	0.00	-	-	33.47	-62.97	-78.67	-20.60	32.64**	-1.54	-8.57	-9.24**	-8.17**	-7.09
		PR	-0.37	-20.36	-5.00	14.46	14.19	7.69	39.35	12.39	-26.14	-13.04	-30.67**	-30.00	-0.68	4.29	-4.79
98	SPSFR 94002A x ICSR 93011	R	18.89	-10.83	7.00	-	-	-23.31	-54.51	-76.16	-11.24	40.66**	13.72	-17.14	-3.66	-3.66	-0.24
		PR	-0.37	-20.36	-5.00	15.42	-3.43	34.59	32.81	4.57	-26.71	24.67**	2.13	-4.00	-12.12*	-12.12	-11.74**
99	SPSFR 94002A x ICSR 93009	R	52.86*	33.75	7.00	-	-	-29.24	-85.98	-86.92	-51.31	61.29**	35.87*	-10.71	-4.08	-3.42	0.00
		PR	49.81	19.76	42.86	-61.50	-64.97	-67.12*	-50.13*	-62.04*	-70.72**	8.73	-8.99	-19.00**	7.76*	10.46**	5.65
100	SPSFR 94002A x ICSR 93010	R	42.86	25.00	0.00	-71.64**	-71.64**	102.97	2.59	-48.29	92.51	29.03*	-2.44	-14.28	-2.70	-1.37	2.13
		PR	-0.37	-20.00	-5.00	-	-	-	107.14*	78.46*	-0.57	5.88	-18.18**	-10.00	-4.64	-6.49	-6.09
101	SPSFR 94003A x ICSR 93031	R	11.11	7.53	0.00	-15.28	-15.28	106.78	182.61	73.64	329.21	21.39	-6.16	-12.86	-2.49	0.70	1.89
		PR	100.00	33.00	-5.00	123.59**	119.72**	114.64**	162.54**	67.68	10.18	27.06**	6.93	8.00	-2.82	-1.90	-10.43**
102	SPSFR 94003A x ICSR 93011	R	-10.14	-22.50	-7.00	-84.20	-84.20	-61.44	111.02	13.18	179.78	35.26**	14.71	-16.43	0.00	2.05	5.67
		PR	100.00	33.00	-5.00	40.81	19.75	66.90*	177.93	75.10	22.72	27.60**	1.90	4.00	0.94	0.00	-6.96
103	SPSFR 94003A x ICSR 93009	R	43.71*	37.93*	20.00	-14.41	-14.41	108.90	-20.05	-29.38	127.72	43.56**	27.18	-16.43	-4.00	-2.10	2.13
		PR	100.00	33.00	-5.00	132.74**	108.02**	103.00**	136.67	46.29	12.86	21.52*	-3.73	-4.00	-5.06	-6.35	-10.43**
104	SPSFR 94003A x ICSR 93010	R	11.38	6.90	-7.00	-19.03	-45.71	288.56	-28.74	-63.94	-10.86	35.05	6.50	-6.43	-1.99	-1.33	4.96
		PR	100.00	33.00	-5.00	34.73	31.69	28.64	83.17*	21.54	-32.28	19.55**	-0.93	7.00	-2.75	-4.50	-7.83*
105	SPSFR 94001A x ICSR 93031	R	-21.51	-21.51	-27.00	131.76	131.76	190.68	117.59	67.26	76.03	25.79*	6.92	-0.71	-6.63	-4.67	-3.55
		PR	-0.37	-20.36	-5.00	5.80	5.52	0.06	118.49**	62.20	6.58	25.83**	-5.94	-5.00	-3.55	-2.86	-11.31**
106	SPSFR 94001A x ICSR 93011	R	-12.68	-22.50	-7.00	-25.00	-25.00	-5.93	18.54	-30.60	-26.97	41.97**	34.31**	-2.14	-2.26	-1.37	2.13
		PR	74.53*	39.52	66.43*	98.36**	66.67**	132.28**	220.62**	133.17**	63.42**	47.22**	12.77	6.00	-4.50	-3.81	-12.18**
107	SPSFR 94001A x ICSR 93009	R	15.61	7.53	0.00	-47.30	-47.30	-33.90	152.71*	67.60	440.45*	53.00**	52.18*	0.00	-2.02	-1.80	3.08
		PR	-0.37	-20.36	-5.00	140.25**	117.58**	106.32**	109.88**	48.27	14.38	41.01**	10.11	-2.00	-5.77	-4.23	-11.31**
108	SPSFR 94001A x ICSR 93010	R	0.58	-6.45	-13.00	-56.88	-74.66*	81.36	208.65	58.72	67.04	12.15	-2.44	-14.28	-1.33	-0.89	4.50
		PR	25.09	0.00	19.29	167.48**	165.30**	151.57**	177.02**	117.69**	21.29	35.00**	-1.82	8.00	-6.66	-4.69	-11.74**

Contd..

Contd..

S.No.	Hybrids		Productive tillers MP	Productive tillers BP	Productive tillers CHECK	Yield (UNI) MP	Yield (UNI) BP	Yield (UNI) CHECK	Yield (I) MP	Yield (I) BP	Yield (I) CHECK	Plant height MP	Plant height BP	Plant height CHECK	Days to 50% flowering MP	Days to 50% flowering BP	Days to 50% flowering CHECK
109	SPSFR 94031A x ICSR 93031	R	-15.61	-21.51	-27.00	-28.38	-28.38	232.63	47.25	-11.26	-49.81	44.93**	15.38**	7.14	-3.93	-3.03	-1.89
		PR	19.76	0.00	-28.57	68.80*	57.11	48.11	57.40*	38.93	-8.71	30.18**	-3.33	10.00	-30.56	-3.78	-11.74**
110	SPSFR 94031A x ICSR 93011	R	7.00	-10.83	7.00	-74.45**	-74.45**	18.64	672.15	535.42	14.23	46.37**	28.43**	-6.43	-5.72	-5.50	-2.60
		PR	19.76	0.00	-28.57	45.57	15.22	60.58	58.63	31.07	-8.14	25.93**	8.51	2.00	-1.66	-1.89	-10.00**
111	SPSFR 94031A x ICSR 93009	R	0.00	0.00	-20.00	-31.11	-31.11	219.92	-51.35	-74.80	-18.73	46.75**	34.79**	-11.43	-1.37	-0.47	2.60
		PR	139.52**	100.00**	42.86	76.50*	71.82	39.59	69.86*	40.89	8.23	21.02**	-0.47	-5.00	-2.55	-4.54	-8.70**
112	SPSFR 94031A x ICSR 93010	R	33.75	33.75	7.00	-46.64	-56.01**	214.83	3125.64	1929.03	135.58	50.00**	21.95**	7.14	-0.68	0.91	4.01
		PR	59.28	33.00	-5.00	108.58**	95.13**	82.02*	111.06*	100.77**	11.86	19.11**	0.00	6.00	-2.54	-4.96	-8.27**
	PRBR cms x PRLR hybrids																
113	SPSFPR 94001A x ICSR 93031	R	15.05	15.05	7.00	-	-	53.39	186.53	85.11	258.43	21.98	-14.62	-20.71*	2.19	3.74	4.96
		PR	14.16	0.00	-5.00	113.79**	103.17**	112.75**	72.72*	60.89*	5.73	31.71**	6.93	8.00	-3.27	-1.43	-10.00**
114	SPSFPR 94001A x ICSR 93011	R	-18.31	-27.50	-13.00	-	-	41.53	40.88	-23.02	49.06	67.53**	26.47**	-7.86	-0.34	0.00	3.55
		PR	-14.16	-24.81	-28.57	34.29	17.60	63.89	50.76**	36.37	-4.42	37.58**	14.89	8.00	2.33	4.29	-4.79
115	SPSFPR 94001A x ICSR 93009	R	7.51	0.00	-7.00	-	-	-	-57.47	-65.97	9.74	75.00**	36.96**	-10.00	-	-	-
		PR	14.16	0.00	-5.00	180.93**	143.65**	155.15**	143.90**	111.60**	63.24**	34.21**	14.61	2.00	-1.37	-0.92	-6.09
116	SPSFPR 94001A x ICSR 93010	R	23.70	15.05	7.00	5.98	5.98	658.47**	222.29	63.64	216.85	47.43**	4.88	-7.86	-3.03	-2.04	2.13
		PR	71.67*	50.38	42.86	54.49	46.06	52.94	198.11**	195.50**	67.58**	31.79**	3.64	14.00	-1.82	-0.92	-6.09
117	SPSFPR 94002A x ICSR 93031	R	0.00	0.00	-7.00	-68.46	-68.46	41.95	-23.08	-54.02	32.96	33.68**	-0.77	-7.86	0.80	3.04	4.26
		PR	67.00	67.00	19.29	109.72**	98.99**	109.06**	56.25*	55.80	2.38	32.52**	6.93	8.00	-1.89	-0.96	-9.57**
118	SPSFPR 94002A x ICSR 93011	R	-18.31	-27.50*	-13.00	-35.78	-35.78	188.98	9.51	-41.84	68.16	45.45**	17.65	-14.28	-1.02	0.00	3.55
		PR	67.00	67.00	19.29	18.13	3.59	44.37	44.65*	39.75	-2.06	33.33**	10.63	4.00	-3.30	-2.39	-10.88**
119	SPSFPR 94002A x ICSR 93009	R	15.61	7.53	0.00	-71.09	-71.09	30.08	-41.70	-44.72	78.28	67.75**	41.31**	-7.14	0.11	-0.45	5.43
		PR	133.00	133.00	66.43	106.19**	78.59*	87.62**	82.70**	68.71*	30.16	43.05**	21.35**	8.00	-0.91	0.48	-6.52
120	SPSFPR 94002A x ICSR 93010	R	-15.61	-21.51	-27.00	-93.68**	-94.85**	-63.14	-25.38	-62.31	8.99	53.76**	16.26	2.14	-1.44	-1.11	4.50
		PR	0.00	0.00	-28.57	66.71*	57.36	65.32	20.15	11.31	-27.28	34.31**	5.00	15.50*	-7.34*	-5.61	-12.18**

Contd..

Contd..

S.No.	Hybrids		Productive tillers MP	Productive tillers BP	Productive tillers CHECK	Yield (UNI) MP	Yield (UNI) BP	Yield (UNI) CHECK	Yield (I) MP	Yield (I) BP	Yield (I) CHECK	Plant height MP	Plant height BP	Plant height CHECK	Days to 50% flowering MP	Days to 50% flowering BP	Days to 50% flowering CHECK
121	SPSFPR 94005A x ICSR 93031	R	28.92	15.05	7.00	-57.17	-57.17	169.49	-42.72	-66.52	11.99	11.30	-1.54	-8.57	-2.53	-0.70	0.47
		PR	-14.16	-24.81	-28.57	57.88*	32.64	83.91*	29.65	21.37	-8.57	21.90**	1.98	3.00	-3.67	0.00	-8.70*
122	SPSFPR 94005A x ICSR 93011	R	-17.10	-33.33	-20.00	-44.78	-44.78	247.46	-54.73	-76.15	-20.22	31.43**	30.15**	-5.18	-0.68	0.00	3.55
		PR	-42.49	-49.62	-52.14	-3.34	-3.59	34.36	-18.06	-20.91	-40.43	35.80**	17.02*	10.00	-7.34*	-3.81	-12.18**
123	SPSFPR 94005A x ICSR 93009	R	4.58	0.00	-20.00	-88.69**	-88.69**	-28.81	-51.20	-52.07	60.30	38.02**	32.58**	-5.36	0.68	0.68	5.67
		PR	43.35	25.56	19.29	17.15	-8.93	26.27	-23.54	-24.44	-41.71	37.58**	21.35**	8.00	3.59	5.00	0.43
124	SPSFPR 94005A x ICSR 93010	R	21.57	16.25	-7.00	-75.74**	-77.21**	63.14	-26.75	-63.05	23.60	19.28	8.13	-5.00	0.67	1.35	6.38
		PR	-14.16	-24.81	-28.57	14.43	-4.29	32.70	29.96	13.04	-14.85	32.59**	7.28	18.00*	-8.03*	-7.20*	-10.43**
125	SPSFPR 94007A x ICSR 93031	R	-3.33	-6.45	-13.00	-45.52	-45.52	232.20	31.45	-26.18	238.95	29.06**	0.77	-6.43	0.71	1.91	0.71
		PR	-25.09	-40.12	-28.57	103.51**	99.53**	95.83**	38.18*	23.92	-18.57	34.97**	8.91	10.00	-3.77	-2.86	-11.31**
126	SPSFPR 94007A x ICSR 93011	R	-3.38	-16.67	0.00	2.57	2.57	525.42**	-36.58	-67.05	51.31	37.14*	17.65	-14.28	0.47	2.87	1.66
		PR	25.09	0.00	19.29	47.04	25.29	74.61*	79.19*	56.26	9.51	29.48**	7.44**	1.00	-4.24	-3.33	-11.74**
127	SPSFPR 94007A x ICSR 93009	R	-4.19	-8.05	-20.00	-	-	-	46.43	24.63	472.28*	46.67**	31.53*	-13.57	1.62	4.78	3.55
		PR	-0.37	-20.36	-5.00	60.29	42.97	40.31	54.02*	29.07	-0.43	40.40**	19.11*	6.00	0.93	2.34	-4.79
128	SPSFPR 94007A x ICSR 93010	R	35.33	29.89*	13.00	-47.06	-50.98	250.85	30.47	-34.34	201.50	26.02	0.40	-11.79	-0.46	3.34	2.13
		PR	-25.09	-40.12	-28.57	37.90	34.49	31.99	76.95*	71.29	-4.56	13.95	-10.91	-2.00	-5.50	-3.73	-10.43**
	SB cms x PRLR hybrids																
129	ICSA 20 x ICSR 93031	R	46.58	15.05	7.00	-73.03**	-73.03**	125.85	133.33	54.39	170.04	12.69	-14.62	-20.71*	-0.45	1.88	3.08
		PR	25.09	0.00	19.29	9.70	-1.28	16.41	168.31**	137.18**	55.82*	10.98	4.80	-4.00	-5.26	-5.71	-13.12
130	ICSA 20 x ICSR 93011	R	23.70	-10.83	7.00	-76.27	-76.27	98.73	166.80	47.11	157.30	33.72	10.78	-19.29*	-2.04	-0.92	2.60
		PR	-25.09	-40.12	-28.57	-22.93	-28.86	-0.86	67.37*	43.91	0.86	21.68**	-4.33	1.00	-4.79	-5.24	-13.49**
131	ICSA 20 x ICSR 93009	R	20.30	0.00	-20.00	-15.28	-15.28	609.32**	-47.14	-59.23	31.46	44.66**	25.00	-17.85**	-0.45	0.00	4.96
		PR	-25.09	-40.12	-28.57	115.67**	78.18**	110.12**	80.73*	49.44	15.29	29.19**	16.85	4.00	-5.61	-8.18	-12.18**
132	ICSA 20 x ICSR 93010	R	20.30	0.00	-20.00	-18.47	-24.39	533.05**	331.16	119.27	283.52	26.31*	-2.44	-14.28	-4.12	-3.91	1.77
		PR	-0.37	-20.36	-5.00	35.71	21.53	43.31	81.94	73.32	-3.43	2.20	-4.80	-7.00	-7.90	-10.81	-13.90**

Contd..

Contd..

S.No.	Hybrids		Productive tillers			Yield (UNI)			Yield (I)			Plant height			Days to 50% flowering		
			MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK	MP	BP	CHECK
133	ICSA 89001 x ICSR 93031	R	73.33**	67.74**	56.00**	459.20**	459.20**	2257.63**	-64.84	-80.85**	21.35	15.69	-9.23	-15.71	-0.57	0.94	2.13
		PR	-33.33	-50.00	-28.57	-99.94**	-99.95**	-99.94**	-32.70*	-42.60	-46.56	-15.43	-26.73**	-26.00**	0.48	0.97	-8.70**
134	ICSA 89001 x ICSR 93011	R	-29.47*	-39.17	-27.00	40.70	40.70	493.22**	-44.60	-71.51**	80.52	47.73**	27.45**	-7.14	0.34	0.68	4.26
		PR	-11.33	-33.50	-5.00	71.93**	51.79*	111.55**	35.18*	18.47	10.29	14.29	-2.88	-4.00	-3.35	-3.81	-12.18**
135	ICSA 89001 x ICSR 93009	R	19.76	14.94	0.00	-71.66	-71.66	19.49	-81.12	-85.76**	-9.74	33.74*	20.65	-20.71	0.34	0.68	4.96
		PR	11.33	-16.50	19.29	-	-	-	46.87*	54.29	25.01	20.25**	10.11	-2.00	6.08	9.14**	-1.30
136	ICSA 89001 x ICSR 93010	R	4.19	0.00	-13.00	-2.46	-22.50	454.66**	70.71	-14.24	443.45**	29.95**	4.06	-8.57	-1.68	-0.68	3.55
		PR	11.33	-16.50	19.29	83.33	71.79	83.33	91.43	53.00	42.43	15.22	-3.63	6.00	-3.72	-0.48	-10.00
137	ICSA 89004 x ICSR 93031	R	12.05	0.00	-7.00	7.59	7.59	260.17	56.40	-7.89	192.88	7.76	-14.62	-20.71**	-4.59	-2.80	-1.66
		PR	0.00	0.00	-28.57	7.71	-16.62	43.42	62.67*	49.74	17.01	27.68	-3.81	13.00	-6.70*	-9.42	-12.18**
138	ICSA 89004 x ICSR 93011	R	-24.35	-39.17**	-27.00	-38.35	-38.35	106.36	80.60	-4.59	203.37	19.10	3.92	-24.28**	-7.48	-6.85	-3.55
		PR	-33.00	-33.00	-52.14	-1.06	-10.45	54.03	-16.91	-21.19	-38.42	-12.95	4.29	-26.00**	1.16	-1.79	-4.79
139	ICSA 89004 x ICSR 93009	R	0.65	-3.75	-23.00	-	-	-	-51.58	-51.92	55.06	21.43	10.87	-27.14**	-4.05	-4.05	0.71
		PR	0.00	0.00	-28.57	-16.74	-39.75*	3.63	45.66*	44.73	13.10	23.64**	-2.26	2.00	-2.95	-3.58	-0.52
140	ICSA 89004 x ICSR 93010	R	21.57	16.25	-7.00	-48.93	-62.52	168.22	36.06	-31.33	118.35	26.63*	2.44	-10.00	-0.67	0.00	4.96
		PR	33.00	33.00	-5.00	-6.72	-28.07	23.75	62.45*	39.14	8.73	18.28	-10.81	10.00	-11.01**	-11.21**	-13.92**
141	ICSA 90002 x ICSR 93031	R	-3.63	-7.00	-7.00	-52.60	-52.60	201.27	7.27	-43.48	494.01**	27.09*	-0.77	-7.86	-2.52	-0.93	0.24
		PR	33.33	0.00	42.86	-	-	-	11.41	-3.50	-13.42	-11.11	8.57**	-24.00**	0.01	-3.53	-5.22
142	ICSA 90002 x ICSR 93011	R	-9.09	-16.67	0.00	-	-	-	-	-	-	-1.72	-15.69	-38.57**	2.27	2.74	6.38
		PR	-11.33	-33.50	-5.00	85.51**	64.10**	128.70**	39.94*	24.63	11.81	21.95*	-5.24	0.00	-8.72**	-11.95	-13.49**
143	ICSA 90002 x ICSR 93009	R	-3.33	-13.00	-13.00	26.47	26.47	703.81**	-69.62**	-80.15**	108.61	54.55**	38.59**	-8.93	-6.89	-6.68	-2.48
		PR	55.33	16.50	66.43	67.30*	43.68	54.03	-0.40	-7.38	-16.90	33.34**	0.46	6.00	-0.89	-2.20	-3.91
144	ICSA 90002 x ICSR 93010	R	3.33	-7.00	-7.00	-22.17	-26.52	425.85**	-21.82	-60.80**	311.99**	24.49*	-0.81	-12.86	-4.49	-3.62	0.71
		PR	-33.33	-50.00*	-28.57	-35.12	-39.33	-34.96	-51.74*	-60.88*	-64.91**	-22.22**	-36.36**	-30.00**	4.02	3.11	1.30

MP : Mid parent; BP : Better parent
* Significant at 5 per cent level; ** Significant at 1 per cent level

89030, SPSFR 94001A x ICSV 89015, SPSFR 94003A x ICSR 90002, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSR 90002, SPSFR 94031A x ICSR 89076, SPSFR 94031A x ICSR 93009 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 89076, SPSFPR 94002A x ICSR 90002, SPSFPR 94002A x ICSR 90014, SPSFPR 94005A x ICSR 90002, SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female lines), ICSA 89004 x ICSR 90002 (developed on susceptible female lines) over mid parent; SPSFR 94003A x ICSV 89030, SPSFR 94001A x ICSR 89076, SPSFR 94031A x ICSR 89076, SPSFR 94031A x ICSR 93009 (developed on rainy season-bred resistant female lines), SPSFPR 94002A x ICSR 90014, SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female lines) over better parent; SPSFR 94001A x ICSV 89015, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSR 90002 (developed on rainy season-bred resistant female lines), SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female line) over check.

Thus, none of the hybrids showed significantly high positive heterosis (≥100.00) over mid parent, better parent and check in rainy season, whereas significantly high positive heterosis (≥100.00) was exhibited by thirteen hybrids over mid parent; six hybrids over better parent; four hybrids over check in postrainy season.

4.6.10 Yield (UNI)

In rainy season, the heterosis ranged from -93.68 to 1127.95 (over mid parent), -94.85 to 1127.75 (over better parent) and -63.14 to 1739.83 (over check). In postrainy season, the heterosis ranged from -99.94 to 180.93 (over mid parent), from -99.95 to 165.30 (over better parent), and from -99.94 to 191.60 (over check) (Table 19).

Significant positive heterosis (desirable) was exhibited by fourteen hybrids over mid parent, thirteen hybrids over better parent, and forty hybrids over check in rainy season and thirty four hybrids over mid parent, twenty four hybrids over better parent and thirty six hybrids over check in postrainy season.

During rainy season, significantly high positive heterosis of ≥200.00 was recorded by SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89030, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSV 89030, and SPSFR 94002A x ICSR 89076 (developed on rainy season-bred resistant female lines), ICSA 89001 x ICSR 93031 (developed on susceptible female lines) over mid parent; SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89030, SPSFR 94001A x ICSV 712, and SPSFR 94002A x ICSR 89076 (developed on rainy season-bred resistant female lines), ICSA 89001 x ICSR 93031 (developed on susceptible female line) over better parent; and SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94002A x ICSV 89015, SPSFR 94002A x ICSV 89030, SPSFR 94001A x ICSV 712, SPSFR 94031A x ICSV 89015, SPSFR 94031A x ICSV 89030, SPSFR 94002A x ICSR 89076, SPSFR 94002A x ICSR 90002, SPSFR 94002A x ICSR 90005, SPSFR 94002A x ICSR 90014, SPSFR 94003A x ICSR 90014, SPSFR 94031A x ICSR 89076, SPSFR 94031A x ICSR 90002, SPSFR 94031A x ICSR 90005 and SPSFR 94031A x ICSR 90014 (developed on rainy season-bred resistant female lines), SPSFPR 94002A x ICSV 88088, SPSFPR 94001A x ICSR 93010, SPSFPR 94007A x ICSR 93011, SPSFPR 94002A x ICSR 90005, SPSFPR 94002A x ICSR 90014, SPSFPR 94005A x ICSR 90005 and SPSFPR 94007A x ICSR 89076 (developed on postrainy season-bred resistant female lines), ICSA 89004 x ICSV 89015, ICSA 90002 x ICSV 88088, ICSA 90002 x ICSV 89030, ICSA 20 x ICSR 89076, ICSA 20 x ICSR 90014, ICSA 89004 x ICSR 89076, ICSA 89004 x ICSR 90014, ICSA 90002 x ICSR 90005, ICSA 90002 x ICSR 90014, ICSA 20 x ICSR 93009, ICSA 20 x ICSR 93010, ICSA 89001 x ICSR 93031, ICSA 89001 x ICSR 93011, ICSA 89001 x ICSR 93010, ICSA 90002 x ICSR 93009 and ICSA 90002 x ICSR 93010 (developed on susceptible female lines) over check.

During postrainy season, significantly high positive heterosis (≥100.00) was exhibited by the hybrids, SPSFR 94002A x ICSV 712, SPSFR 94003A x ICSR 93031, SPSFR 94031A x ICSR 93010, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010 and SPSFR 94031A x ICSR 93031 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 89076, SPSFPR 94001A x ICSR 93009, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93009, SPSFPR 94007A x ICSR 93031 and SPSFPR 94001A x ICSR 93031 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSR 93009, (developed on susceptible female line) over mid parent; SPSFR 94002A x ICSV 712, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 93031, SPSFPR 94001A x ICSR 93009, SPSFPR 94001A x ICSR 89076 (developed on postrainy season-bred resistant female lines) over better parent; SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93009, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94002A x ICSV 712, SPSFR 94031A x ICSR 90014 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 89076, SPSFPR 94005A x ICSR 90002, SPSFPR 94001A x ICSR 93031, SPSFPR 94001A x ICSR 93009, SPSFPR 94002A x ICSR 93031, SPSFPR 94005A x ICSV 89030 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSR 90002, ICSA 89001 x ICSR 90014, ICSA 89004 x ICSR 90014, ICSA 20 x ICSR 93009, ICSA 89001 x ICSR 93011, ICSA 90002 x ICSR 93011 (developed on susceptible female lines) over check.

Significantly high positive heterosis (≥200.00) was during rainy season was exhibited by seven hybrids over mid parent; five hybrids over better parent; and forty hybrids over check during rainy season. In postrainy season significantly high positive heterosis (≥100.00) was exhibited by thirteen hybrids over mid parent; eight hybrids over better parent; and nineteen hybrids over check .

4.6.11 Yield (I)

During rainy season, the heterosis over mid parent ranged from -95.23 to 3219.35, over better parent from -94.03 to 3219.35 and over check from -62.17 to 888.01. During postrainy season, the heterosis over mid parent ranged from -70.65 to 312.61, over better parent from -78.57 to 303.18 and over check from -80.06 to 295.16 (Table 19).

Significant positive heterosis (desirable) was exhibited by nine hybrids over mid parent, five hybrids over better parent, twenty two hybrids over check in rainy season; seventy seven hybrids over mid parent, twenty hybrids over better parent, and seven hybrids over check in postrainy season.

During rainy season, significantly high positive heterosis (≥200.00) was exhibited by the hybrids, SPSFR 94001A x ICSV 89030, SPSFR 94031A x ICSV 89030, SPSFR 94002A x ICSR 90002, SPSFR 94031A x ICSR 89076 (developed on rainy season-bred resistant female lines) over mid parent; SPSFR 94002A x ICSV 88088, SPSFR 94031A x ICSV 89030, SPSFR 94031A x ICSR 89076 (developed on rainy season-bred resistant female lines) over better parent; SPSFR 94001A x ICSR 93009, SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94001A x ICSV 89030, SPSFR 94002A x ICSR 89076, SPSFR 94002A x ICSR 90005, SPSFR

94002A x ICSR 90014, SPSFR 94003A x ICSR 90014 (developed on rainy season-bred resistant female lines), SPSFPR 94005A x ICSR 89076, SPSFPR 94007A x ICSR 93009 and SPSFPR 94005A x ICSR 90005 (developed on postrainy-season bred resistant female lines), ICSA 20 x ICSR 89076, ICSA 20 x ICSR 90005, ICSA 89004 x ICSR 90005, ICSA 89004 x ICSR 90014, ICSA 20 x ICSV 712, ICSA 90002 x ICSR 90002, ICSA 90002 x ICSR 93031 and ICSA 90002 x ICSR 93010, ICSA 89004 x ICSV 712, ICSA 89004 x ICSV 89015 and ICSA 89001 x ICSR 93010 (developed on susceptible female lines) over check.

During postrainy season, significantly high positive heterosis of ≥100.00 was exhibited by the hybrids, SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94003A x ICSV 712, SPSFR 94003A x ICSV 89030, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSV 88088, SPSFR 94001A x ICSV 89030, SPSFR 94031A x ICSV 89030, SPSFR 94003A x ICSR 90005, SPSFR 94003A x ICSR 90014, SPSFR 94031A x ICSR 90005, SPSFR 94002A x ICSR 93010, SPSFR 94003A x ICSR 93031, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent); SPSFPR 94001A x ICSV 712, SPSFPR 94002A x ICSR 90014, SPSFPR 94001A x ICSR 93009, SPSFPR 94001A x ICSR 93010 (developed on postrainy season-bred resistant female parents), ICSA 20 x ICSV 89030, ICSA 20 x ICSR 93031 (developed on susceptible female lines) over mid parent; SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female parent), SPSFPR 94002A x ICSR 90014, SPSFPR 94001A x ICSR 93009, SPSFPR 94001A x ICSR 93010 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSV 89030 and ICSA 20 x ICSR 93031 (developed on susceptible female parent) over better parent.

Significantly high positive heterosis of ≥200.00 was exhibited by five hybrids over mid parent, two hybrids over better parent and twenty two hybrids over check in rainy season. During postrainy season, significantly high positive heterosis (≥100.00) was exhibited by twenty four hybrids over mid parent and eleven hybrids over better parent. None of the hybrids exhibited significant high heterosis (≥100.00) over check.

4.6.12 Plant Height

The heterosis over mid parent ranged from -11.51 to 95.04 (rainy) and -22.50 to 59.42 (postrainy), over better parent from -20.00 to 71.02 (rainy) and -36.36 to 44.73 (postrainy), and over check from -50.00 to 7.14 (rainy) and -44.00 to 58.01 (postrainy) (Table 19).

Significant positive heterosis (desirable) was exhibited by sixty one hybrids over mid parent, twenty seven hybrids over better parent in rainy season; fifty one hybrids over mid parent, sixteen hybrids over better parent and four hybrids over check in postrainy season.

During rainy season, significantly high positive heterosis of ≥50.00 was exhibited by SPSFR 94003A x ICSV 89015, SPSFR 94002A x ICSR 93009, SPSFR 94001A x ICSR 93009, SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSV 89015, SPSFPR 94002A x ICSV 89015, SPSFPR 94001A x ICSR 90002, SPSFPR 94001A x ICSR 90005, SPSFPR 94001A x ICSR 93011, SPSFPR 94001A x ICSR 93009, SPSFPR 94002A x ICSR 93009, SPSFPR 94002A x ICSR 93010 (developed on postrainy season-bred resistant female lines), ICSA 90002 x ICSR 93009 (developed on susceptible female lines) over mid parent; SPSFR 94003A x ICSV 89015 (developed by rainy season-bred resistant female lines), SPSFPR 94001A x ICSV 89015, SPSFPR 94002A x ICSV 89015, SPSFPR 94001A x ICSR 93009 (developed on postrainy season-bred resistant female lines) over better parent. None of the hybrids showed significant positive heterosis over check.

During postrainy season, significantly high positive heterosis (≥30.00) was exhibited by the hybrids, SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 712, SPSFR 94001A x ICSR 90005, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031 (developed on rainy season-bred resistant female lines), SPSFPR 94002A x ICSV 89015, SPSFPR 94001A x ICSR 90002, SPSFPR 94002A x ICSR 90002, SPSFPR 94001A x ICSR 93031, SPSFPR 94001A x ICSR 93011, SPSFPR 94001A x ICSR 93009, SPSFPR 94001A x ICSR 93010, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR

94002A x ICSR 90002, SPSFPR 94001A x ICSR 93031, SPSFPR 94001A x ICSR 93011, SPSFPR 94001A x ICSR 93009, SPSFPR 94001A x ICSR 93010, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94002A x ICSR 93009, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93009, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93009 (developed on postrainy season bred resistant female lines), ICSA 90002 x ICSR 93009, ICSA 20 x ICSV 712, ICSA 90002 x ICSR 90005, ICSA 90002 x ICSV 712 (developed on susceptible female lines) over mid parent; SPSFPR 94002A x ICSV 89015, SPSFPR 94002A x ICSR 90002 (developed on postrainy season-bred resistant female lines), ICSA 90002 x ICSV 712 (developed on susceptible female line) over better parent; SPSFPR 94001A x ICSR 90002 (developed on postrainy season-bred resistant female line) over check.

Thus, in rainy season high positive heterosis (≥50.00) was exhibited by thirteen hybrids over mid parent; four hybrids over better parent; and none of the hybrids showed high positive heterosis over check. Significantly high positive heterosis (≥30.00) was exhibited by twenty seven hybrids over mid parent; three hybrids over better parent; and only one hybrid over check in postrainy season.

4.6.13 Days to 50% Flowering

During rainy season, the heterosis ranged from -9.24 to 6.22 (over mid parent), from -8.17 to 6.21 (over better parent), and from -2.37 to 9.22 (over check value). During postrainy season, the heterosis ranged from -30.56 to 16.12 (over mid parent), from -60.00 to 16.12 (over better parent), and from -13.92 to 9.13 (over check) (Table 19).

During rainy season, none of the hybrids exhibited significant positive heterosis (for lateness) over either mid parent or better parent. Only one hybrid exhibited significant positive heterosis over check , SPSFPR 94001A x ICSV 89015 (developed on postrainy season-bred resistant female line). Significant negative heterosis (for earliness) was exhibited by SPSFR 94001A x ICSV 88088 and SPSFR 94002A x ICSR 93031 over both mid and better parents (developed on rainy season-bred resistant female lines). None of the hybrids exhibited significant negative heterosis over check.

In postrainy season, significant positive heterosis (for lateness) over mid parent was exhibited by the hybrids, SPSFR 94003A x ICSV 89015, SPSFR 94002A x ICSR 90005, SPSFR 94003A x ICSR 90002, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSV 89015, SPSFR 94002A x ICSR 93009, SPSFR 94001A x ICSV 89030 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSV 712, SPSFPR 94001A x ICSR 89076, SPSFPR 94007A x ICSR 89076, SPSFPR 94007A x ICSR 90002 (developed on postrainy season-bred resistant female lines), ICSA 90002 x ICSR 89076, ICSA 89001 x ICSV 88088, ICSA 89004 x ICSV 88088, ICSA 89004 x ICSV 89030 and ICSA 90002 x ICSV 89030 (developed on susceptible female lines). Significant positive heterosis over better parent was exhibited by SPSFR 94003A x ICSV 89015, SPSFR 94001A x ICSV 89015, SPSFR 94002A x ICSR 93009, SPSFR 94002A x ICSR 90005, SPSFR 94001A x ICSR 89076, SPSFR 94001A x ICSV 89030 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSR 89076, SPSFPR 94007A x ICSR 89076, SPSFPR 94001A x ICSV 712, SPSFPR 94005A x ICSV 89015 (developed on postrainy season-bred resistant female lines), ICSA 89004 x ICSV 88088, ICSA 89004 x ICSV 89030, ICSA 90002 x ICSV 89030, ICSA 90002 x ICSR 89076 and ICSA 89001 x ICSR 93009 (developed on susceptible female lines). Significant positive heterosis over check was exhibited by ICSA 90002 x ICSV 89030 (developed on susceptible female line), SPSFR 94002A x ICSR 90005, SPSFR 94031A x ICSR 89076 (developed on rainy season-bred resistant female lines) and SPSFPR 94007A x ICSR 90002 and SPSFPR 94001A x ICSV 712 (developed on postrainy season-bred resistant female lines).

During postrainy season, significant negative heterosis (for earliness) over mid parent was exhibited by the hybrids, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93010, SPSFPR 94002A x ICSR 90014 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSR 90005, ICSA 89004 x ICSR 90014, ICSA 90002 x ICSR 90002, ICSA 90002 x ICSR 90005, SPSFR 94002A x ICSR 93011, ICSA 89004 x ICSR 93031, ICSA 89004 x ICSR 93010, ICSA 90002 x ICSR 93011 (developed on susceptible female lines). Significant negative heterosis over better parent was exhibited by SPSFPR 94005A x ICSR 93010 (developed on postrainy season-bred resistant female line), ICSA 89004 x ICSR 90014 and ICSA 89004 x ICSR 93010 (developed on susceptible female line). Significant negative heterosis over check value was exhibited by SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 712, SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 89015, SPSFR 94001A x ICSR 90005, SPSFR 94001A x ICSR 90014, SPSFR 94031A x ICSR 90005, SPSFR

94031A x ICSR 90014, SPSFR 94002A x ICSR 93011, SPSFR 94003A x ICSR 93031, SPSFR 94003A x ICSR 93009, SPSFR 94003A x ICSR 93010, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93011, SPSFR 94001A x ICSR 93009, SPSFR 94001A x ICSR 93010, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011, SPSFR 94031A x ICSR 93009 and SPSFR 94031A x ICSR 93010 (developed on rainy season-bred resistant female lines), SPSFPR 94001A x ICSV 712, SPSFPR 94001A x ICSV 88088, SPSFPR 94001A x ICSV 89015, SPSFPR 94002A x ICSV 712, SPSFPR 94002A x ICSV 88088, SPSFPR 94002A x ICSV 89030, SPSFPR 94005A x ICSV 712, SPSFPR 94007A x ICSV 712, SPSFPR 94007A x ICSV 88088, SPSFPR 94007A x ICSV 89015, SPSFPR 94007A x ICSV 89030, SPSFPR 94002A x ICSR 90005, SPSFPR 94002A x ICSR 90014, SPSFPR 94005A x ICSR 90005, SPSFPR 94001A x ICSR 93031, SPSFPR 94002A x ICSR 93031, SPSFPR 94002A x ICSR 93011, SPSFPR 94002A x ICSR 93010, SPSFPR 94005A x ICSR 93031, SPSFPR 94005A x ICSR 93011, SPSFPR 94005A x ICSR 93010, SPSFPR 94007A x ICSR 93031, SPSFPR 94007A x ICSR 93011, SPSFPR 94007A x ICSR 93010 (developed on postrainy season-bred resistant female lines), ICSA 20 x ICSV 88088, ICSA 20 x ICSV 89015, ICSA 20 x ICSV 712, ICSA 20 x ICSV 89030, ICSA 89001 x ICSV 712, ICSA 89001 x ICSV 89015, ICSA 89004 x ICSV 712, ICSA 89004 x ICSV 89015, ICSA 90002 x ICSV 712, ICSA 90002 x ICSV 88088, ICSA 20 x ICSR 89076, ICSA 20 x ICSR 90002, ICSA 20 x ICSR 90005, ICSA 20 x ICSR 90014, ICSA 89001 x ICSR 90002, ICSA 89001 x ICSR 90005, ICSA 89001 x ICSR 90014, ICSA 89004 x ICSR 90002, ICSA 89004 x ICSR 90005, ICSA 89004 x ICSR 90014, ICSA 90002 x ICSR 90002, ICSA 90002 x ICSR 90005, ICSA 90002 x ICSR 90014, ICSA 20 x ICSR 93011, ICSA 20 x ICSR 93009, ICSA 20 x ICSR 93010, ICSA 89001 x ICSR 93031, ICSA 89001 x ICSR 93011, ICSA 89004 x ICSR 93031, ICSA 89004 x ICSR 93010 and ICSA 90002 x ICSR 93011 (developed on susceptible female lines).

Thus, in rainy season none of the hybrids showed significant positive heterosis (desirable for lateness) either over the mid parent or better parent and only one hybrid showed significant positive heterosis over check; significantly negative heterosis (desirable for earliness) was exhibited by two hybrids over mid parent; two hybrids over better parent; and none of the hybrids recorded significant negative heterosis over check. In postrainy season, sixteen hybrids recorded significantly positive heterosis over mid parent; fifteen hybrids over better parent, and five hybrids over check; and significant negative heterosis was exhibited by thirteen hybrids over mid parent, three hybrids over better parent and seventy five hybrids over check.

Discussion

CHAPTER V

DISCUSSION

The sorghum shoot fly, *A. soccata* is a major pest of sorghum in Asia causing severe damage to the seedlings and is an important yield limiting factor in both rainy and postrainy seasons (Jotwani, 1981). Planting early in the rainy season enables the crop to escape from shoot fly attack, as the crop grows over the vulnerable stage (early seedling stage) at which time the shoot fly buildup is low. The All India Coordinated Sorghum Improvement Programme (AICSIP) recommends early planting in the late part of September (middle of October normal sowing) in order to boost postrainy season sorghum productivity, but the shoot fly buildup is heavy during this period in postrainy season. Hence it is experienced that host plant resistance is required to permit following the recommended early planting to reduce the losses caused by shoot fly in sorghum and stabilizing the yield.

Significant variability for resistance has been established among germplasm lines (Dabholkar *et al*, 1989). At ICRISAT, resistant sources have been identified and genetic diversity was observed for shoot fly resistance in these sources (Agarwal and Abraham, 1985). However, improvement of varieties (pure lines) for postrainy season has not met with success in Indian NARS or ICRISAT programs. In view of high levels of heterosis (advantage of hybrid over the pure lines) reported in sorghum by several workers for various traits, in particular for grain yield and fodder yield (Rao and Murthy, 1970; Quinby, 1970), hybrids are the target materials in various breeding programs.

Some studies showed that the inheritance of resistance to shoot fly is quantitative and polygenically controlled. It is expressed as a dominant trait under low shoot fly pressure and additive or additive x additive under high pressure (Borikar and Chopde, 1980). These studies were based on crosses involving pure lines. However, the hybrids developed from male steriles released for postrainy season are said to be highly susceptible to shoot fly (Rao and Rao, 1956; Jotwani and Srivastava, 1970). Yet, information on inheritance of shoot fly resistance in hybrids developed from cms lines is scanty primarily because shoot fly resistant cms lines are not available with many sorghum improvement programs. ICRISAT Asia Center bred shoot fly resistant cms lines specifically for rainy and postrainy seasons, but the information on the role of cms systems and value of specific breeding approaches followed is not documented adequately.

The present study involved 144 hybrids developed at ICRISAT during 1994/95 by crossing 12 cytoplasmic male sterile lines to 12 diverse testers to produce 9 sets of 4 x 4 line x tester combinations and it was initiated with the primary focus on finding the methods of developing shoot fly resistant hybrids from cms lines and methods of breeding shoot fly resistant cms lines. More specifically, the investigation addresses the following:

1. Evaluate the methods of screening and to determine appropriate method and range of shoot fly load at which the genotypes can be discriminated easily.
2. Characterize the various types of parents (cms lines and restorer lines) with known breeding history for shoot fly resistance and various characters that contribute to resistance.
3. Determine the magnitude of correlations between various characters and shoot fly resistance
4. Determine the value of crossing various types of parents in producing shoot fly resistant hybrids.
5. Study the genetics of resistance to shoot fly in hybrids involving parents of different origins and with different resistance levels.

Taneja and Leuschner (1985) outlined screening procedures aimed at differentiating sorghum genotypes for shoot fly resistance. The same procedure was adapted here for screening in rainy season (EIIK) and postrainy season (EIIR), experiments with artificial infestation. The other two experiments under natural infestation were EIK during rainy season, and EIR during postrainy season.

Deadheart percentage is a major parameter used to gauge resistance to shoot fly. High range and low CV provide ready distinction among genotypes and therefore these estimates were used here to determine which of the procedures (artificial infestation/ natural infestation), seasons (rainy and postrainy seasons) and pest pressures (low vs high pest pressures) as outlined above provided better discrimination among the genotypes.

In rainy season, both artificial and natural infestations recorded high deadheart percentage. Mean deadheart percentage in the suceptible check, CSH 9 was 93.28% under natural infestation and 95.23% under artificial infestation. The resistant check, IS 18551 recorded 68.01 under natural infestation and 53.93 under artificial infestation. During postrainy season, the deadheart percentages were 72.61 (EIR) and 65.83 (EIIR) in susceptible check, CSH 9 and 59.06 (EIR) and 34.46 (EIIR) in resistant check, IS 18551. Considering these, it can be seen that there is no significant difference between the natural and artificial environments during rainy season. It is possible that high shoot fly pressure was built up in natural environment due to environmental conditions such as high temperature with intermittent rains which favoured high oviposition in the natural environment. As a result both the trials, sown on the same day showed similar deadheart pressure. During postrainy season, the oviposition in the artificial environment (planted late, average minimum temperature in the first 20 days was 15.4°C) was lower than in the natural environment which was planted early when the average minimum temperature was high (21.7°C). This might have lead to the less deadheart percentage in artificial environment in spite of providing opportunities to enhance shoot fly population through interlards and fish meal placement. Thus, the desired fly activity could not be realized in artificial environment in the postrainy season due to environmental conditions. Hence to ensure uniform shoot fly pressure under field conditions shoot fly population dynamics should be studied through monitoring the adult flies by fish meal-baited traps, egg count on seedlings and actual damage to the sorghum seedling (deadhearts). Thus knowledge of peak activity period of shoot fly during the season enables us to plant the test material at an appropriate time to provide sufficient insect pressure. To test the insect uniformity, a susceptible control is planted at frequent intervals across the field and by checking the deadheart percentage damage in susceptible control at frequent intervals, the desired level of infestation can be maintained by intervening shoot fly control sprays when the deadheart (%) exceeds 50% in the susceptible control. Differences among the genotypes in each of the rainy season experiments are barely significant because the pest pressure was very high (>90% in the susceptible check). On the other hand, highly significant differences among the genotypes for deadheart % were observed in both the postrainy season experiments. This shows that the genotypes can be discriminated effectively for resistance when deadheart % ranges around 60 - 70 in susceptible checks.

Shoot fly lays white, elongated, cigar-shaped eggs singly on the under surface of the leaves parallel to the midrib at seedling stage. The larva after hatching crawls along the leaf sheath and moves upward to reach the plant whorl. So it is expected that various leaf parameters such as early seedling vigour and glossiness in early stage may have a role to play in oviposition preference/ non preference of the genotypes. Other factors such as trichomes and leaf parameters were reported by several workers (Maiti and Bidinger, 1979; Khurana and Verma , 1985) to contribute to resistance. Traits such as tillering and uniformity in recovery may measure the ability of genotypes to recover and provide grain yield inspite of attack. In addition, traits such as plant height, days to 50% flowering and grain yield are the plant parameters contributing to the adaptation of the genotypes. However, it may not be possible to measure all the traits in the field to a level to discriminate the genotypes.

The statistics (range, mean, SE and CV) were examined to find out which of the several traits particularly the ones related to resistance can be used to differentiate the genotypes. Only traits such as early seedling vigour, glossiness, II total egg count, trichomes (AB) in uninfested plants, I deadheart% (EIK and EIIK), III deadheart % (EIR and EIIR), 5^{th} leaf length, 5^{th} leaf width, 5^{th} leaf droopiness, days to 50% flowering, plant height, total tillers plant^{-1}, productive tillers plant^{-1}, uniformity in recovery and yield (UNI and I) showed high range with low CV across all four environments and therefore were used to differentiate the genotypes.

5.1 Mean performance of different genotypes for various characters

Sorghum shows two types of resistance to shoot fly. The first is primary resistance (seedling resistance), which is indicated by differences in the number of seedlings attacked by the pest (Doggett *et al.*, 1970). The second, recovery resistance (Doggett *et al.*, 1970), involves the ability of injured plant to recover successfully from the primary attack of shoot fly. A critical analysis of mean performance of hybrids and parents over two seasons in two different environments viz., rainy (EIK and EIIK) and postrainy (EIR and EIIR) seasons revealed that many traits contributed to the resistance as measured by deadhearts. The shoot fly resistance (low deadheart %) was found to be influenced by early seedling vigour, glossiness, trichome density, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery, plant height (positively) and by egg count, total tillers, productive tillers, yield and days to 50% flowering (negatively). Among these, early seedling vigour, glossiness, trichome density, 5th leaf length, 5th leaf width, 5th leaf droopiness and egg count are traits related with primary resistance. Other traits, like uniformity in recovery, total tillers and productive tillers influence the recovery resistance.

The susceptible parental lines had significantly more egg laying and higher percentage of deadhearts than the resistant parental lines indicating that the breeding method employed to develop the resistant parental lines was effective. The egg laying and deadheart percentage were higher during rainy season compared to postrainy season. These results revealed strong seasonal effects on the genetic control of shoot fly resistance. Similar results were obtained by Jotwani and Srivastava (1970) and Farah (1992), who suggested that fluctuations in shoot fly incidence were due to meteorological factors such as temperature and relative humidity, which appeared to be congenial for shoot fly survival during kharif season. Differences between seasons for early seedling vigour, glossiness, ovipositional preference, 5th leaf length, 5th leaf width, 5th leaf droopiness and trichome density were significant. The genotypes with primary resistance were found to be highly vigorous, more glossy, with greater 5th leaf length, 5th leaf width, 5th leaf droopiness and trichome density during rainy season than in postrainy season. This was probably due to environmental variation. The resistant parental lines and hybrids involving resistant parents were superior for resistance compared to the susceptible parental lines and their corresponding hybrids. The roles of various traits on shoot fly resistance were reported by several workers, Taneja and Leuschner (1985), and Patel and Sukhani (1990) on seedling vigour; Blum (1968 & 1972) on glossiness; Maiti and Bidinger (1979), Maiti *et al.* (1980), Taneja and Leuschner (1985) on trichomes and Khurana (1980), Vijayalakshmi (1993) on leaf parameters.

Uniformity in recovery, production of tillers plant^{-1} and productive tillers plant^{-1}, -the parameters that reflect recovery resistance were greater during postrainy season than in rainy season, while the converse was the case with egg laying and deadheart damage. Perhaps, high shoot fly pressure in rainy season might have caused attack on the tillers repeatedly particularly when the shoot fly populations progressively increase as the rainy season continues. This was supported by the findings of Singh and Rana (1986). Shoot fly resistant parental lines and hybrids involving resistant parental lines showed greater uniformity in recovery than susceptible parental lines and corresponding hybrids indicating that the tillers of resistant cultivars were less preferred by the shoot fly for egg laying and hence recovered faster than susceptible cultivars. This was in confirmation of the findings of Deeming (1972). However, susceptible cultivars and their respective hybrids showed higher total tiller production than resistant ones. Thus significant differences were maintained between resistant and susceptible varieties for tiller number as was also reported by Sharma *et al.* (1977). As expected, susceptible parental lines produced maximum number of productive tillers. On the contrary, PRLR lines also produced maximum number of productive tillers which may be due to their photoperiod sensitivity. Although the total tiller production was more in susceptible genotypes there was no significant difference for productive tiller production among the hybrids indicating tiller development consequent to 'deadheart' formation in the main shoot and subsequent survival and recovery depend on the level of primary resistance. The hybrids and parental lines selected for primary resistance also showed high recovery resistance indicating that higher plant recovery which is characteristic of resistant varieties. This relationship revealed that recovery depends on the level of primary resistance as also observed by Singh and Rana (1986).

The susceptible parental lines recorded higher grain yield plant^{-1} (under UNI conditions) compared to resistant parental lines indicating the need to improve the yield potential of the resistant parental lines through further breeding. Hybrids had significantly higher yield compared to their parents. This superiority was as expected on account of heterosis in the hybrids. Thus the hybrids with high recovery resistance appear to yield more under shoot fly infestation. The hybrids involving shoot fly resistant parents were earlier in flowering and taller than the hybrids involving susceptible parents. Similar results were also recorded for plant height by Mate *et al.* (1979) and Singh and Jotwani (1980a).

The genotypes selected for high *per se* performance based on the low deadheart percentage along with grain yield revealed that several hybrids and parents had also exhibited superior performance for other desirable traits (Table 20). Of all the genotypes selected (Table 20) the hybrids, SPSFR 94001A x ICSV 88088, SPSFR 94031A x ICSV 89030 and SPSFPR 94002A x ICSR 93010 and among the parents, the female lines, SPSFR 94002A and SPSFR 94001A exhibited good shoot fly resistance along with high grain yield across the seasons. All the selected 15 hybrids were developed from the resistant bred female lines. Of the 15 hybrids, one hybrid was from the susceptible bred line as pollinator, 11 hybrids were from the resistant bred restorers and 3 hybrids were from the landrace restorers.

Among the hybrids selected for shoot fly resistance, the hybrids SPSFR 94003A x ICSV 89030, SPSFR 94001A x ICSR 93009 and SPSFPR 94007A x ICSR 90002 in spite of their high oviposition (ovipositional preference), showed low deadheart % indicating the presence of antibiosis mechanism which in some way hindered the shoot fly maggot to cause the damage. Jotwani and Srivastava (1970) observed that even after eliminating the non-preference mechanism, some of the varieties exhibited moderate level of resistance to shoot fly due to presence of antibiosis. Sharma and Rana (1983) also reported heritability of antibiosis in F_1 and F_2 generations of high yielding and resistant varietal crosses.

Inspite of high deadheart %, 18 hybrids recovered fast and produced significantly higher yield. This may be due to their intrinsic yield potential or due to their recovery resistance. The hybrids selected for recovery resistance are given in Table 21. Of the 18 hybrids selected, only three hybrids were developed from susceptible parents (SB cms and SBR), while the rest had one or both parents resistant, belonging to the bred group (RBR cms, PRBR cms and RBR) or landrace group (PRLR). This again shows that the primary resistance in the parents contributes to the recovery resistance in the hybrids.

Table 20: Genotypes selected based on the *per se* performance for low deadheart percentage along with grain yield

S.No.	Genotypes	Group	Season selected	Selection for other traits
I	HYBRIDS			
1.	SPSFR 94002A x ICSV 712	RBR cms x RBR	Rainy	Ovipositional non-preference, yield
2.	SPSFR 94002A x ICSV 88088	RBR cms x RBR	Rainy	Ovipositional non-preference, yield
3.	SPSFR 94002A x ICSV 89015	RBR cms x RBR	Rainy	Ovipositional non-preference, trichomes, productive tillers, yield
4.	SPSFR 94002A x ICSV 89030	RBR cms x RBR	Rainy	Ovipositional non-preference, yield
5.	SPSFR 94003A x ICSV 88088	RBR cms x RBR	Postrainy	Ovipositional non-preference, 5[th] leaf length, width, droopiness, uniformity in recovery, productive tillers, yield
6.	SPSFR 94003A x ICSV 89030	RBR cms x RBR	Postrainy	Yield
7.	SPSFR 94001A x ICSV 88088	RBR cms x RBR	Rainy & Postrainy	Early seedling vigour, glossiness, ovipositional non-preference, trichomes, productive tillers, yield
8.	SPSFR 94001A x ICSV 89030	RBR cms x RBR	Rainy	Ovipositional non-preference, total tillers, productive tillers, yield
9.	SPSFR 94031A x ICSV 89030	RBR cms x RBR	Rainy & Postrainy	Ovipositional non-preference, uniformity in recovery, yield
10.	SPSFPR 94002A x ICSV 712	PRBR cms x RBR	Postrainy	Glossiness, ovipositional non-preference, trichomes, uniformity in recovery, productive tillers, yield
11.	SPSFPR 94002A x ICSV 89030	PRBR cms x RBR	Postrainy	Glossiness, ovipositional non-preference, 5[th] leaf length, droopiness, uniformity in recovery, yield
12.	SPSFPR 94007A x ICSR 90002	PRBR cms x SBR	Postrainy	Yield
13.	SPSFR 94001A x ICSR 93009	RBR cms x PRLR	Rainy	Early seedling vigour, glossiness, trichomes, 5[th] leaf length, width, droopiness, uniformity in recovery, productive tillers, yield
14.	SPSFR 94031A x ICSR 93031	RBR cms x PRLR	Postrainy	Early seedling vigour, glossiness, ovipositional non-preference, 5[th] leaf length, width, droopiness, productive tillers, yield
15.	SPSFPR 94002A x ICSR 93010	PRBR cms x PRLR	Rainy & Postrainy	Early seedling vigour, glossiness, ovipositional non-preference, trichomes, 5[th] leaf length, width, droopiness, uniformity in recovery, yield
II	LINES			
1.	SPSFR 94002A	RBR cms	Rainy & Postrainy	Glossiness, ovipositional non-preference, yield
2.	SPSFR 94003A	RBR cms	Postrainy	Glossiness, ovipositional non-preference, uniformity in recovery, yield
3.	SPSFR 94001A	RBR cms	Rainy & Postrainy	Glossiness, ovipositional non-preference, trichomes, 5[th] leaf length, yield
4.	SPSFPR 94005A	PRBR cms	Postrainy	Ovipositional non-preference, 5[th] leaf length, yield
5.	SPSFPR 94007A	PRBR cms	Postrainy	Early seedling vigour, glossiness, ovipositional non-preference, 5[th] leaf length, 5[th] leaf droopiness, uniformity in recovery, Yield

Table 21. Hybrids selected for recovery resistance

S.No.	Hybrids	Group	Season selected	Selection for other traits
1.	SPSFPR 94007A x ICSV 712	PRBR cms x RBR	Postra	Uniformity in recovery, productive tillers, yield
2.	ICSA 89004A x ICSV 712	SB cms x RBR	Rainy	Total tillers, productive tillers, yield
3.	SPSFR 94001A x ICSR 90014	RBR cms x SBR	Rainy	Productive tillers, yield
4.	SPSFR 94001A x ICSR 90005	RBR cms x SBR	Rainy	Productive tillers, yield
5.	SPSFR 94003A x ICSR 93009	RBR cms x PRLR	Postrainy tillers,yield	Uniformity in recovery,productive
6.	SPSFR 94003A x ICSR 93010	RBR cms x PRLR	Postrainy	Uniformity in recovery, productive tillers, yield
7.	SPSFR 94001A x ICSR 93010	RBR cms x PRLR	Postrainy	Uniformity in recovery, yield
8.	SPSFPR 94005A x ICSR 93011	PRBR cms x PRLR	Postrainy	Uniformity in recovery, yield
9.	SPSFPR 94005A x ICSR 93010	PRBR cms x PRLR	Rainy	Uniformity in recovery, yield
10.	SPSFPR 94007A x ICSR 93011	PRBR cms x PRLR	Rainy	Uniformity in recovery, productive tillers,yield
11.	SPSFPR 94007A x ICSR 93010	PRBR cms x PRLR	Rainy & Postrainy	Uniformity in recovery,productive tillers, yield
12.	ICSA 89001 x ICSR 93011	SB cms x PRLR	Postrainy	Productive tillers, yield
13.	SPSFR 94031A x ICSR 90002	RBR cms x SBR	Rainy & Postrainy	Productive tillers, yield
14.	SPSFPR 94007A x ICSR 89076	PRBR cms x SBR	Rainy	Total tillers, productive tillers, yield
15.	ICSA 20 x ICSR 90002	SB cms x SBR	Postrainy	Total tillers, productive tillers, yield
16.	ICSA 89001 x ICSR 89076	SB cms x SBR	Postrainy	Total tillers, productive tillers,yield
17.	ICSA 89004 x ICSR 90014	SB cms x SBR	Postrainy	Productive tillers, yield
18.	SPSFR 94002A x ICSR 93010	RBR cms x PRLR	Postrainy	Productive tillers, yield

5.2 Correlations

The associations between different characters which finally sum up in the expression of shoot fly resistance - early seedling vigour, leaf characters (glossiness, trichome density, leaf length, leaf width and leaf droopiness), recovery traits (total tillers, productive tillers and uniformity in recovery), grain yield and adaptation characters (days to 50% flowering and plant height)- in relation to shoot fly resistance parameters (oviposition and deadheart percentage), are useful in formulating a breeding strategy as the correlated response influences the selection criteria for genetic improvement in selection programs. The phenotypic correlation coefficient estimates between shoot fly resistance parameters and the characters contributing to it, and among the characters themselves are given in Table 8.

5.2.1 Early Seedling Vigour Vs Shoot Fly Resistance Parameters

Seedling vigour gives an idea about the growth rate during the early and critical stage of the plant for shoot fly incidence. It is expected that resistant cultivars may have high seedling vigour which enables them to grow fast and may help to grow out the susceptible stage (seedling stage) in a relatively shorter period than the slow growing susceptible cultivars. In this study, early seedling vigour was negatively and significantly correlated with egg count and deadheart percentage in rainy season in the hybrids. There existed a negative relationship only between the dead heart percentage and seedling vigour during postrainy season in hybrids, and the correlation between seedling vigour and egg count was also in the same direction but not significant. This indicates that there were fewer eggs and lower incidence of dead hearts in hybrids which were more vigorous, while this relationship was not consistent and significant in case of parents during both rainy and postrainy seasons. This inconsistency may be due to distinct expression of other traits that may compensate the differences in egg laying in parents or the trait, early vigour, might not have expressed to the threshold limit to curtail oviposition leading to low deadheart. An examination of seedling vigour in parents and hybrids showed that parents were not as vigorous as hybrids (Table 8).

The negative relationship between vigour and deadhearts (%) was in confirmity with the results obtained by Taneja and Leuschner (1985) who reasoned that rapid growth of seedling may retard the first instar larvae from reaching the growing point. Mate *et al.* (1979) also indicated that most resistant types grew taller and had higher growth rate than the susceptible ones even though the growth rate difference was not significant. Singh and Jotwani (1980a) also indicated that fast growth of seedling contributes to shoot fly resistance.

5.2.2 Leaf Characters Vs Shoot Fly Resistance Parameters

Under field conditions, resistance is primarily due to non-preference for oviposition. The leaf is the site of oviposition for shoot fly hence leaf characters such as glossiness of leaves, presence of trichomes, leaf length, leaf width and leaf droopiness are the most important traits which have positive influence on shoot fly resistance.

Glossy leaves may possibly affect the quality of light reflected from them which in turn may influence the host preference leading to less egg laying and deadhearts. On the other hand, high trichome density on the abaxial surface of the leaf leads to non-preference for oviposition by shoot fly and high density on the adaxial surface may interfere with larval movement and survival leading to reduced deadhearts. Several studies in sorghum have clearly supported this view (Maiti and Bidinger, 1979; Bapat and Mote, 1982; Taneja and Leuschner, 1985; Jadhav *et al*, 1986). The results obtained from present study also revealed that there is a highly significant positive correlation between glossiness intensity and trichome density both, in the parents (r = 0.58 and 0.36) and hybrids (r=0.43 and 0.35) for rainy and postrainy seasons respectively, indicating that in most cases glossiness and trichomes exist together. This is quite an interesting and important relationship from the view point of shoot fly resistance. Shoot fly egg laying and deadheart percentage are highly significantly and negatively associated with glossiness and trichome density in case of both parents and hybrids during rainy and postrainy seasons, indicating that both act as deterring factors for ovipositional non-preference of the shoot fly to sorghum genotypes.

Davies and Seshu Reddy (1980) found fifth and fourth leaves are preferred in order, for oviposition in the field. There is an inverse correlation between the distance of eggs from the base of the leaf blade and production of 'deadhearts' in the infested seedlings (Mowafi, 1967). In this study, strong and significant negative correlations between leaf parameters (5^{th} leaf length, 5^{th} leaf width and 5^{th} leaf droopiness) and shoot fly resistance parameters (oviposition and deadhearts %) were noticed in both seasons in the hybrids. In the case of parents, highly significant and negative correlations were observed only in rainy season. Although not significant, the correlations were in the same direction during postrainy season. Thus longer, wider and drooper leaves may be contributing towards resistance to the shoot fly. Studies by Khurana (1980) also showed significant negative correlation of shoot fly infestation with leaf length and leaf breadth, where as Sandhu *et al.* (1986) showed positive relationship in different varieties. Vijayalakshmi (1993) observed correlations of leaf length, width and drooping depth with deadhearts (%) in opposite directions in tall (+ve) and dwarf (-ve) groups. The contrasting results might have been due to varied types of genetic material used in the studies and/or due to existence of different biotypes with time. So far there is no report about the existence of biotypes in shoot fly either place specefic or time specific. The present study is only indication and this, however, needs to be confirmed, especially in no-choice conditions.

5.2.3 Recovery Traits Vs Shoot Fly Resistance Parameters

Early attack on the main shoot by shoot fly induces the production of few synchronous tillers, which grow rapidly and most of which survive to produce harvestable earheads, so that the yield is not much reduced. Thus, traits like uniformity in recovery, total tillers and productive tillers may be considered as a secondary mechanism of resistance or recovery resistance.

Uniformity in recovery showed strong negative correlation with egg laying and deadheart formation by shoot fly in the parents and hybrids in both the seasons. That means plants with fewer eggs and fewer deadhearts recovered faster to give uniform growth and earhead production.

Shoot fly infestation (egg count and deadheart %) exhibited positive correlation with total tillers in the hybrids consistently across the seasons, while such relationship in parents was not statistically consistent across seasons, although numerically so. Thus, in general the susceptible genotypes have more tillers.

In the study, productive tillers were positively correlated with egg count in hybrids only in postrainy season. During rainy season, although such relation was not statistically significant but was in opposite direction in case of both parents and hybrids. This may be due to high shoot fly pressure during rainy season, since the competition between flies for egg laying was more and in this case they had no choice. These results are in confirmity with Singh and Rana (1986) who reported recovery resistance does not appear to be an useful mechanism particularly when shoot fly populations progressively increase as the rainy season continues. Thus, such relation was not strong and consistent with deadheart formation across the seasons in both hybrids and parents.

5.2.4 Grain Yield Vs Shoot Fly Resistance Parameters

Grain yield in infested and uninfested conditions were significantly and positively correlated with shoot fly oviposition in hybrids during rainy season, and in case of parents during postrainy season.

Deadheart formation showed significant positive relation with yield (I) in case of hybrids (during rainy season) and parents (during postrainy season). This means that the occurence of more deadhearts may support the role of other compensatory mechanisms such as recovery resistance (Doggett, 1972). This might have been due to the fact that many cultivars were able to produce side tillers after the main shoot was killed by shoot fly, which in turn could produce a reasonable yield provided the plant was not attacked again and optimum fertility and moisture conditions prevailed/existed.

5.2.5 Adaptation Characters Vs Shoot Fly Resistance Parameters

Positive correlations were observed between days to 50% flowering and shoot fly resistance parameters. This may be due to tiller production in infested plants which took more days for flowering across the seasons. However such a relationship was not strong or consistent with the parents. Plant height was negatively correlated with shoot fly resistance parameters in both the seasons. Earlier Mate *et al.* (1979) indicated that most resistant types grew taller than susceptible ones. Singh and Jotwani (1980a) also reported similar results. Karanjkar *et al.* (1992) noticed significant negative correlation between plant height and shoot fly deadhearts. Vijayalakshmi (1993) also found that plant height was negatively correlated with number of eggs 100 plants^{-1} and deadheart percentage for dwarf and tall groups in rainy season.

5.3 INHERITANCE AND GENE ACTION

Hybrids, because of their heterotic advantage for productivity, are popular with farmers and therefore form target material in many breeding programs. It is important therefore to know the type of female parents and male parents that lead to shoot fly resistant hybrids. The 144 hybrid combinations in the present study were categorised into nine distinct groups based on the breeding history of the parents (Table 9-11). Comparatively least egg count and low deadheart % was recorded in all the hybrid groups involving resistant parental groups, while other combinations (SB cms x RBR, RBR cms x SBR, PRBR cms x SBR, SB cms x SBR, SB cms x PRLR) supported high egg count with high deadheart % indicating dominance/ intermediate/ overdominance for susceptibility. This clearly indicates that to develop resistant hybrids both male and female parents should be resistant. These findings were supported by Balakotaiah *et al.* (1975), Rana *et al.* (1975 & 1981), Sharma *et al.* (1977), Borikar and Chopde (1981), Biradar and Borikar (1985), Nimbalkar and Bapat (1987) and Singh and Verma (1988).

Mean performance of the nine distinct groups with regard to different characters related to shoot fly resistance revealed the superiority of PRLR group for seedling vigour, in both the seasons studied. The hybrids involving resistant females (RBR cms x PRLR and PRBR cms x PRLR) recorded higher seedling vigour compared to the SBR and SB cms parental lines and their hybrid groups. Seedling vigour was low during postrainy season compared to rainy season and this tendency particulary existed in susceptible parental groups and their hybrids indicating dominance of low vigour over high seedling vigour in low temperature conditions. This signifies that the susceptible parental lines were also selected indirectly for low seedling vigour under low temperatures, and that the resistant genotypes for high seedling vigour.

Expression of glossiness was more in rainy season than in postrainy season. The hybrid groups involving both parents with glossiness (RBR cms x RBR, PRBR cms x RBR, RBR cms x PRLR and PRBR cms x PRLR) were extremely glossy. On the other hand, the other groups of hybrids which involved one glossy (RBR cms, PRBR cms and PRLR) parent and another non-glossy (SB cms and SBR) parent or both non-glossy parents were all non-glossy, irrespective of the season, indicating that non-glossy trait was dominant and the trait expression was stable across the seasons in the hybrids. This is in confirmation of the results obtained by Tarumoto (1980), and Agarwal and House (1982) who found that glossiness behaves as a recessive trait.

Season specificity for trichome density was reflected in the hybrid groups depending upon the type of parents involved. In the hybrids of PRBR cms (postrainy season-bred resistant female lines) group the trichome expression during rainy season was lower than postrainy season. The same was observed in the parents. This showed that the female parents bred in postrainy season were indirectly selected for high trichome density in the low temperature conditions of postrainy season. Further this implies that season-specific breeding program should be taken up to capture this mechanism in breeding for resistance to shoot fly resistance. The hybrids were intermediate between the parents for trichome density and low density appeared to be dominant. This indicated that both parents should have high trichome density in order to have hybrids with high trichome density to ensure higher levels of resistance, as trichomes contribute to ovipositional non-preference mechanism. Sharma *et al.* (1977), Gibson and Maiti (1983), and Tarumoto (1980) studied the nature of gene action for non-preference and found that the presence of trichomes on the abaxial surface was governed by single recessive gene, but the inheritance of trichome density appeared to be more complex.

It was noticed that among the parental types, the PRLR group, and among the hybrid groups, the hybrids (RBR cms x PRLR, PRBR cms x PRLR) involving resistant females (RBR cms and PRBR cms) and the landraces (PRLR) had the longest leaf length compared to both the susceptible parental and hybrid groups. Considering the gene action it was clear that short leaf dominates over long leaf. Similar results were also recorded for leaf width and leaf droopiness. Further, in all hybrid groups droopiness was dominant/ overdominant.

In respect to uniformity in recovery among the hybrid groups involving PRLR group as male parent, high uniformity in recovery was either partially dominant or intermediate depending on type of female parent, where as in the hybrid groups involving either SBR or RBR group as male parents, low uniformity in recovery was partially dominant/ dominant/ overdominant depending on the female parent. A clear pattern was observed that hybrids based on rainy season-bred females recovered well in rainy season and these based on postrainy season-bred females recovered well in postrainy season demonstrating again the importance of season-specific breeding that had been used in developing these resistant female groups.

Tiller production was higher during postrainy season and the crosses which involved susceptible parental lines produced more tillers plant^{-1}. Similarly productive tillers plant wère also more during postrainy season. A marked reduction in productive tiller production was observed from early rabi (EIR) to late rabi (EIIR), possibly due to abiotic stress like drought that prevailed during late rabi. Among the parental lines, SB cms and PRLR groups produced maximum number of productive tillers. The hybrid groups did not differ significantly for productive tiller production and grain yield. In other words, in hybrids the susceptibility/ resistance of parent did not influence for yield, although among parents susceptible parental line groups gave higher yield than resistant groups.

The hybrids involving PRLR groups as restorers were early and tall in all environments during both seasons compared to hybrids involving susceptible line groups (SB cms and SBR) which were late and dwarf in all the four environments. The earliness observed in the resistant hybrid groups produced from PRLR restorers on RBR cms and PRBR cms might confer advantage in escaping the commonly occuring terminal drought in postrainy season.

Thus for shoot fly resistance (low deadheart damage) and its associated traits (high seedling vigour, high glossiness, high trichome density and low egg laying), the hybrid groups of RBR cms x PRLR, PRBR cms x PRLR, RBR cms x RBR and PRBR cms x RBR were excellent. On the other hand, the hybrid groups of RBR cms x SBR, RBR cms x PRLR, PRBR cms x PRLR and SB cms x PRLR performed well for recovery as reflected by high productive tiller number.

5.4 COMBINING ABILITY

The choice of suitable parents for evolving better varieties or hybrids is important in plant breeding. Parents for hybrid breeding can be selected based on either *per se* performance or general combining ability (GCA) or both . The *per se* performance, however, is not a reliable index as a line with high yield potential may not necessarily exhibit its superiority in cross combinations (Srivastava *et al.,* 1979). Therefore there is a constant need to identify and select potential combiners which can produce combinations superior to the existing ones. Studies in a single environment are of restricted applicability as combining ability was reported to be influenced by environment. Hence in the present investigation, the combining ability studies were carried out under two different environments namely rainy-natural (EIK) and postrainy-natural (EIR) environments. The use of line x tester design (Kempthorne, 1957), in deciding the relative combining ability of a number of male and female parents to produce desirable hybrids is well known (Rao *et al.,* 1968). Hence in the present study, 12 cytoplasmic male sterile lines developed at IAC were crossed with 12 restorers lines and the resulting 144 hybrids along with their parents were evaluated for shoot fly resistance and its related traits and yield. The differences among the parents and hybrids were significant for GCA effects for all the traits studied.

Among the parents selected for primary resistance based on high *per se* performance for low deadheart % along with high grain yield (Table 20), SPSFR 94002A (RBR cms) during rainy season and SPSFR 94003A (RBR cms), SPSFPR 94007A (PRBR cms) during postrainy season were good general combiners for low deadheart %. The grouping of parents based on high *per se* performance along with desirable GCA effcts (Table 22) revealed that the parents SPSFR 94002A (RBR cms), SPSFPR 94007A (PRBR cms) in rainy season and SPSFPR 94007A (PRBR cms) in postrainy season were found to have high desirable GCA effects for early seedling vigour. Regarding GCA effects for glossiness, SPSFR 94002A, SPSFR 94003A, SPSFR 94001A (RBR cms) and SPSFPR 94007A (PRBR cms) in rainy season, SPSFR 94003A (RBR cms), SPSFPR 94005A and SPSFPR 94007A (PRBR cms) in postrainy season were observed to be good general combiners. The parents, SPSFPR 94007A (PRBR cms) in rainy season, and SPSFPR 94005A, SPSFPR 94007A (PRBR cms) in postrainy season for 5th leaf length; SPSFPR 94005A, SPSFPR 94007A (PRBR cms) in rainy season for 5th leaf width; SPSFPR 94007A (PRBR cms) in rainy season and SPSFPR 94005A, SPSFPR 94007A (PRBR cms) in postrainy season for 5th leaf droopiness were found to have high desirable GCA effects. For trichome density, SPSFR 94001A (RBR cms), SPSFPR 94005A (PRBR cms) in rainy season and SPSFR 94001A (RBR cms) during postrainy season were found to have high desirable GCA effects among parents. In respect of egg count, the parents SPSFR 94001A (RBR cms), SPSFPR 94007A (PRBR cms) in rainy season and SPSFR 94003A (RBR cms), SPSFPR 94007A (PRBR cms) in postrainy season revealed significant desirable GCA effects.

Considering the uniformity in recovery, SPSFR 94002A, SPSFR 94001A (RBR cms), SPSFPR 94005A, SPSFPR 94007A (PRBR cms) in rainy season, and SPSFPR 94007A (PRBR cms) in postrainy season were good combiners among parents. Among parents, SPSFR 94001A (RBR cms) exhibited significant GCA effects for total tillers plant^{-1} and productive tillers plant^{-1} in postrainy season. While none of the parents exhibited significant GCA effects for the above two characters in the rainy season.

Considering the grain yield plant^{-1}, parents SPSFR 94002A (RBR cms) for yield-UNI and yield-I in rainy season and SPSFR 94001A (RBR cms) for yield-UNI and yield-I in postrainy season were found to have desirable GCA effects. Regarding the character plant height, SPSFR 94001A (RBR cms), SPSFPR 94005A (PRBR cms) in rainy season and SPSFPR 94005A (PRBR cms) in postrainy season were found to have desirable GCA effects. In respect of days to 50% flowering, SPSFPR 94005A (PRBR cms) in both rainy and postrainy seasons, and SPSFR 94002A (RBR cms) in postrainy season were observed to have positive GCA effect, and SPSFR 94002A, SPSFR 94001A (RBR cms) in rainy season were found to have negative GCA effects.

Table 22: Parents with high *per se* performance (selected for low deadheart % along with grain yield) with desirable GCA effects

Parents	High *per se* performance with desirable GCA effects for various traits	
	Rainy season	Postrainy season
1. SPSFR 94002A	Early seedling vigour, glossiness, deadheart %, uniformity in recovery, yield-UNI, yield-I, earliness	Lateness
2. SPSFR 94003A	Glossiness	Glossiness, egg count, deadheart%
3. SPSFR 94001A	Glossiness, egg count, trichome density, uniformity in recovery, plant height, earliness	Trichome density, total tillers, productive tillers,yield-UNI, yield-I
4. SPSFPR 94005A	Glossiness, trichome density, 5th leaf width, uniformity in recovery, plant height, lateness	Glossiness,5th leaf length, 5th leaf droopiness, plant height,lateness
5. SPSFPR 94007A	Early seedling vigour, egg count, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery	Early seedling vigour, glossiness, egg count, deadheart %, 5th leaf length,5thleafdroopiness,uniformity in recovery

Further a perusal of these results (Table 13) revealed that, SPSFPR 94007A (PRBR cms), ICSR 93031, ICSR 93010 (PRLR) for high seedling vigour; SPSFR 94003A, SPSFR 94031A (RBR cms), SPSFPR 94002A, SPSFPR 94005A (PRBR cms), ICSR 93031, ICSR 93011, ICSR 93009 (PRLR) for high glossiness; SPSFR 94031A (RBR cms), SPSFPR 94002A, SPSFPR 94007A (PRBR cms) for low egg count; SPSFR 94031, ICSV 88088 and ICSR 93009 for low deadheart %; SPSFR 94001A (RBR cms), SPSFPR 94001A, SPSFPR 94002A (PRBR cms), ICSV 712, ICSV 88088 (RBR) for trichome density; SPSFPR 94007A (PRBR cms), ICSR 93031, ICSR 93011, ICSR 93010 (PRLR) for 5th leaf length; ICSR 93031 and ICSR 93010 (PRLR) for 5th leaf width; SPSFPR 94007A (PRBR cms), ICSR 93031, ICSR 93010 (PRLR) for 5 thleaf droopiness; SPSFR 94031 (RBR cms), SPSFPR 94002A, SPSFPR 94007A (PRBR cms), ICSV 88088 (RBR), ICSR 93031, ICSR 93011 and ICSR 93010 (PRLR) for high uniformity in recovery; ICSA 89001 (SB cms) for total tillers; SPSFR 94031 (RBR cms), SPSFPR 94005A (PRBR cms), ICSR 93031, ICSR 93011, ICSR

93009, ICSR 93010 (PRLR) for plant height; SPSFPR 94005A (PRBR cms), ICSR 90002 (SBR) for lateness; ICSR 93031, ICSR 93011 (PRLR) for earliness were found to have desirable GCA effects across the seasons i.e., during both rainy and postrainy seasons.

Among the parents selected for recovery resistance, ICSA 20 showed desirable GCA effects for seedling vigour, 5th leaf length, 5th leaf droopiness, uniformity in recovery, yield-I, plant height and earliness during postrainy season and for total tillers in rainy season.

Further close examination of GCA effects for lines (Table 23) revealed that among lines SPSFR 94031A (for seedling vigour, glossiness, deadheart %, 5th leaf droopiness and uniformity in recovery), SPSFR 94001A (for egg laying, 5th leaf width and plant height), SPSFPR 94001A (for trichome density and lateness), SPSFPR 94007A (for 5th leaf length), ICSA 89001 (for total tillers and yield-UNI), SPSFR 94002A (for yield-I and earliness) were the best general combiners for rainy season. During postrainy season, ICSA 20 (for seedling vigour, 5th leaf droopiness, 5th leaf length, yield-I and earliness), SPSFPR 94007A (for glossiness, egg laying and deadheart %), SPSFPR 94001A (for trichome density), SPSFR 94031A (for uniformity in recovery), ICSA 89001 (for total tillers), SPSFR 94001A (for productive tillers and yield-UNI), ICSA 89001 (for plant height), and SPSFR 94002A (for lateness) were superior combiners.

Among testers, ICSR 93010 (for seedling vigour, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery and plant height), ICSR 93011 (for glossiness), ICSR 93009 (for egg laying), ICSV 88088 (for deadheart %), ICSV 712 (for trichome density and lateness), ICSR 93031 (for uniformity in recovery, productive tillers and earliness), ICSR 90005 (for yield-UNI, yield-I) were found to be the best general combiners during rainy season. ICSR 93010 (for seedling vigour, 5th leaf length, 5th leaf width and plant height), ICSR 93011 (for glossiness, uniformity in recovery, yield-UNI and earliness), ICSR 93031 (for egg laying), ICSV 88088 (for deadheart % and trichome density), ICSR 93009 (5th leaf droopiness), ICSR 89076 (for total tillers, productive tillers and lateness), ICSV 89030 (yield-I) were found to be best combiners for postrainy season (Table 24).

The study of specific combining ability effects (Tables 14-16) revealed significant and desirable SCA effects in several hybrid combinations, for primary resistance, recovery resistance to shoot fly and yield. The number of hybrids with significant desirable SCA effects and hybrid with high SCA effects in desirable direction for each trait in both seasons studied is given in Table 25.

SPSFR 94001A x ICSV 88088 (for early seedling vigour), SPSFR 94002A x ICSR 90005 (for glossiness, egg count and uniformity in recovery), SPSFPR 94005A x ICSV 712 (for deadheart %), ICSA 20 x ICSR 90014 (for trichome density), SPSFPR 94001A x ICSV 89030 (5th leaf length), SPSFR 94002A x ICSR 93010 (for 5th leaf width), SPSFPR 94005A x ICSR 93011 (for 5th leaf droopiness), SPSFPR 94002A x ICSR 89076 (for total tillers plant^{-1}), SPSFR 94001A x ICSR 93011 (for productive tillers plant^{-1}), SPSFR 94001A x ICSR 93011 (for yield-UNI), SPSFR 94031A x ICSV 712 (for yield-I), SPSFR 94002A x ICSR 90002 (for earliness), SPSFPR 94002A x ICSR 93010 (for lateness), SPSFR 94031A x ICSV 89015 (for plant height) in rainy season and SPSFPR 94001A x ICSR 90002 (for early seedling vigour and plant height), SPSFR 94031A x ICSR 93031(for glossiness), ICSA 20 x ICSR 90002 (for egg count), SPSFPR 94005A x ICSR 93009 (for deadheart % and 5th leaf length), SPSFPR 94007A x ICSR 89076 (for trichome density), ICSA 90002 x ICSR 93009 (for 5th leaf width), ICSA 89001 x ICSR 89076 (for 5th leaf droopiness), ICSA 89001 x ICSR 93009 (for uniformity in recovery), SPSFR 94003A x ICSR 90014 (for total tillers plant^{-1}), SPSFR 94002A x ICSR 90005 (for productive tillers plant^{-1}), SPSFR 94002A x ICSV 712 (for yield-UNI), ICSA 89004 x ICSR 90002 (for yield-I), ICSA 89001 x ICSV 712 (for earliness) and SPSFPR 94005A x ICSR 89076 (for lateness) in postrainy season were noticed to have high SCA effects.

The hybrid combinations were further categorised, based on high *per se* performance along with significant SCA effects in desirable direction for each trait in rainy and postrainy seasons were given in the Table 26. A further perusal of SCA effects over the two seasons (Table 15), revealed that, the SCA effects were not consistant for majority of characters for two seasons except for hybrids ICSA 89004 x ICSV 89030 (for 5th leaf length), SPSFR 94031A x ICSR 93031 (for uniformity in recovery), SPSFR 94031A x ICSV 712, SPSFR 94003A x ICSR 90005, ICSA 90002 x ICSR 93011 (for yield-I), SPSFPR 94002A x ICSR 93010 (for lateness) and SPSFPR 94007A x ICSV 88088 (for plant height) which were found consistant across the two seasons.

Table 23 : Lines showing superior combining ability for various traits

Characters	Rainy season		Postrainy season	
	Line	Group	Line	Group
1. Early seedling vigour	SPSFR 94031A (-0.74)	RBR cms	ICSA 20 (-0.89)	SB cms
2. Glossiness	SPSFR 94031A (-1.93)	RBR cms	SPSFPR 94007A (-2.99)	PRBR cms
3. Egg count Plant $^{-1}$	SPSFR 94001A (-0.43)	RBR cms	SPSFPR 94007A (-0.73)	PRBR cms
4. Deadheart %	SPSFR 94031A (-4.61)	RBR cms	SPSFPR 94007A (-14.22)	PRBR cms
5. Trichome density (mm ^{2})	SPSFPR 9400A (19.11)	PRBR cms	SPSFPR 94001A (54.10)	PRBR cms
6. 5^{th} leaf length (cm)	SPSFPR 94007A (2.78)	PRBR cms	ICSA 20 (4.16)	SB cms
7. 5^{th} leaf width (cm)	SPSFR 94001A (0.21)	RBR cms	No significant difference	-
8. 5^{th} leaf droopiness (cm)	SPSFR 94031A (1.03)	RBR cms	ICSA 20 (1.64)	SB cms
9. Uniformity in recovery	SPSFR 94031A (-1.54)	RBR cms	SPSFR 94031A (-0.71)	RBR cms
10.Total tillers plant $^{-1}$	ICSA 89001 (0.42)	SB cms	ICSA 89001 (0.80)	SB cms
11.Productive tillers plant $^{-1}$	No significant difference	-	SPSFR 94001A (0.51)	RBR cms
12.Yield-UNI (g plant $^{-1}$)	ICSA 89001 (9.17)	SB cms	SPSFR 94001A (11.26)	RBR cms
13.Yield-I (g plant $^{-1}$)	SPSFR 94002A (4.68)	RBR cms	ICSA 20 (8.98)	SB cms
14.Plant height (m)	SPSFR 94001A (13.25)	RBR cms	ICSA 89001 (12.39)	SB cms
15.Days to 50% flowering				
i. Earliness	SPSFR 94002A (-2.36)	RBR cms	ICSA 20 (-3.93)	SB cms
ii. Lateness	SPSFPR 94001A (1.64)	PRBR cms	SPSFR 94002A (2.71)	RBR cms

Table 24 : Testers showing superior combining ability for various traits

Characters	Rainy season		Postrainy season	
	Tester	Group	Tester	Group
1. Early seedling vigour	ICSR 93010 (-0.85)	PRLR	ICSR 93010 (-1.12)	PRLR
2. Glossiness	ICSR 93011 (-1.20)	PRLR	ICSR 93011 (-1.80)	PRLR
3. Egg count Plant ^{1}	ICSR 93009 (-0.32)	PRLR	ICSR 93031 (-0.46)	PRLR
4. Deadheart %	ICSV 88088 (-4.69)	RBR	ICSV 88088 (-12.79)	RBR
5. Trichome density (mm ^{2})	ICSV 712 (27.46)	RBR	ICSV 88088 (34.09)	RBR
6. 5th leaf length (cm)	ICSR 93010 (2.07)	PRLR	ICSR 93010 (3.67)	PRLR
7. 5th leaf width (cm)	ICSR 93010 (0.20)	PRLR	ICSR 93010 (0.27)	PRLR
8. 5th leaf droopiness (cm)	ICSR 93010 (0.83)	PRLR	ICSR 93009 (1.55)	PRLR
9. Uniformity in recovery	ICSR 93031 (-1.01)	PRLR	ICSR 93011 (-0.71)	PRLR
	ICSR 93010 (-1.01)	PRLR		
10.Total tillers plant ^{1}	No significant difference	-	ICSR 89076 (1.33)	SBR
11.Productive tillers plant ^{1}	ICSR 93031 (0.08)	PRLR	ICSR 89076 (0.56)	SBR
12.Yield-UNI (g plant ^{1})	ICSR 90005 (5.90)	SBR	ICSR 93011 (9.09)	PRLR
13.Yield-I (g plant ^{1})	ICSR 90005 (3.05)	SBR	ICSV 89030 (8.87)	RBR
14.Plant height (m)	ICSR 93010 (47.25)	PRLR	ICSR 93010 (29.14)	PRLR
15.Days to 50% flowering				
i. Earliness	ICSR 93031 (-2.19)	PRLR	ICSR 93011 (-2.96)	PRLR
ii. Lateness	ICSV 712 (0.83)	RBR	ICSR 89076 (2.88)	SBR

Table 25: Hybrids showing superior specific combining ability (SCA) for various traits

Traits		No. of hybrids with desirable SCA effects		Hybrid with superior SCA effect	
		Rainy	Postrainy	Rainy season	Postrainy season
1.	Early seedling vigour	5	7	SPSFR 94001A x ICSV 88088 (-1.68)	SPSFPR 94001A x ICSR 90002 (-2.72)
2.	Glossiness	5	1	SPSFR 94002A x ICSR 90005 (-3.40)	SPSFR 94031A x ICSR 93031 (-3.03)
3.	Egg count plant^{-1}	4	11	SPSFR 94002A x ICSR 90005 (-1.65)	ICSA 20 x ICSR 90002 (-1.57)
4.	Deadheart %	3	6	SPSFPR 94005A x ICSV 712 (-11.84)	SPSFPR 94005A x ICSR 93009 (-28.62)
5.	Trichome density (mm^{-2})	10	11	ICSA 20 x ICSR 90014 (64.19)	SPSFPR 94007A x ICSR 89076 (47.57)
6.	5th leaf length (cm)	10	12	SPSFPR 94001A x ICSV 89030 (7.38)	SPSFPR 94005A xICSR 9\3009 (6.84)
7.	5th leaf width (cm)	7	1	SPSFR 94002A x ICSR 93010 (0.74)	ICSA 90002 x ICSR 93009 (2.04)
8.	5th leaf droopiness (cm)	10	9	SPSFPR 94005A x ICSR 93011 (3.39)	ICSA 89001 x ICSR 89076 (3.46)
9.	Uniformity in recovery	7	12	SPSFR 94002A x ICSR 90005 (-2.50)	ICSA 89001 x ICSR 93009 (-2.09)
10.	Total tillers plant^{-1}	5	5	SPSFPR 94002A x ICSR 89076 (1.28)	SPSFR 94003A x ICSR 90014 (2.31)
11.	Productive tillers plant^{-1}	2	8	SPSFR 94001A x ICSR 93011 (0.59)	SPSFR 94002A x ICSR 90005 (1.55)
12.	Yield-UNI (g plant^{-1})	10	14	SPSFR 94001A x ICSR 93011 (37.69)	SPSFR 94002A x ICSV 712 (57.03)
13.	Yield-I (g plant^{-1})	9	15	SPSFR 94031A x ICSV 712 (13.75)	ICSA 89004 x ICSR 90002 (40.57)
14.	Days to 50% flowering i. Earliness	8	8	SPSFR 94002A x ICSR 90002 (-3.67)	ICSA 89001 x ICSV 712 (-6.71)
	ii.Lateness	2	17	SPSFPR 94002A x ICSR 93010 (3.66)	SPSFPR 94005A x ICSR 89076 (9.18)
15.	Plant height (m)	4	11	SPSFR 94031A x ICSV 89015 (38.14)	SPSFPR 94001A x ICSR 90002 (44.78)

Table 26 Hybrids showing high *per se* performance (selected for low deadheart % along with grain yield) with desirable SCA effects

Traits	Rainy season	Postrainy season
1 Early seedling vigour	SPSFR 94001A x ICSV 88088	SPSFR 94001A x ICSV 89030
2 Glossiness		SPSFR 94031A x ICSR 93031
3 Egg count		SPSFR 94031A x ICSR 93031
4 Trichome density		SPSFPR 94002A x ICSV 712
5 5th leaf length		SPSFR 94001A x ICSV 89030 SPSFR 94031A x ICSV 89030 SPSFPR 94002A x ICSV 89030
6 5th leaf width	SPSFR 94002A x ICSV 89015	
7 5th leaf droopiness		SPSFR 94001A x ICSV 89030 SPSFPR 94002A x ICSV 89030
8 Uniformity in recovery	SPSFR 94031A x ICSR 93031	SPSFPR 94002A x ICSV 89030 SPSFR 94031A x ICSR 93031
9 Yield LNI	SPSFPR 94002A x ICSV 89030	SPSFR 94002A x ICSV 712 SPSFPR 94002A x ICSR 93010
10 Yield I		SPSFR 94002A x ICSV 89015
11 Days to 50% flowering		
i Earliness		SPSFR 94001A x ICSV 89030
ii Lateness	SPSFPR 94002A x ICSR 93010	SPSFPR 94002A x ICSR 93010
12 Plant height		SPSFR 94001A x ICSV 89030 SPSFR 94001A x ICSR 93009

Commercial exploitation of heterosis in crop plants is regarded as a major breakthrough in the realm of plant breeding. Heterosis breeding had led to considerable yield improvement of several cereal crops including sorghum (Rai, 1979). A major breakthrough was achieved in sorghum production with the release of CSH-1 and CSH-4 during 1970's and CSH-9 in 1980s. This initial success in exploitation of hybrid vigour had led to the intensive identification of additional heterotic combinations. The development of cytoplasmic male sterile lines further enhanced the scope for exploitation of new heterotic combinations. Identification of superior hybrid combinations, combining high heterosis for grain yield along with shoot fly resistance for rabi season has received much attention in the recent years.

The results revealed the presence of high variation in heterosis over mid parent, better parent and check among different crosses for all attributes, during both seasons. Heterosis over mid parent, better parent and check was negative and highly significant for majority of crosses for egg count and deadheart % during postrainy season. A negative and highly significant heterosis will be desirable as for as shoot fly resistance is concerned as it indicates a decreased egg laying and lower deadheart % in F_1 hybrids. In the present study, 11 crosses over mid parent, 5 crosses over better parent and 35 crosses over check exhibited significant negative heterosis for egg count and 4 crosses over mid parent, one cross over better parent and 28 crosses over check exhibited significant negative heterosis for deadheart % in postrainy season. Thus out of 144 hybrids, 5 crosses and one cross for egg count and deadheart % respectively exhibited high and significant negative heterosis over better parent indicating the preponderance of non-additive gene action and role of overdominance for eggs plant^{-1} character. Halalli *et al.* (1982) studied heterosis over better parent for decreased egg laying and deadheart % and found that it was present only in few crosses but most of the heterotic effects were non-significant.

The ultimate aim is to produce heterotic hybrids for grain yield with shoot fly resistance. In the present study majority of the hybrids recorded positive and significant heterosis over mid parent, better parent and check for total tillers in both seasons, for productive tillers in postrainy season and negative for uniformity in recovery during rainy season. Significantly high positive heterosis over mid parent, better parent and check was exhibited for majority of crosses for yield-UNI and yield-I. Positive heterosis for grain yield was observed in the majority of hybrids as revealed by several workers (Harer and Bapat, 1982; Mehtre and Borikar, 1992).

Majority of hybrids (sixty one hybrids over mid parent, sixteen hybrids over better parent, four hybrids over check in postrainy season; fifty one hybrids over mid parent, twenty seven hybrids over better parent in rainy season) showed positive heterosis for plant height which is a desirable feature to obtain dual purpose hybrids. Postive heterosis for plant height was observed by Rao (1986). Days to 50% flowering recorded negative heterosis (thirteen hybrids over mid parent, three hybrids over better parent and seventy five hybrids over check) during postrainy season. Earliness is a desirable feature in rabi sorghum to escape from drought situations. Negative heterosis for days to flowering has been reported by Shankaregouda *et al*, 1972. Positive heterosis for days to 50% flowering was also observed in sixteen hybrids over mid parent, fifteen hybrids over better parent, five hybrids over check in postrainy season and one hybrid over check in rainy season as supported by Subbarao *et al.* (1976) and Thanky *et al.* (1981).

A perusal of these results revealed that few hybrids which exhibited high heterosis (over mid parent), heterobeltiosis (over better parent) and standard heterosis (over check). These were SPSFR 94002A x ICSV 712 for yield-UNI (in postrainy season), SPSFR 94002A x ICSV 88088 for yield-I (in rainy season), SPSFR 94002A x ICSV 89030 for yield-UNI (in postrainy season), SPSFR 94003A x ICSV 89030 for total tillers (in rainy season), SPSFR 94001A X ICSV 89015 for productive tillers (in postrainy season), SPSFR 94031A x ICSV 89015, SPSFR 94031A x ICSR 93031, SPSFR 94031A x ICSR 93011 and SPSFR 94001A x ICSR 93031 for uniformity in recovery (in rainy season), SPSFPR 94002A x ICSR 90002 for low egg count, deadheart % and trichome density (in postrainy season), SPSFPR 94001A x ICSR 90014 for total tillers (in rainy season), SPSFR 94003A x ICSR 93031 for yield-UNI (in postrainy season), SPSFR 94001A x ICSR 93009 for trichome density and yield-UNI (in postrainy season), SPSFR 94031A x ICSR 93009 for trichome density (in postrainy season) and ICSA 89001 x ICSR 93031 for total tillers and productive tillers (in rainy season).

The hybrid combinations were further categorised based on high *per se* performance for low deadheart % and grain yield along with high heterosis over better parent (heterobeltiosis) for low deadheart % and high grain yield were given in Table 27. In rainy season, the hybrids, SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088 for yield-UNI and yield-I, SPSFR 94002A x ICSV 89015, SPSFR 94002A x ICSV 89030, SPSFR 94031A x ICSV 89030 for yield-UNI, SPSFR 94001A x ICSV 89030 and SPSFR 94031A x ICSR 93031 for yield-I and in postrainy season, the hybrids, SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 89030, SPSFPR 94002A x ICSV 89030, SPSFR 94001A x ICSR 93009 for yield-UNI, SPSFR 94003A x ICSV 88088, SPSFR 94001A x ICSV 88088, SPSFPR 94007A x ICSR 90002, SPSFR 94031A x ICSR 93031, SPSFPR 94002A x ICSR 93010 for deadheart %, SPSFR 94031A x ICSV 89030 for yield-I showed significantly high heterosis over better parent. In these combinations, the parents must have favourable alleles fixed at different loci to provide maximum overdominance which was exhibited through high heterobeltiosis.

Table 27 Hybrids selected based on high *per se* performance (for low deadheart % and high grain yield) along with heterobeltiosis

	Hybrids	High *per se* performance with desirable heterosis for deadheart % & yield	
		Rainy season	Postrainy season
1	SPSFR 94002A x ICSV 712	Yield UNI, Yield I	Yield UNI
2	SPSFR 94002A x ICSV 88088	Yield UNI, Yield I	
3	SPSFR 94002A x ICSV 89015	Yield UNI	
4	SPSFR 94002A x ICSV 89030	Yield UNI	Yield UNI
5	SPSFR 94003A x ICSV 88088		Deadheart %
6	SPSFR 94001A x ICSV 88088		Deadheart %
7	SPSFR 94001A x ICSV 89030	Yield I	
8	SPSFR 94031A x ICSV 89030	Yield UNI	Yield I
9	SPSFPR 94002A x ICSV 712		Deadheart %
10	SPSFPR 94002A x ICSV 89030		Yield UNI
11	SPSFPR 94007A x ICSR 90002		Deadheart %
12	SPSFR 94001A x ICSR 93009		Yield UNI
13	SPSFR 94031A x ICSR 93031	Yield I	Deadheart %
14	SPSFPR 94002A x ICSR 93010		Deadheart %

A close perusal of these results (Tables 17-19) indicated hybrids SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 89030 (for yield-UNI) over check; SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 89030 (for yield-UNI), SPSFR 94002A x ICSV 88088 (for yield-I) over better parent; SPSFR 94002A x ICSV 712, SPSFR 94002A x ICSV 88088 (for yield-UNI and yield-I), SPSFR 94031A x ICSV 89030, SPSFR 94031A x ICSR 93031 (for yield-I), SPSFR 94001A x ICSV 88088, SPSFPR 94002A X ICSV 89030, SPSFR 94001A x ICSR 93031, SPSFR 94001A x ICSR 93009 and SPSFPR 94002A x ICSR 93010 (for plant height), SPSFPR 94002A x ICSV 712 and SPSFR 94001A x ICSR 93009 (for trichome density) over mid parent showed significant heterosis across the seasons.

A critical evaluation of hybrid combinations with high *per se* performance for low deadheart % and yield, heterosis over better parent, higher combining ability revealed the superiority of hybrids, SPSFR 94001A x ICSV 88088 with grain yield of 77.50 (UNI) and 99.25 (I) g plant-1, SPSFR 94002A x ICSV 712 with grain yield 46.03 (UNI) and 55.97 (I) g plant-1, SPSFR 94002A x ICSV 88088 with grain yield 55.25 (UNI) and 67.33 (I) g plant-1, SPSFR 94002A x ICSV 89015 with 57.39 (UNI) and 64.97 (I) g plant-1, SPSFR 94003A x ICSV 88088 with 63.75 (UNI) and 54.42 (I) g plant-1, SPSFR 94003A x ICSV 89030 with 56.26 (UNI) and 67.98 (I) g plant-1, SPSFR 94001A x ICSV 89030 with 72.88 (UNI) and 55.18 (I) g plant-1 belonging to RBR cms x RBR group, SPSFR 94001A x ICSR 93009 with grain yield 62.33 (UNI) and 56.00 (I) g plant-1 belonging to RBR cms x PRLR group, SPSFPR 94002A x ICSV 712 with 43.33 (UNI) and 73.67 (I) g plant-1 belonging to PRBR cms x RBR group and SPSFPR 94002A x ICSR 93010 with 47.88 (UNI) and 56.72 (I) g plant-1 belonging to PRBR cms x PRLR group for shoot fly resistance (as measured by deadheart %) with high grain yield compared to check M 35-1 which recorded 41.89 and 53.39 g plant-1 in UNI and I samples respectively. Further the hybrids SPSFR 94001A x ICSV 88088 and SPSFR 94001A x ICSR 93009 were selected during both rainy and postrainy seasons indicating their potentiality during both the seasons and may be recommended for wide cultivation after further confirmatory trials.

Finally, it may be concluded that 1. Breeding for resistance was effective in developing shoot fly resistant cms lines and restorer lines, 2. The susceptibility in the female parents was overdominant in the hybrid, 3. Resistance was required in both the parents to produce shoot fly resistant hybrids either for rainy or postrainy seasons, 4. Land race germplasm lines adapted to postrainy season including M 35-1 could be used as restorers in crosses with the resistant females to produce resistant hybrids, 5. Resistance was primarily due to ovipositional non-preference, 6. Several morphological, and leaf parameters affected resistance in addition to glossiness and trichomes, and 7. Season - specificity was observed in the expression of various traits associated with resistance particularly trichome density and recovery resistance parameters, 8. The observed season-specificity in the resistance as measured by deadhearts might be due to the observed differences in the expression of various traits (see point 7). Further, it may also be due to the biotype speceficity. The present studies can not over rule the role of biotype specificity. However, further controlled studies are required to differentiate the causes for the observed specificity in the resistance/susceptible levels.

Summary

CHAPTER VI

SUMMARY

The investigations were undertaken to study the genetics of shoot fly resistance in sorghum hybrids of cytoplasmic male sterile lines with special emphasis on the inheritance of different characters associated with shoot fly resistance in different seasons and to estimate the average degree of dominance for such characters besides information on the heterosis and nature of combining ability.

A line x tester experiment using a total of 12 cytoplasmic male sterile lines and 12 diverse restorers in nine sets (each set containing 4 x 4 combinations) was undertaken for this investigation. The resulting 144 hybrids and 24 parents along with eight standard checks were evaluated at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India in the rainy and postrainy (1995-96) seasons under natural and artificial environments with varying levels of shoot fly infestation. Fish meal and interlards were used to enhance shoot fly population in artificial environment. Observations were recorded on early seedling vigour, glossiness, egg count, deadheart %, 5^{th} leaf length, 5^{th} leaf width, 5^{th} leaf droopiness, trichome density, uniformity in recovery, total tillers, productive tillers, yield-UNI, yield-I, plant height and days to 50% flowering.

On the basis of over all performance for different characters, the resistant parental lines and hybrids involving them were superior compared to the susceptible parental lines and their corresponding hybrids. The susceptible parental lines had significantly more egg laying and higher percentage of deadhearts compared to resistant parental lines indicating the breeding method employed to develop the resistant parental lines was effective. Less number of eggs in the restorer parental lines indicated that the resistance in these lines is due ovipositional non-preference. The egg laying and deadheart % were more during rainy season compared to postrainy season indicating the strong seasonal effects on the genetic control of shoot fly resistance. The genotypes with primary resistance were found to be highly vigorous, more glossy with maximum 5^{th} leaf length, 5^{th} leaf width, 5^{th} leaf droopiness and high trichome density during rainy season compared to postrainy season. Uniformity in recovery, production of tillers $plant^{-1}$ and productive tillers

plant^{-1}, the parameters that reflect recovery resistance were more during postrainy season, while converse was the case with egg laying and deadheart damage. Resistant parental lines and hybrids showed maximum uniformity in recovery compared to susceptible parental lines and corresponding hybrids indicating that the tillers of resistant cultivars are less preferred by the shoot fly for egg laying and hence recovered fast compared to susceptible cultivars. Although susceptible cultivars and respective hybrids showed high total tiller production compared to resistant ones, there was no significant difference for productive tiller production among the hybrids. As expected, the susceptible parental lines recorded higher grain yield plant^{-1} compared to resistant parental lines indicating the need to improve the yield potential of the resistant parental lines through further breeding. However, the resistant hybrids had significantly high yield (2.25 to 1127.95% in postrainy season) than their parents on account of their heterotic condition. On the other hand, the yield in the susceptible hybrids was 6.78 to 186.13% higher than their parents.

Correlation studies revealed that the seedling characters, leaf parameters, leaf characters, recovery traits, grain yield and adaptation characters were correlated with shoot fly resistance parameters (egg count and deadheart %) but their interrelationships and the magnitude of association in the parents and hybrids varied in rainy and postrainy seasons.

Inheritance and gene action studies based on hybrid group means in relation to parental line group means indicated dominance/ intermediate/ over dominance for susceptibility (as measured by egg count and deadheart %) in various hybrid and parent groups. Dominant gene action was observed for low seedling vigour and non-glossiness in low temperature conditions. Season specificity for trichome density was reflected in the hybrid groups depending upon the type of parents involved and low density (associated with susceptibility) appeared to be additive. In the hybrids of PRBR cms (postrainy season-bred resistant female lines) group the trichome expression during rainy season was lower than postrainy season. On the other hand, it was reverse in the hybrids of RBR cms (rainy season-bred resistant cms lines) which supported low density in the postrainy season, and high density in the rainy season. Same was observed in the parents *per se* also. Considering gene action for leaf parameters it was clear that short leaf dominates over the long leaf. Similar results were also recorded for leaf width and leaf droopiness. In respect to uniformity in recovery among the hybrid groups, the hybrid groups involving rainy season-bred females recovered well in rainy season and postrainy season-bred female hybrid groups recovered well in post-rainy season demonstrating again the effectiveness of season-specific breeding that had been used in developing these resistant female groups. or this might have also be due to existence of the different biotypes with time or due to both. This however, needs to be further confirmed especially in no-choice conditions. Mean performance of hybrid groups with regard to different characters related to shoot fly resistance revealed that for shoot fly resistance (as measured by deadheart %) and its associated traits (high seedling vigour, high glossiness, high trichome density and low egg laying) the hybrid groups of RBR cms x PRLR, PRBR cms x PRLR, RBR cms x RBR and PRBR cms x RBR were excellent. On the other hand, the hybrid groups of RBR cms x SBR, RBR cms x PRLR, PRBR cms x PRLR and SB cms x PRLR were performed well for recovery as reflected by high productive tiller number. The hybrids involving PRLR group as restorers (RBR cms x PRLR and PRBR cms x PRLR) were early and tall in all environments during both seasons compared to hybrids involving susceptible line groups (SB cms and SBR) which were late and dwarf. The earliness observed in the resistant hybrid groups might confer advantage in escaping the commonly occurring terminal drought in postrainy season.

Combining ability studies revealed that among lines SPSFR 94031A (for seedling vigour, glossiness, deadheart %, 5th leaf droopiness and uniformity in recovery), SPSFR 94001A (for egg laying, 5th leaf width and plant height), SPSFPR 94001A (for trichome density and lateness), SPSFPR 94007A (for 5th leaf length), ICSA 89001 (for total tillers and yield-UNI), SPSFR 94002A (for yield-I and earliness) were the best general combiners for rainy season. During postrainy season ICSA 20 (for seedling vigour, 5th leaf droopiness, 5th leaf length, yield-I and earliness), SPSFPR 94007A (for glossiness, egg laying and deadheart %), SPSFPR 94001A (for trichome density), SPSFR 94031A (for uniformity in recovery), ICSA 89001 (for total tillers), SPSFR 94001A (for productive tillers and yield-UNI), SPSFPR 94005A (for plant height) and SPSFR 94002A (for lateness) were superior combiners.

Among testers, ICSR 93010 (for seedling vigour, 5th leaf length, 5th leaf width, 5th leaf droopiness, uniformity in recovery and plant height), ICSR 93011 (for glossiness), ICSR 93009 (for egg laying), ICSV 88088 (for deadheart %), ICSV 712 (for trichome density and lateness), ICSR 93031 (for uniformity in recovery, productive tillers and earliness) and ICSR 90005 (for yield-UNI and yield-I) were found to be the best general combiners during rainy season. ICSR 93010 (for seedling vigour, 5th leaf length, 5th leaf width and plant height), ICSR 93011 (for glossiness, uniformity in recovery, yield-UNI and earliness), ICSR 93031 (for egg laying), ICSV 88088 (for deadheart % and trichome density), ICSR 93009 (5th leaf droopiness), ICSR 89076 (for total tillers, productive tillers and lateness) and ICSV 89030 (yield-I) were found to be best combiners for postrainy season.

A perusal of GCA effects in combination with high *per se* performance (for low deadheart % with high grain yield) over two seasons revealed that, SPSFPR 94007A (PRBR cms) for high seedling vigour; SPSFR 94003A (RBR cms) and SPSFPR 94007A (PRBR cms) for high glossiness; SPSFPR 94007A (PRBR cms) for low egg count; SPSFR 94001A (RBR cms) for trichome density; SPSFPR 94007A (PRBR cms) for 5th leaf length; SPSFPR 94007A (PRBR cms) for 5th leaf droopiness; SPSFPR 94007A (PRBR cms) for high uniformity in recovery; SPSFPR 94005A (PRBR cms) for plant height; SPSFPR 94005A (PRBR cms) for lateness were found to have desirable GCA effects across the seasons i.e., during both rainy and postrainy seasons.

A further perusal of SCA effects over the two seasons, revealed that, the SCA effects were not consistent for majority of characters for two seasons except for hybrids ICSA 89004 x ICSV 89030 (for 5th leaf length), SPSFR 94031A x ICSR 93031 (for uniformity in recovery), SPSFR 94031A x ICSV 712 , SPSFR 94003A x ICSR 90005, ICSA 90002 x ICSR 93011 (for yield-I), SPSFPR 94002A x ICSR 93010 (for lateness) and SPSFPR 94007A x ICSV 88088 (for plant height).

SPSFR 94001A x ICSV 88088 (for early seedling vigour), SPSFR 94002A x ICSR 90005 (for glossiness, egg count and uniformity in recovery), SPSFPR 94005A x ICSV 712 (for deadheart %), ICSA 20 x ICSR 90014 (for trichome density), SPSFPR 94001A x ICSV 89030 (5th leaf length), SPSFR 94002A x ICSR 93010 (for 5th leaf width), SPSFPR 94005A x ICSR 93011 (for 5th leaf droopiness), SPSFPR 94002A x ICSR 89076 (for total tillers plant^{-1}), SPSFR 94001A x ICSR 93011 (for productive tillers plant^{-1}), SPSFR 94001A x ICSR 93011 (for yield-UNI), SPSFR 94031A x ICSV 712 (for yield-I), SPSFR 94002A x ICSR 90002 (for earliness), SPSFPR 94002A x ICSR 93010 (for lateness), SPSFR 94031A x ICSV 89015 (for plant height) in rainy season and SPSFPR 94001A x ICSR 90002 (for early seedling vigour and plant height), SPSFR 94031A x ICSR 93031(for glossiness), ICSA 20 x ICSR 90002 (for egg count), SPSFPR 94005A x ICSR 93009 (for deadheart % and 5th leaf length), SPSFPR 94007A x ICSR 89076 (for trichome density), ICSA 90002 x ICSR 93009 (for 5th leaf width), ICSA 89001 x ICSR 89076 (for 5th leaf droopiness), ICSA 89001 x ICSR 93009 (for uniformity in recovery), SPSFR 94003A x ICSR 90014 (for total tillers plant^{-1}), SPSFR 94002A x ICSR 90005 (for productive tillers plant^{-1}), SPSFR 94002A x ICSV 712 (for yield-UNI), ICSA 89004 x ICSR 90002 (for yield-I), ICSA 89001 x ICSV 712 (for earliness) and SPSFPR 94005A x ICSR 89076 (for lateness) in postrainy season were noticed to have high SCA effects.

The results revealed the presence of high variation in heterosis over mid parent, better parent and check among different crosses for all attributes, during both seasons. A critical evaluation of hybrid combinations with high *per se* performance for low deadheart % with high heterosis over better parent and combining ability revealed the following superior hybrids having high grain yield in postrainy season: SPSFR 94001A x ICSV 88088 with grain yield of 77.50 (UNI) and 99.25 (I) g plant-1, SPSFR 94002A x ICSV 712 with grain yield 46.03 (UNI) and 55.97 (I) g plant-1, SPSFR 94002A x ICSV 88088 with grain yield 55.25 (UNI) and 67.33 (I) g plant-1, SPSFR 94002A x ICSV 89015 with 57.39 (UNI) and 64.97 (I) g plant-1, SPSFR 94003A x ICSV 88088 with 63.75 (UNI) and 54.42 (I) g plant-1, SPSFR 94003A x ICSV 89030 with 56.26 (UNI) and 67.98 (I) g plant-1, SPSFR 94001A x ICSV 89030 with 72.88 (UNI) and 55.18 (I) g plant-1 belonging to RBR cms x RBR group, SPSFR 94001A x ICSR 93009 with grain yield 62.33 (UNI) and 56.00 (I) g plant-1 belonging to RBR cms x PRLR group, SPSFPR 94002A x ICSV 712 with 43.33 (UNI) and 73.67 (I) g plant-1 belonging to PRBR cms x RBR group and SPSFPR 94002A x ICSR 93010 with 47.88 (UNI) and 56.72 (I) g plant-1 belonging to PRBR cms x PRLR group compared to check M 35-1 which recorded 41.89 and 53.39 g plant-1 in UNI and I samples respectively. Further the hybrids SPSFR 94001A x ICSV 88088 and SPSFR 94001A x ICSR 93009 were selected during both rainy and postrainy seasons indicating their potentiality during both the seasons and may be recommended for wide cultivation after further confirmatory trials.

Finally, it may be concluded that 1. Breeding for resistance was effective in developing shoot fly resistant cms lines and restorer lines, 2. The susceptibility in the female parents was overdominant in the hybrid, 3. Resistance was required in both the parents to produce shoot fly resistant hybrids either for rainy or postrainy seasons, 4. Land race germplasm lines adapted to postrainy season including M 35-1 could be used as restorers in crosses with the resistant females to produce resistant hybrids, 5. Resistance was primarily due to ovipositional non-preference, 6. Several morphological, and leaf parameters affected resistance in addition to glossiness and trichomes, and 7. Season - specificity was observed in the expression of various traits associated with resistance particularly trichome density and recovery resistance parameters. 8. The observed season-specificity in the resistance as measured by deadhearts might be due to the observed differences in the expression of various traits (see point 7). Further, it may also be due to the biotype speceficity. The present studies can not over rule the role of biotype specificity. However, further controlled studies are required to differentiate the causes for the observed specificity in the resistance/susceptible levels.

Literature Cited

REFERENCES

Agarwal B L and Abraham C V 1985 Breeding Sorghum for resistance to shoot fly and midge. In Proceedings of International Sorghum Entomology workshop, 15-21 July 1984, Texas A&M University, College Station, Texas, USA. pp 371-383.

Agarwal B L and House L R 1982 Breeding for pest resistance in sorghum. In Sorghum in the eighties. Proceedings of the International Symposium on Sorghum, 2-7 Nov. 1981, ICRISAT, Patancheru, Andhra Pradesh, India. pp. 435-446.

Balakotaiah K, Rana B S, Tripathi D P and Rao N G P 1975 Genetic analysis of some exotic and Indian crosses in Sorghum X. Inheritance of resistance to sorghum shoot fly. Indian Journal of Genetics and Plant Breeding. 35:344-347.

Bapat D R and Mote U N 1982 Sources of shoot fly resistance in Sorghum. Journal of Maharashtra Agricultural Universities 7:238-240.

Bernays E A, Chapman R F and Woodhead S 1983 Behaviour of newly hatched larvae of *Chilo partellus* Swinhoe (Lepidoptera:Pyralidae) associated with their establishment in the host plant, sorghum. Bulletin of Entomological Research. 73:75-83.

Biradar S G and Borikar S T 1983 Genetics of basal internodal length in sorghum (En). Sorghum News Letter 26:90-91.

Biradar S G and Borikar S T 1985 Genetic analysis of shoot fly resistance in relation to growth stages in sorghum. Journal of Plant Breeding 95 (2):173-178

Blum A 1967 Varietal resistance in sorghum to the sorghum shoot fly (*Atherigona varia* var. *soccata*) Crop Science. 7:461-462.

Blum A 1968 Anatomical phenomena in seedlings of shoot fly (*Atherigona varia soccata*). Crop Science. 9:508-510.

Blum A 1969a Factors associated with tiller survival in sorghum varieties resistant to the sorghum shoot fly (*Atherigona varia soccata*).Crop Science. 8:388-391.

Blum A 1969b Oviposition preference by the sorghum shoot fly (*Atherigona varia soccata*) in Progenies of susceptible x resistant sorghum crosses. Crop Science 9:695-696.

Blum A 1972 sorghum breeding for shoot fly resistance. In Control of sorghum shoot fly (ed M G Jotwani and W R Young). Oxford & IBH,New Delhi. pp 180-191.

Borikar S T and Chopde P R 1980 Inheritance of shoot fly resistance under three levels of infestation sorghum. Amdica 25:175-184.

Borikar S T and Chopde P R 1981 Inheritance of shoot fly resistance in sorghum. Journal of Maharashtra Agricultural Universities 6:47-48.

Borikar S T and Chopde P R 1982 Genetics of resistance to sorghum shoot fly. Zeitschrift fur pflanzenzuchtung 88 (3) : 220-224.

Borikar S T, Chundurwar R D and Chopde P R 1982 Genetic variability for shoot fly resistance in sorghum. Journal of Maharashtra Agricultural Universities 7(3):223-225.

Burton G W, Hanna W W, Johnson J C, Jr Jeuck D B, Monson W G, Prwell J B, Wells H D and Wildstorm N W 1977 Pleiotropic effects of the trichome-less gene in pearl millet on transpiration, forage quality and pest resistance. Crop Science 17:613-616.

Chundurwar R D, Karanjkar R R and Borikar S T 1992 Stability of shoot fly resistance in sorghum. Journal of Maharashtra Agricultural Universities. 17 (3):380-383

Comstock R E and Robinson H F 1952 Estimation of average dominance of genes. In Heterosis (Iowa State College Press, Ames) .pp. 494

Davies J C and Seshu Reddy K V 1980 Shoot fly species and their graminacious hosts in Andhra Pradesh, India. Presented at the International Study Workshop on the sorghum shoot fly, 5-8 May 1980 ICIPE, Nairobi, Kenya.

Dabholkar A R, Lal G S, Mishra R C and Brache N B 1989 Combining ability analysis of resistance of sorghum to shoot fly. Indian Journal of Genetics and Plant Breeding 49: 325-330.

Deeming J C 1972 A review of the taxonomy of African shoot flies in sorghum. In control of sorghum shoot fly (Jotwani M G and Young W R eds.) New Delhi India, Oxford and IBH.

Doggett H and Majisu B N 1965 Sorghum breeding research. Annual report of East African Agriculture and Forestry Research Organization pp. 70-79.

Doggett H and Majisu B N 1966 Sorghum, millet and maize breeding. Annual Report of East African Agriculture and Forestry Research Organization. pp. 108-110.

Doggett H, Starks K J and Eberhart S A 1970 Breeding for resistance to the sorghum shoot fly. Crop Science 10:528-531.

Doggett H 1972 Breeding for resistance to sorghum shoot fly in Uganda. In control of sorghum shoot fly (Jotwani M G and Young W R eds.) New Delhi India, Oxford and IBH pp.192 -201.

Farah M A 1992 Seasonal variation in sorghum resistance to shoot fly (*Atherigona soccata* Rondani) (En). M.Sc., Thesis, Andhra Pradesh Agricultural University; Hyderabad, Andhra Pradesh, India PP.102

FAO (Food and Agriculture Organization) 1994 FAO Production year book 1994 vol.48.

Gibson P T and Maiti R K 1983 Trichomes in segregating generations of sorghum matings I. Inheritance of presence and density. Crop Science 23:73-75.

Hadley N F 1981 Cuticular lipids of terrestrial plants and arthropods:A Comparison of their structure, composition and water proofing function. Biological Review 56:23-47.

Halalli M S, Gowda B T S, Kulkarni K A and Goud J V 1982 Inheritance of resistance to shoot fly (*Atherigona soccata* Rond.) in Sorghum (*Sorghum bicolor* (L.)Moench). (En). SABRAO Journal 14(2):165-170.

Halalli M S, Gowda B T S, Kulkarni K A and Goud J V 1983 Evaluation of advanced generation progenies for resistance to shoot fly in sorghum. (En). Indian Journal of Genetics and Plant Breeding 43(2):291-293.

Harer P N and Bapat D R 1982 Heterosis studies in grain sorghum. Journal of Maharashtra Agricultural Universities. 7 (1):30-32.

International Crops Research Institute for the Semi-Arid Tropics, Annual Report for 1992 Patancheru, Andhra Pradesh, India.

International Crops Research Institute for the Semi-Arid Tropics, Annual report for 1993 Patancheru, Andhra Pradesh, India.

Jadhav S S, Mote U N and Bapat D R 1986 Biophysical plant characters contributing to shoot fly resistance. Sorghum Newsletter 29-70.

in K K and Bhatnagar M P 1962 Studies on varietal resistance to the Jowar shoot fly. Indian Journal of Genetics and Plant Breeding 22:224-229.

Jotwani M G 1981 Insect resistance in sorghum plants. Insect Science and its application 2: 93-98.

Jotwani M G and Davies J C 1980 Insect resistance studies in sorghum at International Institutes and National Programs with special reference to India. In Proceedings of the Short course in host plant resistance(Ed. M K Harris) Texas A&M University, College Station, Texas, USA pp.224-236.

Jotwani M G and Srivastava K P 1970 Studies on sorghum lines resistant against shoot fly *Atherigona varia soccata* Rond. Indian Journal of Entomology 32:1-3.

Jotwani M G, Marawaha K K, Srivastava K M and Young W R 1970 Seasonal incidence of shoot fly (*Atherigona varia soccata* Rond.) in jowar hybrids at Delhi. Indian Journal of Enotomology 32:7-15.

Jotwani M G, Sharma G C, Srivastava B G and Marwaha K K 1971 Ovipositional response of shoot fly (*Atherigona soccata* Rond.) on some of the promising resistant lines of sorghum. Investigations on insect pests of sorghum and millets (1965-1970) Final technical report (Ed. Pradhan S) Division of Entomology, Indian Agricultural Research Institute, New Delhi.pp. 119-122.

Jotwani M G, Sharma G C and Srivastava K P 1974 Utility of non-preference for oviposition in developing sorghum lines resistant to shoot fly. Entomology News letter 4:38-39.

Karanjkar R R, Chundurwar R D and Borikar S T 1992 Correlation and path analysis of shoot fly resistance in sorghum. Journal of Maharashtra Agricultural Universities 17 (3):380-383

Kempthorne O 1957 An introduction to genetic statistics. John Wiley and Sons, Inc., New York.

Khurana A D 1980 Studies on resistance in forage sorghum to *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidae) and *Atherigona soccata* (Rond.) (Diptera:Muscidae). Ph.D. Thesis Haryana Agricultural University, Hisar, Haryana pp.160.

Khurana A D and Verma A N 1982 Amino acid contents in sorghum plants, resistant/ susceptible to stem borer and shoot fly. Indian Journal of Entomology 44(2):184-188.

Khurana A D and Verma A N 1985 Some physical characters in relation to stem borer and shoot fly resistance in sorghum. Indian Journal of Entomology 47 (1):14-19.

Klaipongpan N 1973 Inheritance of resistance of sorghum to the shoot fly (*Atherigona varia socaata* Rondani). M.S.Thesis Kansetsart University, Thailand.

Kulkarni N, Hussain sahib K and Murthy K N 1978 Combining ability for shoot fly resistance in sorghum. Indian Journal of Genetics and Plant Breeding 38(2):193-198.

Lal G S, Dabholkar A R , Barche N B and Mishra R C 1986 Genetic analysis of resistance of sorghum genotypes to shoot fly. In proceedings of sorghum symposium on agricultural development in Malwa and Nimar regions of Madhya Pradesh, Jawaharlal Nehru Viswa Vidyalaya pp.183-185.

Langham R M 1968 Inheritance and nature of shoot fly resistance. M.S.Thesis, University of Ahmedu Bello, Zaria, Nigeria.

Liang C H , Reddy C R and Dayton A D 1972 Heterosis, inbreeding depression and heritability in a systematic series of grain sorghum genotypes. Crop Science 12: 409-411.

Maiti R K 1977 Leaf trichomes on sorghum in relation to shoot fly resistance. Presented at the International Sorghum Workshop, March 1977, ICRISAT, Hyderabad, India.

aiti R K and Bidinger F R 1979 A simple approach to the identification of shoot fly tolerance in sorghum. Indian Journal of Plant Protection 7:135-140.

Maiti R K and Gibson P T 1983 Trichomes in segregating generation of sorghum matings II. Association with shoot fly resistance. Crop Science 23:76-79.

Maiti R K , Bidinger F R , Seshu Reddy K V, Gibson P and Davies J C 1980 Nature and occurence of trichomes in sorghum lines with resistance to the sorghum shoot fly. Joint progress report of Sorghum Physiology/ Sorghum Entomology Vol.3. ICRISAT, Patancheru.

Maiti R K, Prasada Rao K E, Raju P S and House L R 1984. The glossy trait in sorghum: its characteristics and significance in crop improvement. Field Crops Research 9:279-289.

Martin J H and Batt R F 1958 Studies on plant cuticle I. The waxy coverings of leaves. Annals of Applied Biology 46:375.

Mate S N, Phadnis B N and Taley Y M 1979 Studies on some physiological factors of shoot fly resistance in sorghum. Sorghum Newsletter 22:66-67.

Mehtre S P and Borikar S T 1992 Combining ability studies involving maldandi cytoplasm in sorghum. Journal of Maharashtra Agricultural Universities 17 (2): 247-249.

Moholkar P R 1981 Investigations on the resistance to shoot fly *Atherigona soccata* (Rondani) and stem borer *Chilo partellus* (Swinhoe) in sorghum. Ph.D. Thesis Indian Agricultural Research Institute. New Delhi.

Mote U N and Bapat D R 1988 Evaluation of some high Yielding sorghum derivatives for resistance to shoot fly. Journal of Maharashtra Agricultural University 13(2):230-231.

Mote U N, Kadam J R and Bapat D R 1983 Evaluation of high Yielding sorghum derivatives for resistance to shoot fly. Sorghum Newsletter 26:30

Mote U N, Kadam J R and Bapat D R 1985 Recovery resistance to shoot fly in some sorghum hybrids. Journal of Maharashtra Agricultural University 10(2):190-193.

Mote U N, Kadam J R and Bapat D R 1986 Antibiosis mechanism of resistance to sorghum shoot fly. Journal of Maharashtra Agricultural University 11:43-46.

Mowafi K 1967 Preliminary studies on the durra shoot fly, *Atherigona indica infuscata* (Emden) (Anthomyiidae: Diptera). B.Sc. dissertation, University of Khartoum, Sudan.

Nimbalkar V S and Bapat D R 1987 Genetic analysis of shoot fly resistance under high level of shoot fly infestation in sorghum. Journal of Maharashtra Agricultural University 12:331-334.

Nimbalkar V S and Bapat D R 1992 Inheritance of shoot fly resistance in sorghum. Journal of Maharashtra Agricultural Universities 17(1):93-96.

Nwanze K F, Reddy Y V R and Soman P 1990 The role of leaf surface wetness in larval behaviour of the sorghum shoot fly, *Atherigona soccata*. Entomologia Experimentalis et Applicata 56:187-195.

Ogwaro K 1978 Ovipositional behaviour and host plant preference of the sorghum shoot fly *Atherigona soccata* (Diptera:Anthomyiidae) .Entomologia Experimentalis et Applicata 23:189-199.

Omori T, Agarwal B L and House L R 1983 Component analysis of the factors influencing shoot fly resistance on sorghum (*Sorghum bicolor* L. Moench). Experimental Agricultural Research Queensland 17:215-218.

Omori T, Agarwal B L and House L R 1988 Genetic divergence for resistance to shoot fly *Atherigona soccata* Rond. in sorghum (*Sorghum bicolor* (L) Moench) and its relationship with heterosis. Insect Science and its Application 9:483-488.

Painter R H 1951 Insect resistance in crop plants. New York, USA Macmillan.

Panse V G and Sukhatme P V 1978 Statistical methods for agricultural workers. ICAR, New Delhi.

Paschal E H and Wilcox J R 1975 Heterosis and combining ability in exotic soybean germplasm. Crop Science 15:344-349

Patel G M and Sukhani T R 1990 Bio physical plant characters associated with shoot fly resistance. Indian Journal of Entomology 52:14-17.

Patel R H, Desai K B, Borad P K, Kukadia M V and Raja K R V 1984 Combining ability for shoot fly resistance in sorghum. Sorghum News Letter 27:87-88.

Paul M D, Kulkarni N and Murthy K N 1984 Genetic variability in the F_3 progenies for shoot fly resistance in grain sorghum. Indian Journal of Agricultural Sciences 54(4):253-255.

Ponnaiya B W X 1951a Studies on the genus *Sorghum* I. Field observations on sorghum resistance to the insect pest, *Atherigona indica* M. Madras University Journal 21:96-117.

Ponnaiya B W X 1951b Studies on the genus *Sorghum* to the insect pest, *Atherigona indica*. Madras University Journal 21:203-217.

Quinby J R 1970 Leaf and panicle size of sorghum parents and hybrids. Crop Science 10: 251 - 253.

Raghavaiah P and Joshi M G 1986 Combining ability studies in Emmer wheat. Indian Journal Genetics and Plant Breeding 46(3):476-483.

Raina A K 1981 Movement, feeding behaviour and growth of larvae of the sorghum shoot fly, *Atherigona soccata* (Resistant cultivars). Insect Science and its application 2 (1/2):77-81.

Raina A K 1982 Fecundity and oviposition behaviour of sorghum shoot fly *Atherigona soccata*. Entomologia Experimentalis et Applicata 31:381-385.

Raina A K 1985 Mechanisms of resistance to shoot fly in sorghum A review. In Proceedings of International sorghum entomology Workshop, 15-21 July, 1984 texas A&M University, College Station, Texas USA pp. 131-136.

Raina A K, Thindwa H Z, Othieno S M and Corkhill R T 1981 Resistance in sorghum to the shoot fly: Larval development and adult longevity and fecundity on selected cultivars. Insect Science and its application 2:99-103.

Raina A K, Thindwa H Z, Othieno S M and Douglass L W 1984 Resistance in sorghum to sorghum shoot fly (Diptera:Muscidae) oviposition on selected cultivars. Journal of Economic Entomology 77:648-651.

Rana B S, Barah B C, Binswanger H P and Rao N G P 1984 Breeding optimum plant types in sorghum. Indian Journal of Genetics and Plant Breeding 44:385-398.

Rana B S, Jotwani M G and Rao N G P 1981 Inheritance of host plant resistance to the sorghum shoot fly. Insect Science and its Application 2(1/2):105-109.

Rana B S, Singh B U and Rao N G P 1985 Breeding for shoot fly and stem borer resistance in sorghum. In proceedings of the International Sorghum Entomology Workshop, 15-21 July 1984, Texas A&M University, College Station. Texas, USA pp. 347- 360.

Rana B S, Tripathi D P, Balakotaiah K, Damodar R and Rao N G P 1975 Genetic analysis of some exotic x Indian crosses in sorghum selection for shoot fly resistance. Indian Journal of Genetics 35:350-355.

Rao N G P 1986 Dwarfing genes of sorghum in retrospect. Indian Journal of Genetics and Plant Breeding 46:80-87.

Rao N G P and Murthy B R 1970 Components if heterosis in two sorghum hybrids. Indian Journal of Genetics 30: 230- 236.

Rao S B P and Rao D V N 1956 Studies on the sorghum shoot fly, *Atherigona indica* Malloch (Anthomyiidae :Diptera) at Siraguppa, Mysore Agricultural Journal 31:158-174.

Rao N G P, Rana V K S and Tripathi D P 1968 Line x tester analysis of combining ability in sorghum. Indian Journal of Genetics and Plant Breeding 28(3):231-238.

Rao N G P, Rana B S, Balakotaiah K, Tripathi D P and Fayed M F S 1974 Genetic analysis of some exotic x Indian crosses in sorghum viii F_1 analysis of ovipositional non-preference underlying resistance to sorghum shoot fly. Indian Journal of Genetics and Plant Breeding 34:122-127.

Rao M, Sindgi S S and Srinivasulu G 1977 Breeding for shoot fly resistance in sorghum. Sorghum News Letter 13:32-38.

Sandhu G S, Dhaliwal G S and Sindhu B S 1986 Resistance of forage sorghum to shoot fly (*Atherigona soccata* Rond.). Indian Journal of Agricultural Sciences 56(11):753-756.

Shankaregouda B T, Madhav Rao and Mensinkai S W 1972 Heterosis and line x tester analysis of ability in selected lines of sorghum (*Sorghum bicolor* pers.) I. Magnitude of heterosis. Mysore Journal of Agricultural Sciences 6 (3):234-241.

Sharma G C, Jotwani M G, Rana B S and Rao N G P 1977 Resistance to the sorghum shoot fly, *Atherigona soccata* (Rondani) and its genetic analysis. Journal of Entomological Research 1:1-12.

Sharma G C and Rana B S 1983 Resistance to the sorghum shoot fly, *Atherigona soccata* (Rond.) and selection for Antibiosis. Journal of Entomological Research 7:133-138.

Sharma G C and Rana B S 1985 Genetics of ovipositional non-preference and dead-heart formation governing shoot fly resistance in sorghum. ---104-105.

Sesu Reddy and Davies J C 1978 Species of *Atherigona* in Andhra Pradesh. PANS 23:379-383.

Sesu Reddy K V and Davies J C 1979 A new medium for mass rearing of sorghum stem borer, *Chilo partellus* (Swinhoe) Lepidoptera:Pyralidae and its use in resistance screening. Indian Journal of Plant Protection 6:8-55.

Silva fernandes A M S 1965 Studies on plant cuticle VIII. Surface waxes in relation to water repellency. Annals of Applied Biology 66:297-304.

Singh S P 1986 Screening of forage sorghum genotypes for resistance to shoot fly *Atherigona soccata* (Rondani) and stem borer, *Chilo partellus* (Swinhoe) and to estimate avoidable Ph.D Thesis Haryana Agricultural University, Hissar, Haryana.

Singh R K and Chaudhary 1985 Biometrical techniques in genetics and breeding. International Bioscience Publishers. Hissar, India.

ingh S P and Jotwani M G 1980a Mechanisms of resistance in sorghum to shoot fly I Ovipositional non-preference. Indian Journal of Entomology 42:240-247.

Singh S P and Jotwani M G 1980b Mechanisms of resistance in sorghum to shoot fly II. Antibiosis. Indian Journal of Entomology 42:353-360.

Singh S P and Jotwani M G 1980c Mechanisms of resistance in sorghum to shoot fly IV. Role of morphological characters of seedlings. Indian Journal of Entomology 42:806-808

Singh R and Narayana K L 1978 Influence of different varieties of sorghum on the biology of the sorghum shoot fly. Indian Journal of Agricultural Science 48:8-12.

Singh B U and Rana B S 1986 Resistance in sorghum to the shoot fly *Atherigona socaata* Rondani. Insect Science and its application 7: 577-587.

Singh S P and Verma A N 1988 Inheritance of resistance to shoot fly, *Atherigona soccata* (Rondani) in forage sorghum. Journal of Insect Science 1 (1):49-52

Singh B U, Rana B S and Rao N G P 1981 Host plant resistance to mite(*Oligonychus indicus* H.) and its relationship with shoot fly (*Atherigona soccata* Rond.) resistance in sorghum. Journal of Entomological Research 5:25-30.

Singh S P, Jotwani M G, Raina B S and Rao N G P 1978 Stability to host plant resistance to sorghum shoot fly *Atherigona soccata*. Indian Journal of Entomology. 40:376-383.

Snedecor G W and Cochran W G 1967 Statistical methods (6th ed., Iowa State University Press, Ames,

Soto P E 1974 Ovipositional preference and antibiosis in relation to resistance to a sorghum shoot fly. Journal of Economic Entomology 67:265-267.

Srivastava AN, Singh K P, Mishra A R and Singh H G 1979 Combining ability in sorghum. Madras Agricultural Journal 66: 546-556.

Starks K J 1970 Increasing infestations of the sorghum shoot fly in experimental plots. Journal of Economic Entomology 63:1715-1716.

Starks K J, Eberhart S A and Doggett H 1970 Recovery from shoot fly attack in a sorghum diallel. Crop Science 10:519-522.

Subbarao G, Jagadish C A and House L R 1976 Combining ability studies in sorghum.II American x African crosses. Indian Journal of Heredity 8 (1/2): 51-57

Sukhani T R and Jotwani M G 1979 Effects of site of oviposition on shoot fly damage to different growth stages of sorghum seedling. Indian Journal of Entomology 41:366-370.

Tarumoto I 1980 Inheritance of glossiness of leaf blades in sorghum, *Sorghum bicolor* (L.) Moench. Japanese Journal of Breeding 30:237-240.

Taneja S L and Leuschner K 1985 Resistance screening and mechanisms of resistance in sorghum to shoot fly. In Proceedings of the International Sorghum Entomology Workshop, 15-21 July, 1984, Texas A&M University, College Station, Texas, USA pp. 115-129.

Thanky H H, Desei K B and Tikka S B S 1981 Heterosis and combining ability in grain sorghum (*Sorghum bicolor* (L.) Moe). Gujarat Agricultural University Research Journal 6(2):65-71.

Usman S 1968 Preliminary studies on the incidence of shoot fly on hybrid jowar under differential sowings. Mysore Journal of Agricultural Sciences. 2: 44-48.

Veda Moorthy G 1967 Insect pests of sorghum and their control (including sources of resistance). PANS 13:121-126.

Vijayalakshmi K 1993 Study of the interrelationship of important traits contributing to the resistance of shoot fly in *Sorghum bicolor* (L.). M.Sc. Thesis, Andhra Pradesh Agricultural University, Hyderabad.

Wongtong S and Palanakamjorn S 1975 Entomological research during 1975. In Thailand Natural Corn and Sorghum Program Annual Report 1975. Department of Agriculture, Kasetsart pp.301-302

Woodhead S 1987 The influence of surface chemicals of sorghum on the behaviour of the stem borer *Chilo partellus* (Swinhoe). In Proceedings of VI International Symposium on insect-plant relationships,Pau, France (In Press).