A Research and Network Strategy for Sustainable Sorghum Production Systems For Latin America

Tenth Season Report

(January–August 2000)

National Agricultural Research Systems In Latin America

Contents

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Executive summary

During the season, January to August 2000, major research activities were carried out at the Centro Internacional de Agricultura Tropical (CIAT) research farm, Cali, Colombia. These activities can be grouped broadly into 1) seed increase, 2) advancing the progenies and populations with selection for resistance to leaf diseases and high grain yield and boldness, and 3) backcrossing of the maintainer lines on to male-sterile lines. The materials seed increased are selected grain sorghum A/B, and R-lines, grain sorghum controls susceptible to acid soil conditions, grain sorghum hybrids made with acid soil tolerant A- and R-lines, pearl millet A/B lines, open pollinated populations, pollinators, and hybrids, and forage sorghum lines and hybrids. Several grain sorghum F_2 progenies were advanced with selection. An additional backcross was made to convert the selected sorghum maintainer lines into A-lines.

In addition, data received from the network collaborators in particular Zamorano, Hondurus (grain sorghum B- & R- lines and hybrids trials), Pescador, Cauca hill side, Colombia (grain sorghum B- & R- lines trials and pearl millet forage trial), Procampo, Buga, Colombia (grain sorghum B- & R- lines trials and hybrid trials, and forage pearl millet and sorghum trial) and Yopal, Colombian lowlands, colombia (pearl millet satelite trial). The analyses were carried out and the summarized results are presented in this report.

Further interaction with the partners showed that National programs of Brazil and Colombia are interested in the material. Colombia is interested to purse the release of pearl millet and sorghum for forage use. Several private sector cooperators, in particular, Semmentas Matsuda of Brazil, ORE program of Haiti, and Procampo and Generar Ltd (associated to NOVARTIS) of Colombia are interested in the grain sorghum parental lines and research work and supported financially for conducting the trials.

1. Background information

The 1999-second season (July–December) represented an improvement in the hybrid development and testing process. The activities were mainly conducted to obtain grain sorghum hybrids adapted to acid soil conditions with good agronomic performance, less susceptibility to leaf diseases and grain boldness. One hundred and twenty nine hybrids were evaluated in two locations at the Colombian Lowlands under different aluminum saturations (Matazul-60% and La Libertad-70%). Some hybrids significantly out yielded (41% more) Real 60, a Al^{+3} tolerant control (4.03 t ha^{-1}). Further, the hybrids were taller, earlier, and less susceptible to foliar diseases and had higher green leaf area at maturity, compared to Real 60. Identification of new male-sterile maintainer lines and conversion into male-sterile lines on different cytoplasms were also taken up.

Breeding process in sorghum for grain and forage purpose consisted of selections made in S_{45}, F_{35} and F_{15} progenies at Matazul and La Libertad. Regarding forage sorghum, 56 S_{45} were selected from 246 progenies evaluated. Selection was performed for high biomass, less susceptibility to foliar diseases and stem borer and high green area at maturity. Eleven lines from those selected produced biomass higher than 45 t ha^{-1}. ICSP HT (high tillering) and LG (large grain) populations were advanced through mass selection for the respective traits.

Pearl millet materials were verified for their identity by growing the seed from three different sources - International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), CIAT and Corporacion Colombiana de Investigacion Agropecuaria (CORPOICA). Some A/B lines did not match while others matched well among the sources.

Network activities were increased with the addition of the private companies from Colombia and Brazil. Data from Zamorano (Honduras) and Procampo (Colombia) were returned. Data base development were completed and represented a good source of information for all the collaborators.

2. Season I-2000 (January-August 2000) activities

The program for the first season of 2000 was carried out in twelve major areas.

- Seed increase of acid soil tolerant grain sorghum materials (A/B and R-lines) for dispatching to the collaborators and seed store
- Seed increase of acid soil susceptible grain sorghum materials (B and R lines) for inclusion in the nurseries
- Seed production of 54 advanced sorghum hybrids for dispatching to the collaborators
- Segregating sorghum breeding materials evaluation (large grain and high tillering S_{35}, and F_{35} and F_{45} from emasculated crosses)
- Seed increase of acid soil susceptible forage sorghum materials for inclusion as controls in the nurseries and trials
- Male steriles conversion by backcrossing
- Advancing of ICSP LG population with mass selection in isolated plots
- Seed increase of the forage sorghum variety IS 13868 and several new forage sorghum hybrids with the selected A-lines in a isolated plot
- Seed increase of pearl millet A/B lines, open pollinated populations and pollinators
- Seed production of pearl millet hybrids for evaluation at La Libertad 2000-II
- Seed increase of three open pollinated pearl millet populations in isolation plots
- A satellite pearl millet evaluation trial at Carimagua (Colombian lowlands) under 80% of aluminum saturation

2.1 *Crop establishment activities*

A general description of the materials planted in CIAT during the first season of 2000 is given in Table 1

Three different fields were used to complete the planting activities Main field was planted on March 3rd (seed increase of basic breeding materials and hybrid production), in C-1 northeast block, a field previously planted with sugar cane Isolations were planted in two different fields (J-1 and K-3) on February 16th, both fields previously planted with cassava

Twelve different sorghum A-lines were planted fifteen days after the planting of forage sorghum line, IS 13868 as a pollinator to obtain forage hybrids for further evaluation under acid soil conditions

The isolated field (K-3) used for pearl millet populations seed-production was planted twice with two different open pollinated populations (ICMV-IS 94206 and ICMP 87200) with one month of difference in the sowing time, in order to avoid cross pollination between populations

Fertilization was aimed to obtaining 80% of the optimum production with 120 kg of N, 32 kg of P, 95 kg of K and 15 kg of S per hectare Based on soil analysis, only N, Zn and B were applied

Crop establishment (due to superficial soil crust) represented one of the main problems Following this, flowering growth stage coincided with high rainfall during late March and April, which affected the crossing process Ergot incidence was not severe during this season

Armyworm (*Spodoptera* sp) and sugarcane borer (*Diatraea* sp) were biologically controlled with a fungus mixture of *Nomuraea rileyi*, *Metharrizium sp* and *Bacillus thuringiensis*, sprayed at 18 and 30 days after emergency Release of *Trichogramma exiguum and T atopovirilia* were also performed four times at every ten days after planting Atrazine spray (1,5-l ha^{-1}) was given as a pre-emergency application to control weeds Further weed control was done by hand during later stages of the crop

2.2 *Observation/and outcomes*

Bulk quantities of the A-, B-, and R- lines and grain sorghum acid soil susceptible lines were seed increased A single representative head in each line was harvested separately for further increases (Table 2) On average, 2-kg seed for each line was obtained and these would be dispatched to the collaborators whenever they request them

Fifty-three advance F_1 hybrids were increased satisfactorily, obtaining 2 to 3-kg of seed per each hybrid (Table 3) These materials would be dispatched during the second semester of 2000 to collaborators

Grain sorghum progenies (F_3s, F_4s and S_{45}) were evaluated and selected for grain yield potential (open heads with bold grain), less susceptibility to leaf diseases and for agronomic desirability For the selected materials, data on emergency, early vigor, plant height, days to flowering and grain color were recorded A single representative head was harvested separately for further seed increase and five to six similar looking plants were harvested and bulked for network trials

Twenty-seven S_6 progenies were selected in the S_5 large grain nursery from 39 progenies evaluated Segregation for height was present in six progenies, resulting in 33 selections, advanced for further evaluation under acid soil conditions Medium to short height plants with white bold grain represented the most common type of plants selected Days to flowering ranged from 59 to 70 days (Table 4)

Same selection process as in S_{45} of LG progenies, was carried out in the emasculated F_3 and F_4 progenies Selection for short height and brown bold grain represented the main criteria as a way to avoid bird damage Days to flowering showed a mean value of 69 (SD ± 4 43), and this resulted in 95 F_4 selections Selection in emasculated F_4s resulted in 50 F_4s with high proportion of white bold grain progenies

Sorghum evaluation for forage purpose was carried out for high biomass yield, the presence of brown mid rib (sweet stem), and the high percentage of green leaf area at maturity It is very important to point out, that the sweet stem presented in these materials, would be a good source of energy for animal

One hundred and ten S_6s progenies were selected from 198 progenies evaluated Based on high biomass values, 24 progenies were further selected for evaluation in the network trials with the collaborators (Table 5), the remaining selections would be evaluated at La Libertad under acid soil conditions (Table 6)

According to the male sterility response in some F_1s evaluated under acid soil conditions, the backcross process started during the first semester of 1999 in five BC_1s was continued to the second cycle Eleven new maintainers were identified and advanced to BC_1 stage and these would be planted during the first semester, 2001 Information on the maintainers and BCs is given in Table 7 Three lines are converted with A_1 cytoplasm and 21 lines with A_2 cytoplasm

The ICSP LG (large grain) population was subjected to mass selection and recombination under neutral soil conditions at CIAT farm This cycle had more number of male sterile plants in the population Selection for tan dwarf plants, with big earheads and large grain resulted in 200 each male-sterile and fertile plants The seed from these were mixed in 3 1 ratio to make up the bulk for the next cycle

Pearl millet materials were increased satisfactorily The purity of the materials was verified, and agronomic performance was recorded Pollinators and populations were scored and identified for forage, dual or grain purpose

The best forage performance in the open pollinated pearl millet varieties were showed by ICMP 87200, ICMV-IS 88305, ICMV-IS 94206, IP 18378, LHGP, TGP and SOSAT-C88, populations and IPC 0501, IPC 1705, IPC 0736 and TIFT 186 pollinators Further the new

populations introduced from ICRISAT-Patancheru. Dauro Rm3 and Leonis Rm2 were highly useful for forage purpose as both showed excellent performance under neutral soil conditions These two materials will be evaluated under acid soil conditions during the second semester of 2000 A/B lines ICMA/B 90111 and ICMA/B 88006 showed the best forage performance and they will be used in the forage hybrid programs

The forage sorghum IS 13868 isolation resulted in 100-kg of IS 13868 seed Further, 1 to 2 kg seeds of the hybrids with the selected A-lines planted in the same isolation were also obtained The hybrids will be evaluated under acid soil conditions at La Libertad during the second semester of 2000 Open pollinated pearl millet forage populations increased in isolated plots resulted in 50-kg of seed per each material Pearl millet materials, thus increased in large quantities would be used in the *Llanos* for forage and mulch purpose in farming systems experiments

3 Network trials

3.1 ZAMORANO, Honduras (Dr. Rafael Arturo Mateo)

Data sets from the network trials 1999, season II were received for grain sorghum B-, R-lines and hybrid trials The forage trial was not planted

The materials were planted at ZAMORANO on 12th November 1999 in a completely randomized block design Each trial was planted in three reps (four rows, five meters long) with Real 60 as a tolerant check and SPRU 94008 as a susceptible check An amount of 120-kg ha^{-1} of nitrogen and 45-kg ha^{-1} of P_2O_5 was applied Atrazine spray (Gesaprin 90 WDG 2-kg ha^{-1}) was given as an early post-emergency application Trials were harvested on 10th April 2000

The materials were well established, but severely affected by ergot and plant cycle was delayed when compared with the 1997 season II, both ergot and delayed life cycle resulted from the low temperatures prevalent during crop growth

The grain sorghum B-lines trial consisted of 16 entries In general, the materials showed good establishment with the exception of ICSB 94 and the susceptible check High values in the agronomic performance evaluation (2 77 ± STD 0 54) confirm the temperature sensitivity and the incidence of ergot The trial mean grain yield was 3 18 t ha^{-1} The acid soil tolerant line, Real 60 yielded 3 93 t ha^{-1} The B-lines which yielded 3 0 t ha^{-1} and above were selected The best three entries in the trial were SPB_2 94021, SPMD 94045 and SPMD 94004 When compared with the 1997 season II trial (46%), the coefficient of variation for the grain yield treatment was reduced (27 %), thus the data represented meaningful performance of the lines Other details can be found in Table 8

The grain sorghum R-lines trial consisted of 15 entries Establishment of the R-lines was better than the B-lines (1 35 early vigor score mean), however, the mean grain yield (2 93 t ha^{-1}) was lower The R-lines which yielded 3 t ha^{-1} and above were selected ICSR 110 and ICSR 91020 selected during this season were also selected in 1997 season II As in the B-

line trial, the coefficient of variation for grain yield was also low (25%). ICSR 91012, A 2267-2 and ICSR 93033 showed the best yield performance. Other details are given in Table 9.

The grain sorghum hybrid trial consisted of four entries. All hybrids showed poor establishment and were affected badly by ergot incidence and low temperature. Mean grain yield was 2.40 t ha^{-1}. Real 60 yielded 3.70 t ha^{-1}, one ton more than the best hybrid. Performance of the hybrids is given in Table 10.

3.2 *PESCADOR, Cauca hillside (Dr. Edmundo Barrios)*

The materials were planted at Pescador (Cauca) on 18th March 1999 in a completely randomized block design. Each trial was planted in three reps (four rows, three meters long) with Real 60 and Icaravan as acid soil tolerant checks. The field was ploughed twice with ox-ploughs along the contour lines, first form the top of the hill to the bottom and the second one from the bottom of the hill to the top. Weed control was done by glyphosate (3l ha^{-1}) at early stage of the crop, and later on by hand.

The heavy rains received after planting resulted in crusting problem, but this is not enough to reduce the sorghum materials emergency. However, pearl millet materials were affected more and early vigor was reduced. It is important to point out the reduction in plant height and the delay in days to flowering in all the trials.

Regarding to sorghum B-lines trial, it consisted of eight entries and one acid soil tolerant check, Icaravan. The lines selected for acid soil tolerance earlier did not do well under this condition. The lines SPMD 94019 and ICSB 89002 could be useful as male-sterile lines for producing hybrids adapted to hillside conditions. Unfortunately, it was not possible to obtain grain production because of excessive bird damage on these lines. The selection of the materials was based on agronomic desirability, and leaf disease resistance. Other information about the trial can be obtained from Table 11.

The grain sorghum R-line trial consisted of eight entries and one acid soil tolerant check, Real 60. As in the B-line trial, none of the entries tested (Table 12) was better than the check under this condition. However, lines like ICSR 110 and ICSR 194 could be a source of male parents for producing hybrids.

Regarding to the pearl millet trial (Table 13), four open pollinated populations were selected from 10 populations tested. Selection was based on the evaluations for plant stand, green leaf area and high biomass production.

The performance of sorghum and pearl millet materials for grain production under this condition is not so important as dual or forage purpose, because the forage or dual lines could fit the need for mulch to control soil erosion and for animal feed. Actually, research for soil organic matter incorporation and soil erosion control had been carried out with sorghum and pearl millet materials at Pescador and Quilichao by CIAT (Centro Tropics and FIDAR (Fundacion para la investigacion el desarrollo agricola).

3.3 PROCAMPO-Buga, fertile soils (Dr. Gustavo Lemus)

PROCAMPO S A is a seed company located in the Cauca valley, which produce seed for different locations in Colombia, including fertile valleys in Cauca and Tolima, drought zones in the northern coast and acid soils in the llanos

Data sets from the Procampo network trials 1999, season II were received for grain sorghum B- R- and hybrids trials and forage sorghum and pearl millet trial The materials were planted at Procampo station in Buga (Cauca Valley) under fertile soil conditions on 12th October 1999 in a completely randomized block design Each trial was planted in three reps (two rows, three meters long) with Real 60 as an acid soil tolerant check for grain purpose trials and Icaravan for forage purpose trial SPRU 94008 was used as an acid soil susceptible check in all trials Fertilization was performed as basal dose with 100 kg ha^{-1} of KCl, DAP and urea A complete dose of nitrogen was given 35 days after planting with 150 kg ha^{-1} of urea Atrazine spray (1 5 l ha^{-1}) was given as an early post-emergency application Armyworm (*Spodoptera frugiperda*) was controlled with pirimor Trials were harvested on 12th February 2000

Procampo is interested in dwarf, early and high yielding advanced parental lines for hybrid production, with resistance to drought and leaf diseases Regarding to the grain sorghum B-lines trial, seven lines from 16 entries were selected based on their agronomic performance, especially for plant height (dwarf) and grain boldness SPMD 94045 (1275), as Dr Lemmas suggested, would be the best B- line in the trial for grain production, and thus is in conformity with the data obtained across the network trials ICSB 94 showed the highest yield (4 t ha^{-1}), two times the acid soil tolerant check The mean grain production was 1 6 t ha^{-1} Other details are given in Table 14

In the grain sorghum R-line trial, three lines were selected from 15 entries tested ICSR 102 represented the best line in the trial and could be a good source of high yielding performance and this is in conformity with the data obtained in previous trials and nurseries in acid and fertile soil conditions The mean grain yield was 1 42 t ha^{-1} whereas Real 60 yielded 2 3 t ha^{-1} Trial information is given in Table 15

The performance of the hybrid in the trial was not good for Procampo which needs dwarf hybrids for growing in high densities However, it is important to point out that the hybrids of ICSR 194 presented good head size and grain boldness Information about the trial is given in Table 16

Forage trial consisted of 12 open pollinated pearl millet populations and two advanced sorghum forage lines Fresh forage weight and grain yield data were taken in time for sorghum lines, while weight in the pearl millet plots were taken when they were dry

According to Dr Lemmas, who took the observations, IS 13868, a sorghum line and ICMP 92853, a pearl millet population are the best entries in the trial with good potential for forage production Icarvan, the acid soil tolerant check was also proposed for dualpurpose use Further IP 18378 and ICMV-IS 88305 pearl millet populations were also selected as materials for forage production Trial data are given in Table 17

3.4 *YOPAL, (Casanare) Colombian Lowlands. (Dr. Jaime Bernal)*

A pearl millet satellite trial was planted at Yopal during the second semester of 1998. It consisted of 16 open pollinated populations, one maintainer population and two pollinators. The materials were planted in a complete randomize block design with three replications (four rows, three meters long plots).

All the materials were well established with good vigor (1.74 SD ± 0.61). Plant stand was also high but the number of tillers per plant were reduced (3.87). Mean forage yield was 10.21 t ha^{-1} and it represented the limit to select materials under this condition. SOSAT-C88, ICMS 7703, ICMV-IS 88210 and ICMV-IS 88305 were the best populations, and IPC 0501, the best pollinator. HHVBC and GB 8735 corresponds to materials selected for grain purpose. Correlation analysis showed a direct relationship between early vigor and agronomic performance ($R = 0.90$, $P < 0.001$) and with forage yield ($R = 0.57$, $P = 0.009$). Information about this trial is given in Table 18.

3.5 *Interest in the Network*

Reconfirmation of the interest from old partners and addition of new collaborators to the network process was an important activity during the first semester of 2000. In regard of the NARS in Latin America: EMBRAPA, Brazil (Dr. Fredolino do Santos and Dr. Gillson Pita) continued with the collaboration. With regard to ZAMORANO, Honduras, unfortunately, the contact person was signed off form the institution, without giving any information about the network trials sent during the second semester of 1999. In FONAIAP, Venezuela, a new contact was made with Dr. Rafael Gonzalez, who works with grain sorghums at the CIAE-Portuguesa, and he expressed his intention to conduct the network trials under acid soil conditions. Regarding to CORPOICA, Colombia, an exceptional work has been done with the coordination of Dr. Jaime Bernal at La Libertad. Network trials and satellite trials had been planted in different locations and seasons at the lowlands (Yopal, La Libertad and Carimagua). The importance of forage sorghums and pearl millets in the region is increased. Intention is expressed to release both, sorghum and pearl millet material for forage production. At CIAT, the pearl millet satellite trial conducted at Carimagua opened the possibility to take up pearl millet as a crop adapted to the end of the crop season after the soybean, especially for its drought tolerance and high biomass production, which could be used for forage or mulch purposes. Selections made under hillside conditions also show the possibility to use forage sorghum and pearl millet in other programs at CIAT with good results in crop rotation systems.

With regard to private companies, important liaisons are made. In Brazil, Semmentes Matsuda (Dr. Jorge Matsuda) showed its intention to conduct network trials in different locations. Their objective is to select sorghum and pearl millet materials adapted to acid soil conditions, and for drought tolerance in photosensitive background. Drs. Elhassaint Magloire and Levael Eugene from ORE (Organisation pour la Rehabilitation de l'Environnement, Haiti) and CIAT respectively, indicated the need of photosensitive sorghum varieties with resistance to midge adapted to acid and in fertile soils with low nutrient contents and drought stress. In Colombia, PROCAMPO, S.A. (Dr. Gustavo Lemus) pointed out the importance of maintaining the sorghum and pearl millet network, especially

for the national seeds companies GENERAR Ltda. (Dr Hector Duque) an associated company of NOVARTIS in Colombia, also showed the importance of the network for Colombia, and confirmed their intention to work with the network

4 Future plans

The following activities are planned for 2000 season II

Grain sorghum evaluation under acid and fertile soil conditions (Pradera, Tolima valley, Buga, La Libertad, Matazul and Carimagua)

- Sorghum hybrids
- F_4s and F_5s grain sorghum progenies
- S_6s grain sorghum progenies

- Forage sorghum evaluation under acid soil conditions (La Libertad, Matazul and Carimagua)
  - Selected S_5s forage sorghum progenies (a satellite trial)
  - S_6s forage sorghum progenies

- Pearl millet evaluation under acid soil conditions (La Libertad, Matazul and Carimagua) pearl millet materials were divided according to their possible use in forage, dual and grain purpose. Materials classified as forage purpose will be planted in all locations and dual and grain purpose will be planted only at La Libertad

- New cycle of recombination of ICSP LG and HT populations in isolated plots

- Seed increases of ICMV-IS 94206 and ICMP 92853 under acid soil conditions

- Third cycle of recombination of pearl millet synthetic variety in isolation

- Introduction of pearl millet populations in CULTICORE (Carimagua) experiments

5 Staff

Dr Belum V S Reddy Senior Scientist (Breeder) ICRISAT, Patancheru Andhra Pradesh 502 324 India	Project lead scientist, PY02
Dr Hernan Ceballos Senior Scientist (Breeder) CIAT, Palmira AA 6713 Colombia	On-station supervisor
Ing Andres Felipe Rangel B Assistant Research CIAT, Palmira AA 6713 Colombia	On-station full time

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Table 1 Sorghum and pearl millet materials planted at CIAT, Palmira, 2000 season I

Material type	No of genotypes	Date planted
Sorghum	16	3-Mar-00
Male sterile lines		
Maintainers	16	3-Mar-00
Restorers	14	3-Mar-00
Checks	4	3-Mar-00
Acid soil grain susceptible lines	9	3-Mar-00
F_3s of emasculated crosses	68	3-Mar-00
F_3s of emasculated crosses	220	3-Mar-00
S_5s progenies of ICSP LG	39	3-Mar-00
S_5s progenies of ICSP HT	198	3-Mar-00
Acid soil forage susceptible lines	9	3-Mar-00
Male sterile BC_1s	5	3-Mar-00
Male sterile BC_0s	33	3-Mar-00
ICSP LG population	isolated plot	16-Feb-00
IS 13868 + male sterile lines	isolated plot	3-Mar-00
Pearl millet		
Populations	30	16-Feb-00
male sterile lines	14	16-Feb-00
Maintainers	12	16-Feb-00
Pollinators	25	16-Feb-00
ICMV-IS 94206	isolated plot	16-Feb-00
ICMP 87200	isolated plot	3-Apr-00
ICMV-IS 88305	isolated plot	3-Apr-00

Table 2 Grain sorghum materials harvested at CIAT, Palmira, 2000 season I

Maintainers		Restorers		Al^{+3} Susceptible (grain)	
Plot	Pedigree	Plot	Pedigree	Plot	Pedigree
3	SBL 107	1	REAL 60	5	SPRU 94008
1117	ICSB 38	2	ICARAVAN	42	CEM 342 1-2-2
1142	ICSB 73	4	A 2267-2	76	ICSV 210
1152	ICSB 89	39	CEM 328/3-3-1-1	1173	ICSB 88015
1156	ICSB 94	92	IS 21629	1279	SPMD 94050
1178	ICSB 89002	213	ICSR 102	1492	SPGM 94067
1234	SPMD-B 94004	222	ICSR 110	1503	SPAN 94008
1236	SPMD-B 94006	288	ICSR 194	1523	SPLB 94003
1251	SPMD-B 94019	407	ICSR 91012	1526	SPLB 94005
1269	SPMD-B 94036	415	ICSR 91020-1	1537	SPLB 94015
1275	SPMD-B 94045	478	ICSR 93033		
1296	SPHB-B 94006	504	ICSV 93042		
1614	SPA2-B 94013	801	IS 30469-1187-2		
1617	SPA2-B 94016	803	IS 30469-1187-4		
1623	SPA2-B 94021	852	ICSR 143		
1632	SPA2-B 94029	969	ICSV 95126		
1643	SPA2-B 94039	1065	GD 27669		

Table 3 Grain sorghum hybrids developed at CIAT, Palmira, 2000 season I

Short hybrids (< 1.70 m)			Medium tall hybrids (1.71-1.90 m)			Tall hybrids (> 1.91m)		
Plot	Parents		Plot	Parents		Plot	Parents	
1142 *	213 ICSB 73	* ICSR 102	1117 *	407 ICSA 38	* ICSR 91012	1117 *	803 ICSA 38	* IS 30469-1187-4
1142 *	852 ICSB 73	* ICSR 143	1117 *	478 ICSA 38	* ICSR 93033	1117 *	969 ICSA 38	* ICSV 95126
1152 *	852 ICSB 89	* ICSR 143	1117 *	504 ICSA 38	* ICSV 93042	1117 *	1 ICSB 38	* Real 60
1178 *	1065 ICSA 89002	* GD 27669	1156 *	407 ICSA 94	* ICSR 91012	1142 *	969 ICSA 73	* ICSV 95126
1178 *	213 ICSB 89002	* ICSR 102	1178 *	222 ICSB 89002	* ICSR 110	1142 *	288 ICSB 73	* ICSR 194
1178 *	478 ICSB 89002	* ICSR 93033	1234 *	1 SPMD-A 94004	* RFAI 60	1142 *	801 ICSB 73	* IS 30469-1187-2
1236 *	478 SPMD-B 94006	* ICSR 93033	1236 *	415-1 SPMD-A 94006	* ICSR 91029-1	1142 *	803 ICSB 73	* IS 30469-1187-4
1251 *	213 SPMD-B 94019	* ICSR 102	1251 *	288 SPMD-B 94019	* ICSR 194	1142 *	222 ICSB 73	* ICSR 110
1251 *	478 SPMD-B 94019	* ICSR 93033	1269 *	288 SPMD-B 94036	* ICSR 194	1142 *	504 ICSB 73	* ICSV 93042
1269 *	213 SPMD-B 94036	* ICSR 102	1614 *	478 SPA2-A 94013	* ICSR 93033	1152 *	288 ICSB 89	* ICSR 194
1269 *	852 SPMD-B 94036	* ICSR 143	1632 *	478 SPA2-A 94029	* ICSR 93033	1156 *	504 ICSA 94	* ICSV 93042
1275 *	407 SPMD-B 94045	* ICSR 91012				1156 *	288 ICSB 94	* ICSR 194
1275 *	478 SPMD-B 94045	* ICSR 93033				1156 *	803 ICSB 94	* IS 30469-1187-4
1275 *	504 SPMD-B 94045	* ICSV 93042				1178 *	1 ICSB 89002	* Real 60
1275 *	803 SPMD-B 94045	* IS 30469-1187-4				1234 *	288 SPMD-B 94004	* ICSR 194
						1234 *	2 SPMD-B 94004	* Karavan
						1275 *	969 SPMD-A 94045	* ICSV 95126
						1275 *	4 SPMD-B 94045	* A 2267 2
						1296 *	2 SPHB-B 94006	* Karavan
						1296 *	4 SPHB-B 94006	* A 2267 2
						1296 *	19 SPHB-B 94006	* CFM 328 3-3-1-1
						1614 *	1 SPA2-A 94013	* RFAI 60
						1614 *	2 SPA2-A 94013	* Karavan
						1623 *	2 SPA2-B 94021	* Karavan
						1623 *	19 SPA2-B 94021	* CFM 328 3-3-1-1
						1632 *	415-1 SPA2-A 94029	* ICSR 91029-1
						1632 *	1 SPA2-B 94029	* Real 60

Table 4 Selected grain sorghum S_6 progenies at CIAT, Palmira, 2000 season I

Plot	Genotype	Plant height (m)	Days to flowering	Grain color
45-4-3-6-1	LASP-LG 99095-1	1.7	59	white
45-4-2-2-1	LASP-LG 99089-1	1.8	68	white
31-3-1-1-1	LASP-LG 99083-1	1.8	70	white/brown
26-4-3-3-1	LASP-LG 99079-1	2.2	70	white
26-4-3-1-1	LASP-LG 99077-1	2.2	70	white
26-2-2-2-1	LASP-LG 99068-1	1.9	68	white
26-2-2-1-1	LASP-LG 99067-1	1.7	63	white
26-2-1-3-1	LASP-LG 99064-1	1.7	59	white
25-2-1-1-1	LASP-LG 99055-1	2.1	63	brown
19-1-2-1-1	LASP-LG 99041-1	1.8	63	white
19-1-2-1-2	LASP-LG 99041-2	1.7	63	white
19-1-2-1-4	LASP-LG 99041-4	1.6	63	white
19-1-1-3-1	LASP-LG 99040-1	1.6	60	white
19-1-1-2-1	LASP-LG 99039-1	1.6	60	white
19-1-1-2-2	LASP-LG 99039-2	1.7	63	white
19-1-1-2-3	LASP-LG 99039-3	1.8	68	white
19-1-1-2-4	LASP-LG 99039-4	1.7	63	white
11-5-1-2-1	LASP-LG 99023-1	2.0	70	white
11-5-1-1-1	LASP-LG 99022-1	2.0	63	white
11-5-1-1-2	LASP-LG 99022-2	2.0	63	white
11-2-2-2-1	LASP-LG 99018-1	2.3	63	white
11-2-1-3-1	LASP-LG 99016-1	1.5	70	white
9-2-2-3-1	LASP-LG 99011-1	1.5	70	white
9-2-2-3-2	LASP-LG 99011-2	1.5	70	white
9-2-2-1-1	LASP-LG 99009-1	1.8	70	white
9-2-1-1-1	LASP-LG 99007-1	1.8	63	white
9-2-1-1-2	LASP-LG 99007-2	1.8	70	white
	Mean	1.81	65	
	SD ±	0.21	3.99	

Table 5 Selected sorghum forage S_0 progenies at CIAT, Palmira, 2000 season I

Plot	Genotype	No. tillers	Plant height (m)	Days to flowering	Green leaf area (score)[1]	Agronomic performance (score)[2]	Forage yield (t ha^{-1})	Remarks
61-2-5-2	LASP-HT 99221-2	5	1.4	89	4	3	77.56	
61-2-3-3	LASP-HT 99219-3	6	1.6	89	3	3	74.24	very good segregation (2)
10-1-4-3	LASP-HT 99018-3	5	1.1	90	4	2	68.42	very good
61-3-1-1	LASP-HT 99222-1	4	1.0	89	4	1	64.54	
23-1-2-1	LASP-HT 99090-1	3	1.0	90	5	3	59.28	
4-1-3-3	LASP-HT 99005-3	5	1.5	90	6	2	56.51	rust
61-2-2-1	LASP-HT 99218-1	2	1.5	88	6	2	55.68	
61-3-3-1	LASP-HT 99224-1	3	1.5	88	6	2	55.68	
61-3-2-1	LASP-HT 99223-1	4	1.0	88	6	2	55.12	
27-4-1-1	LASP-HT 99062-1	5	1.5	91	6	1	53.11	
61-2-1-1	LASP-HT 99217-1	4	1.5	88	6	2	52.63	
69-1-2-2	LASP-HT 99235-2	3	1.3	74	8	4	51.80	Excellent segregation (3)
10-1-1-3	LASP-HT 99015-3	5	1.2	90	8	2	50.41	Excellent segregation (3)
61-2-4-1	LASP-HT 99220-1	4	1.4	89	5	1	49.58	
69-1-1-1	LASP-HT 99234-1	2	1.5	88	5	1	48.48	very good
61-2-5-1	LASP-HT 99221-1	4	1.1	89	6	2	48.20	very good
56-2-2-2	LASP-HT 99213-2	3	1.2	92	5	2	44.82	
31-3-1-1	LASP-HT 99186-1	3	1.0	88	4	1	41.00	very good
61-1-2-2	LASP-HT 99215-2	3	1.0	89	4	1	39.06	
55-1-1-1	LASP-HT 99206-1	3	1.0	88	4	3	38.78	rust
11-4-3-3	LASP-HT 99018-3	5	1.6	91	4	1	38.64	
61-1-1-1	LASP-HT 99216-1	3	1.2	98	5	1	36.01	
56-2-1-1	LASP-HT 99212-1	4	1.2	92	3	2	35.46	
49-3-3-1	LASP-HT 99176-1	3	1.0	89	6	3	29.91	
	Mean	3.8	1.5	89	5.2	1.7	51.0	
	SDs	1.1	0.4	4	1.4	0.8	12.2	

Score 1 to 9, where 1 = green leaf area, 2 = 1-5% green leaf area reduced

3 = 6-10%, 4 = 11-20%, 5 = 21-30%, 6 = 31-40%, 7 = 40-50%, 8 = 51-75% and 9 = >75% of green leaf area reduced

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 6 Selected sorghum forage S_0 progenies at CIAT, Palmira 2000 season I

Plot	Genotype	No. tillers	Plant height (m)	Days to flowering	Green leaf area (score)[1]	Agronomic performance (score)[1]	Forage yield (t ha^{-1})	Remarks
61-3-3-2	LASP-HT 99224-2	3	3.6	88	5	1	64.10	
61-3-2-2	LASP-HT 99223-2	4	3.5	88	5	2	56.79	
34-1-2-2	LASP-HT 99103-2	3	4.0	91	5	2	55.68	
23-1-2-3	LASP-HT 99050-1	5	3.5	90	4	2	55.12	
23-1-2-2	LASP-HT 99050-2	5	3.9	91	4	2	52.35	
61-3-1-2	LASP-HT 99222-2	3	3.9	88	7	2	51.80	
27-4-1-2	LASP-HT 99062-2	3	3.4	103	6	1	50.14	
27-4-1-3	LASP-HT 99062-3	3	3.5	91	5	1	49.31	
4-1-2-3	LASP-HT 99004-3	5	4.0	90	5	4	49.03	
29-5-2-2	LASP-HT 99082-2	3	3.1	78	6	2	47.09	ok
61-2-3-1	LASP-HT 99219-1	3	3.9	88	6	2	46.54	
4-1-3-4	LASP-HT 99005-4	6	4.1	90	4	2	45.71	
44-1-1-2	LASP-HT 99145-2	3	3.6	86	5	1	45.41	ok
69-1-1-3	LASP-HT 99214-3	3	3.2	77	8	1	45.41	
27-3-4-2	LASP-HT 99061-2	3	3.5	91	4	1	45.15	excellent segregation (2)
10-3-2-3	LASP-HT 99024-3	4	3.9	90	5	1	44.87	
69-1-2-1	LASP-HT 99215-1	4	3.8	64	6	1	44.32	
45-1-3-1	LASP-HT 99152-1	4	3.3	77	6	3	44.04	
10-3-3-3	LASP-HT 99025-3	5	3.8	90	5	1	43.49	
27-3-4-1	LASP-HT 99061-1	6	3.5	90	4	1	43.21	
10-3-3-1	LASP-HT 99025-1	6	4.0	90	5	1	42.38	
56-2-2-3	LASP-HT 99213-3	3	3.3	92	4	1	41.80	
56-2-1-3	LASP-HT 99212-3	4	3.5	92	6	1	40.17	
10-3-2-2	LASP-HT 99024-2	6	3.5	90	5	1	19.89	
4-1-3-2	LASP-HT 99005-2	4	3.8	90	4	2	19.61	ok
29-5-2-1	LASP-HT 99082-1	5	3.4	78	6	1	19.61	ok
61-2-4-2	LASP-HT 99220-2	3	3.4	89	7	2	19.33	
69-1-1-2	LASP-HT 99214-2	2	4.0	86	5	2	17.93	
61-2-1-2	LASP-HT 99217-2	3	3.3	88	4	2	17.40	
56-2-1-2	LASP-HT 99212-2	3	3.2	92	5	1	14.63	sweet stem ok
4-1-3-1	LASP-HT 99005-1	5	3.4	90	6	1	14.35	
27-3-4-3	LASP-HT 99061-3	5	3.9	91	5	2	13.79	
30-2-1-1	LASP-HT 99094-1	4	3.0	65	6	1	13.79	good stem ok
44-1-2-1	LASP-HT 99146-1	2	3.5	86	4	1	13.79	ok
34-1-2-1	LASP-HT 99103-1	3	3.5	91	6	2	13.52	
30-2-2-2	LASP-HT 99095-2	4	3.2	65	6	1	13.24	good stem ok
45-1-4-1	LASP-HT 99153-1	3	3.6	86	4	1	13.24	ok
29-2-3-2	LASP-HT 99074-2	3	3.1	77	8	1	12.96	
44-2-1-2	LASP-HT 99147-2	3	3.5	86	3	1	12.96	good stem excellent
61-1-2-3	LASP-HT 99215-3	3	3.2	98	3	1	11.86	
29-2-3-3	LASP-HT 99074-3	3	3.3	78	8	2	11.58	
11-4-3-1	LASP-HT 99038-1	6	3.5	91	4	1	11.05	
51-3-1-3	LASP-HT 99186-3	2	3.6	88	5	1	11.02	
29-2-3-1	LASP-HT 99074-1	3	3.7	77	7	2	10.94	
4-1-2-2	LASP-HT 99004-2	7	3.8	90	5	3	10.75	
10-1-4-1	LASP-HT 99018-1	5	3.8	90	8	4	10.47	
10-1-4-2	LASP-HT 99018-2	6	3.2	90	5	1	10.47	ok segregation (2)
34-4-3-1	LASP-HT 99114-1	3	3.7	82	7	2	10.47	very good, segregation (2
61-1-1-3	LASP-HT 99214-3	3	3.1	91	3	1	10.19	very good segregation (2
55-1-3-2	LASP-HT 99206-2	3	2.8	92	3	1	29.92	
61-1-1-1	LASP-HT 99214-1	3	3.2	92	5	2	29.92	
47-1-3-3	LASP-HT 99165-3	1	3.0	86	4	2	29.36	
55-1-3-3	LASP-HT 99206-3	3	2.4	92	3	2	29.09	
51-3-1-2	LASP-HT 99186-2	2	3.9	88	5	1	28.53	
11-4-3-2	LASP-HT 99038-2	5	3.6	91	4	1	27.60	
45-1-3-2	LASP-HT 99153-2	2	3.2	92	4	1	27.42	ok

Plot	Genotype	No. tillers	Plant height (m)	Days to flowering	Green leaf area (score)[1]	Agronomic performance (score)[2]	Forage yield (t ha^{-1})	Remarks
10-1-1-1	LASP-HT 99015-1	6	1.1	90	8	2	26.87	
30-2-2-1	LASP-HT 99095-1	3	1.2	65	7	3	26.87	good stem
71-1-2-1	LASP-HT 99241-1	3	1.4	61	7	1	26.87	
4-4-2-2	LASP-HT 99012-3	6	1.8	90	7	2	26.59	
61-2-3-2	LASP-HT 99219-2	3	1.5	88	5	1	26.59	
30-2-1-3	LASP-HT 99094-3	3	1.2	65	8	2	25.76	good stem
61-1-3-2	LASP-HT 99216-2	2	1.0	89	6	3	25.76	
44-1-2-2	LASP-HT 99146-2	3	2.8	92	7	3	24.10	
50-2-2-4	LASP-HT 99182-4	3	1.2	88	3	1	24.10	very good
10-1-1-2	LASP-HT 99015-2	5	2.7	90	6	2	23.82	
30-2-1-2	LASP-HT 99094-2	4	1.1	61	6	1	23.55	good stem, ok
45-1-1-1	LASP-HT 99150-1	3	1.2	86	6	2	22.99	ok
45-1-3-3	LASP-HT 99152-3	3	1.1	86	4	3	21.88	
53-5-2-1	LASP-HT 99194-1	3	2.4	88	4	1	21.88	
53-5-2-2	LASP-HT 99194-2	3	2.5	88	4	2	21.61	
4-1-2-1	LASP-HT 99004-1	6	4.0	90	6	4	21.19	
44-1-1-1	LASP-HT 99145-1	3	1.2	86	6	2	20.78	tan color
50-2-2-3	LASP-HT 99182-3	2	3.0	87	3	1	19.67	
4-4-2-3	LASP-HT 99012-4	6	3.9	90	7	2	18.84	
50-1-3-1	LASP-HT 99180-1	3	2.7	65	4	3	17.17	
71-1-2-2	LASP-HT 99241-2	3	3.5	77	5	2	17.17	
44-2-1-1	LASP-HT 99147-1	2	2.4	86	7	3	16.14	
50-1-3-2	LASP-HT 99180-2	2	2.8	65	3	2	16.14	ok
45-1-4-3	LASP-HT 99153-3	3	3.0	86	4	2	15.79	
4-4-2-1	LASP-HT 99012-2	4	4.0	90	8	4	15.51	
50-1-2-2	LASP-HT 99179-2	2	2.7	59	3	3	14.96	very good segregation (2)
45-1-2-1	LASP-HT 99151-1	2	2.3	86	5	4	14.13	
45-1-4-4	LASP-HT 99153-4	4	3.0	87	5	2	11.36	
50-1-2-1	LASP-HT 99179-1	2	2.6	71	3	4	9.42	
45-1-2-2	LASP-HT 99151-2	2	2.3	65	5	4	8.31	
	Mean	3.6	1.4	85	5.2	1.9	12.45	
	SDs	1.3	0.4	9	1.4	0.9	11.92	

[1] Score 1 to 9, where 1 = green leaf area, 2 = 1-5% green leaf area reduced

3 = 6-10%, 4 = 11-20%, 5 = 21-30%, 6 = 31-40%, 7 = 40-50%, 8 = 51-75% and 9 = >75% of green leaf area reduced

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 7 Stage of the back cross process.

Plot		Genotype		Generation
1624	x 222	SPA_2-A 94022	x ICSR 110	BC_2
1624	x 3	SPA_2-A 94022	x SBL 107	BC_2
1296	x 2	SPMB-A 94006[1]	x ICARAVAN	BC_2
1152	x 1065	ICSA 89[1]	x GD 27669	BC_2
1623	x 213	SPA_2-A 94021	x ICSR 102	BC_2
1617	x 1	SPA_2-A 94016	x REAL 60	BC_1
1614	x 4	SPA_2-A 94013	x A 2267-2	TC
1617	x 4	SPA_2-A 94016	x A 2267-2	TC
1643	x 288	SPA_2-A 94039	x ICSR 194	BC_1
1632	x 288	SPA_2-A 94029	x ICSR 194	BC_1
1617	x 407	SPA_2-A 94016	x ICSR 91012	BC_1
1632	x 407	SPA_2-A 94029	x ICSR 91012	BC_1
1643	x 415	SPA_2-A 94039	x ICSR 91020-1	BC_1
1617	x 478	SPA_2-A 94016	x ICSR 93033	BC_1
1632	x 504	SPA_2-A 94029	x ICSV 93042	BC_1
1617	x 504	SPA_2-A 94016	x ICSV 93042	BC_1
1617	x 801	SPA_2-A 94016	x IS 30469-1187-2	TC
1623	x 801	SPA_2-A 94021	x IS 30469-1187-2	TC
1617	x 803	SPA_2-A 94016	x IS 30469-1187-4	TC
1632	x 803	SPA_2-A 94029	x IS 30469-1187-4	TC
1614	x 803	SPA_2-A 94013	x IS 30469-1187-4	TC
1617	x 852	SPMD-A 94046[1]	x ICSR 143	BC_1
1632	x 969	SPA_2-A 94029	x ICSV 95126	BC_1
1617	x 969	SPA_2-A 94016	x ICSV 95126	BC_1

[1] A_1 (milo) cytoplasm

Table 8 Performance of the selected grain sorghum B-lines at Zamorano, Honduras 1999, 2000 season II

Plot	Genotype	Early vigor (score)[1]	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)[3]	Grain Yield t ha^{-1}
1643	SPB_2 94039	2 6	94	3 3	1 0	3 20
1614	SPB_2 94013	2 3	91	3 0	1 0	3 43
1296	SPHB 94006	1 0	90	2 7	1 3	3 63
1236	SPMD 94006	2 0	95	2 7	1 3	3 73
1142	ICSB 73	1 0	92	2 0	1 0	3 85
1623	SPB_2 94021	1 0	92	2 7	1 0	4 20
1275	SPMD 94045	1 0	95	2 3	1 0	4 57
1234	SPMD 94004	1 0	94	2 0	1 3	4 63
	Checks					
1	Real 60	1 0	86	2 0	1 1	3 93
5	SPRU 94008	2 6				
	Mean	2 1	92	2 7	1 1	3 18
	SD (±)	1 06	2 89	0 54	0 20	0 98
	CV (%)	23 7	1 5	28 8	34 0	27 4

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous
[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable
[3] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected
3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% of leaf area affected

Table 9 Performance of the selected grain sorghum R-lines at Zamorano, Honduras 1999, 2000 season II

Plot	Genotype	Early vigor (score)[1]	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)[3]	Grain yield t ha^{-1}
852	ICSR 143	1 3	69	3 0	1 0	3 00
415	ICSR 91020-1	1 3	55	3 0	1 0	3 07
803	IS 30469-1187-4	1 7	69	2 7	1 0	3 13
213	ICSR 102	1 3	84	2 7	1 0	3 23
222	ICSR 110	1 0	71	3 0	1 0	3 23
504	ICSV 93042	1 0	80	2 7	1 0	3 47
407	ICSR 91012	1 0	70	3 0	1 0	3 83
4	A 2267-2	1 3	70	3 0	1 0	4 00
478	ICSR 93033	1 0	71	2 3	1 0	4 30
	Checks					
1	Real 60	1 0	83	2 0	1 3	3 84
5	SPRU 94008	1 0	51			
	Mean	1 3	68 9	2 8	1 0	2 93
	SD (±)	0 49	9 20	0 38	0 11	0 91
	CV (%)	41 3	17 2	17 7	18 9	24 9

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

[3] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected, 3= 6-10%, 4= 11-20%, 5= 21-30% 6= 31-40% 7=40-50% 8=51-75% and 9 = > 75% of leaf area affected

Table 10 Performance of the advanced grain sorghum hybrids at Zamorano, Honduras, 1999 season II

Plot	Genotype		Early vigor (score)[1]	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)[3]	Grain yield t ha[-1]
1234*2	SPMD 94004	Icaravan	2 7	92	3 0	1 0	1 00
1269*288	SPMD 94036	ICSR 194	2 3	90	3 0	1 0	2 13
1251*288	SPMD 94019	ICSR 194	3 0	91	3 0	1 0	2 45
1296*801	SPHB 94006	IS 30469-1187-2	1 3	85	3 0	1 0	2 75
		Checks					
1		Real 60	1 0	85	2 0	1 0	3 70
5		SPRU 94008	1 0				
		Mean	1 8	89	2 8	1 0	2 40
		SD (±)	0 88	2 81	0 44	0 00	0 98
		CV (%)	24 9	1 5	0 0	0 0	35 7

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous
[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable
[3] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected, 3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% leaf area affected

Table 11 Performance of the selected grain sorghum B-lines at Pescador, Cauca, 1999 season II

Plot	Genotype	Early vigor (score)[1]	Number of plants	Plant height (m)	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)
1251	SPMD 94019	2 6	28	1 3	79	2 3	1 0
1178	ICSB 89002	1 0	27	1 3	78	2 6	2 3
1117	ICSB 38	1 0	30	1 2	79	3 0	2 0
1156	ICSB 94	2 0	19	0 6	101	4 6	4 7
1152	ICSB 89	2 0	20	0 5	80	5 0	2 7
	Checks						
2	Icaravan	1 0	35	1 4	77	2 0	2 7
	Mean	1 6	26	1 0	82	3 2	2 6
	SD (±)	0 71	6 16	0 38	9 2	1 25	1 20
	CV (%)	14 6	17 9	3 5	1 3	18 2	28 3

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous
[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable
[3] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected, 3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% of leaf area affected

Table 12 Performance of the selected grain sorghum R-lines at Pescador, Cauca, 1999 season II

Plot	Genotype	Early vigor (score)[1]	Number of plants	Plant height (m)	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)[3]
222	ICSR 110	1 6	36	1 4	77	1 6	1 0
288	ICSR 194	2 3	28	1 6	82	2 3	1 3
478	ICSR 93033	2 6	23	1 5	98	2 3	1 3
1065	GD 27699	2 0	26	1 6	79	2 3	1 6
213	ICSR 102	2 6	24	1 3	80	3 0	1 0
969	ICSV 95126	1 6	35	1 5	77	3 3	3 0
407	ICSR 91012	2 6	22	1 4	82	4 0	1 0
852	ICSR 143	2 6	21	1 3	80	4 6	1 6
	Checks						
1	Real 60	1 6	33	1 6	77	1 3	2 6
	Mean	2 2	27	1 5	81	2 7	1 6
	SD (±)	0 40	5 63	0 10	6 54	1 08	0 73
	CV (%)	30 0	28 4	3 3	0 9	32 0	32 1

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous
[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable
[3] Score 1 to 9, where 1 = free of leaf diseases, 2 = 1-5% of leaf area affected
3 = 6-10%, 4 = 11-20%, 5 = 21-30%, 6 = 31-40%, 7 = 40-50%, 8 = 51-75% and 9 = > 75% of leaf area affected

Table 13 Performance of the selected forage pearl millet populations tested at Pescador, Cauca, 1999 season II

Plot	Genotype	Early vigor (score)[1]	Number of plants	Number of tillers	Plant height (m)	Days to 50% flowering	Agronomic desirability (score)[2]	Leaf disease (score)[3]
25	ICMV-IS 94206	1.0	29	4	1.6	58	1.0	1.0
23	ICMV-IS 89305	2.7	27	3	1.3	63	1.3	1.0
15	ICMV 85404	1.0	30	3	1.6	60	1.6	1.0
28	SOSAT-C88	2.0	27	3	1.6	59	1.6	1.0
29	LHGP	1.3	33	3	1.6	58	1.6	1.3
24	ICMV-IS 91203	2.3	28	3	1.3	62	2.6	1.0
9	ICMP 92853	3.3	22	2	1.2	63	3.6	1.6
	Mean	1.9	28	3	1.4	60	2.0	1.1
	SD (±)	0.89	3.34	0.73	0.17	2.04	0.9	0.26
	CV (%)	27.4	13.1	23.0	5.7	1.2	29.2	25.9

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous
[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable
[3] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected, 3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = 75% of leaf area affected

Table 14. Performance of the selected grain sorghum B-lines trial at Procampo, Buga, 1999 season II

Plot	Pedigree	Number of plants	Days to flowering	Green leaf area[1]	Agronomic score[2]	Plant height	Grain yield	Grain color	Observations
1156	ICSB 94	17	65	1 6	2 5	1 7	4 0	cream	Bold
1643	SPA2-B 94039	32	71	2 1	2 2	1 7	2 0	white	Bold
1142	ICSB 73	39	74	1 8	2 0	1 9	2 0	cream	Dual purpose
1614	SPA2-B 94013	28	71	1 8	2 3	1 7	1 8	white	
1234	SPMD-B 94004	22	71	1 9	2 7	1 8	1 6	white	Bold
1632	SPA2-B 94029	33	71	2 3	3 0	1 5	1 6	white	
1296	SPHB-B 94006	26	70	2 5	3 2	1 7	1 6	white	
1275	SPMD-B 94045	34	73	1 7	1 8	1 4	1 6	white	Bold
1623	SPA2-B 94021	33	75	2 6	3 5	1 8	1 5	white	Bird damage 20%
1152	ICSB 89	31	72	2 3	2 8	1 6	1 4	cream	
1251	SPMD-B 94019	12	73	2 7	2 0	1 4	1 2	white	Grain mold susceptible
1617	SPA2-B 94016	23	71	2 5	3 3	1 4	1 2	white	Establishment poor
1178	ICSB 89002	25	74	1 5	2 3	1 5	1 0	cream	
1117	ICSB 38	20	69	2 3	3 7	1 4	1 0	white	
1236	SPMD-B 94006	16	69	2 3	2 8	1 5	1 0	white	
1269	SPMD-B 94036	10	73	2 3	2 0	1 4	0 8	white	Establishment poor
	Checks								
1	Real 60	40	74	2 1	2 2	2 0	2 2	brown	
5	SPRU 94008	22	72	2 0	4 2	1 1	1 0	white	
	Mean	26	72	2 1	2 7	1 6	1 6		
	SD (±)	8	2	0 3	0 7	0 2	0 7		
	CV (%)	27 7	2	11 5	17 2	19 7	6 3		

[1] Score 1 to 9, where 1 = green leaf area, 2 = 1-5% green leaf area reduced
3 = 6-10%, 4 = 11-20%, 5 = 21-30%, 6 = 31-40%, 7 = 41-50%, 8 = 51-75%, and 9 = 75% of green leaf area reduced

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 15 Performance of the selected grain sorghum R-lines trial at Procampo, Buga, 1999 season II

Plot	Pedigree	Number of plants	Days to 50% flowering	Leaf Disease (score)[1]	Agronomic desirability (score)[2]	Plant height (m)	Grain yield (t ha^{-1})
852	ICSR 143	21	72	3.5	3.8	1.7	0.86
504	ICSV 93042	24	74	3.1	3.3	1.8	0.88
803	IS 30469-1187-4	29	72	3.0	3.1	1.9	0.89
801	IS 30469-1187-2	17	66	3.3	4.1	1.9	0.97
969	ICSV 95126	33	63	3.0	3.5	1.8	1.03
1065	GD 27699	22	67	3.3	3.8	1.8	1.08
39	CEM 328/3-3-1-1	29	63	2.6	3.8	1.9	1.23
415	ICSR 91020-1	18	69	2.6	3.8	1.9	1.32
222	ICSR 110	33	68	2.6	2.0	1.6	1.46
92	IS 21629	26	68	2.3	4.0	2.7	1.61
288	ICSR 194	16	71	2.6	3.6	1.8	1.64
478	ICSR 93033	34	71	2.8	2.8	1.7	1.76
213	ICSR 102	36	70	2.1	2.0	1.6	1.82
407	ICSR 91012	30	72	3.0	2.8	1.7	2.05
4	A 2267-2	38	72	2.6	3.5	2.1	2.48
	Checks						
1	Real 60	38	74	3.0	3.0	1.9	2.30
5	SPRU 94008	38	68	3.1	4.1	1.1	0.87
	Mean	28	69	2.8	3.3	1.8	1.42
	SD (±)	7.69	3.24	0.35	0.66	0.30	0.52
	CV (%)	31.7	3.2	11.6	11.2	15.5	33.0

[1] Score 1 to 9, where 1 = free of leaf disease, 2 = 1-5% of leaf area affected
3 = 6-10%, 4 = 11-20%, 5 = 21-30%, 6 = 31-40%, 7 = 40-50%, 8 = 51-75% and 9 = > 75% of leaf area affected

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 16. Advanced grain sorghum hybrids tested at Procampo, Buga, 1999 season II

Plot	Pedigree	Number of plants	Days to 50% flowering	Leaf disease (score)[1]	Agronomic Desirability (score)[2]	Plant height (m)	Grain yield (t ha^{-1})	Grain color	Observations
1234 * 2	SPMD-B 94004 * Icaravan	41	62	3.0	3.5	2.5	3.81	brown	
1251 * 288	SPMD-B 94019 * ICSR 194	23	70	2.8	3.8	2.4	2.68	white	high yield and boldness
1269 * 288	SPMD-B 94036 * ICSR 194	27	66	3.0	4.0	2.2	2.20	white	high yield and boldness
1296 * 801	SPHB-B 94006 * IS 30469-1187-2	51	61	3.3	4.0	2.3	3.07	white	
	Checks								
1	Real 60	86	68	3.3	3.0	1.8	1.97	brown	double purpose
5	SPRU 94008	70	64	3.3	5.0	1.1	2.29	white	
	Mean	50	65	3.1	3.8	2.1	2.67		
	SD±	22.5	3.3	0.2	0.6	47.6	0.62		

[1] Score 1 to 9, where 1= free of leaf diseases, 2= 1-5% of leaf area affected,
3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% of leaf area affected

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 17 Performance of the forage pearl millet and sorghum lines tested at Procampo, Buga, 1999 season II

Plot	Pedigree	Number of plants	Days to 50% flowering	Green leaf area[1]	Agronomic desirability (score)[2]	Plant height (m)	Forage yield (t ha^{-1})	Grain yield (t ha^{-1})
	Pearl millet							
3	ICMV 87001	27	61	3 9	3 8	1 6	5 28	0 93
30	TGP	42	60	4 1	4 0	1 6	6 43	0 88
29	LHGP	53	61	3 5	4 3	1 9	7 04	1 44
7	ICMP 87200	49	61	3 8	4 0	1 9	7 68	1 15
20	ICMV-IS 85321	45	63	3 3	3 1	1 9	9 12	1 41
8	ICMP 89410	61	59	3 8	4 0	1 7	10 05	1 35
12	ICMS 7703	63	51	4 0	4 0	1 7	11 06	1 62
28	SOSAT-C88	68	61	3 8	4 0	1 7	11 43	1 96
15	ICMV 85404	65	61	4 0	3 8	1 8	12 36	1 77
22	ICMV-IS 88305	82	61	4 0	4 0	1 9	14 21	2 18
26	IP 18378	57	60	4 0	4 0	2 1	16 29	1 48
9	ICMP 92853	69	61	4 0	3 6	2 0	17 77	2 50
	Sorghum							
897	IS 31496	85	70	3 0	2 3	3 0	35 78	5 98
879	IS 13868	68	77	2 6	1 6	3 3	47 12	4 06
	Check							
2	Icaravan	80	66	3 1	2 8	1 9	32 03	7 96
5	SPRU 94008	76	67	3 1	4 0	1 1	14 58	2 35
	Mean	62	62	3 6	3 6	1 9	16 13	2 43
	SD (±)	15 80	5 60	0 45	0 73	0 52	11 89	1 96
	CV (%)	28 3	7 0	15 1	19 7	10 3	47 45	27 1

Score 1 to 9, where 1= green leaf area, 2= 1-5% of green leaf area redyced,
3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% of green leaf area reduced

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

Table 18 Performance of pearl millet materials tested at Yopal, Casanare, 1998 season II

Plot	Pedigree	Early vigor (score)[1]	Number of tillers	Agronomic desirability (score)[2]	Green leaf area (score)[3]	Forage yield (t ha^{-1})
20	ICMV-IS85321	3 0	3 2	2 7	1 3	6 5
7	ICMP 87200	2 0	4 2	2 3	1 3	6 5
29	LHGP	2 7	4 2	2 3	1 7	6 8
2	NCd2	2 0	3 1	2 0	1 3	7 2
67	ICMR 312	2 7	4 7	2 0	1 0	7 6
32	BKM 1163	1 0	3 4	1 0	1 3	8 1
13	ICMV 155	2 0	3 5	2 3	1 3	8 3
9	ICMP 92853	1 7	3 0	2 0	1 7	8 3
17	ICMV 91123	1 0	3 1	1 0	1 0	9 3
16	ICMV 91059	1 3	3 7	1 7	1 7	9 8
8	ICMP 89410	1 7	3 6	1 7	1 0	10 2
15	ICMV 85404	1 7	2 8	1 7	1 0	11 4
21	ICMV-IS88210	2 5	6 8	2 5	2 0	11 5
22	ICMV-IS88305	1 7	4 4	1 7	1 0	11 8
1	HHVBC	1 7	3 6	1 7	2 0	12 3
12	ICMS 7703	1 0	3 9	1 3	1 7	12 5
57	IPC 0501	1 3	4 5	1 3	1 0	13 4
6	GB 8735	1 3	4 0	1 3	1 3	13 8
28	SOSAT-C88	1 0	3 9	1 0	1 5	18 8
	Mean	1 7	3 9	1 8	1 4	10 2
	SD (±)	0 6	0 9	0 5	0 3	3 2
	CV (%)	37 7	25.8	45 4	32 7	20 9

[1] Score 1 to 5, where 1 = most vigorous and 5 = least vigorous

[2] Score 1 to 5, where 1 = most desirable and 5 = least desirable

[3] Score 1 to 9, where 1= green leaf area, 2= 1-5% of green leaf area reduced, 3= 6-10%, 4= 11-20%, 5= 21-30%, 6= 31-40%, 7=40-50%, 8=51-75% and 9 = > 75% of green leaf area reduced