Welcome from ICRISAT

R.W. Gibbons*

Participants of the Groundnut Conference, Colleagues, Ladies and Gentlemen.

It is with great pleasure that I respond to the request of Dr K.R. Bock to make a few remarks on behalf of the ICRISAT Center Groundnut Program in India at this Second Regional Groundnut Workshop for Southern Africa.

First of all it is a great personal pleasure to be back in this region where I worked on groundnut for 12 years, firstly for the Agricultural Research Council of Central Africa, and then for the Agricultural Research Council of Malawi. I have very pleasant memories of this delightful area of Africa. It is very gratifying to note the active collaboration that has developed between the groundnut researchers of the SADCC countries in such a short time, and the excellent research progress that has been made. This is the second such regional workshop, and there has also been a breeders' tour. All this has been achieved since the ICRISAT program became operational in 1982. However none of this could have taken place without the generous financial backing the program has received from IDRC, the encouragement of SADCC governments, and the facilities provided by the Government of Malawi at the Chitedze Agricultural Research Station, near Lilongwe. I must also place on record the help and encouragement we have received from all the officials and scientists of the SADCC-member States. Today our meeting takes place in Zimbabwe, and on behalf of ICRISAT I thank the Government and the officials who have made this possible. Holding such meetings in different countries of the region broadens our knowledge and demonstrates the type of regional cooperation we all want.

ICRISAT is now placing much more emphasis on the semi-arid regions of Africa with the encouragement of the Consultative Group for International Agricultural Research (CGIAR) and the approval of the ICRISAT Governing Board. In March the ICRISAT Governing Board will meet in Harare for the first time, and prior to that the Program Committee of the Board will review the groundnut work in Malawi and the sorghum and millet work in Zambia and Zimbabwe. In 1986 a groundnut team will be set up in West Africa and will conduct research on a regional basis. We will ensure that this regional research in West Africa will link up effectively with the program in southern Africa and the ICRISAT Center program.

The reports of the first regional workshop were most encouraging, and we hope that the deliberations and conclusions of the second meeting will lead to more cooperation and success, to help the groundnut farmers of the SADCC countries.

Thank you all.

* Program Leader and Principal Plant Breeder, Groundnut Improvement Program, ICRISAT, Patancheru P.O., A.P. 502 324, India.

Rosette and Early Leaf Spot Diseases: A Review of Research Progress, 1984/85

K. R. Bock*

Abstract

Observations made over 2 years on the patterns of spread of groundnut rosette virus (GRV) within fields suggested that primary infections originated from a migration of infective vectors that occurred within days of plant emergence, and that significant radial spread was from these point sources of infection only. Such conditions were simulated in the establishment of a GRV resistance screening nursery in which a disease incidence of about 90% was induced.

Preliminary studies of the inheritance of resistance to GRV confirmed that it is governed by recessive genes. They confirmed an approximate ratio of 15 susceptible plants to 1 resistant plant in progenies of resistant × susceptible crosses.

Grafting experiments indicated that the GRV-resistant cultivar RG 1 is immune to vector inoculation of GRV and also demonstrated symptomless systemic infection. This underlines the necessity for the critical examination of the methods of resistance in those lines that are used as resistant parents in breeding programs.

Aphis craccivora *Koch vector of GRV was trapped in low numbers throughout the dry season, suggesting the presence of local resident populations. Dry season aphid activity was greater in central than in southern Malawi. At one site in October, GRV occurred before the onset of the rains.*

*In preliminary studies of early leaf spot (*Cercospora arachidicola*), the number of leaflets retained were counted at 70 and 88 days after sowing on a range of genotypes. In all ICRISAT trials the highest-yielding line of sequentially branched types retained more leaflets than control varieties, but so did a small number of poorer-yielding entries. Leaf retention among alternately branched types was apparently more uniform.*

Sumário

Roseta e mancha foliar temporã: Uma revisão ao progresso da investigação, 1984/85. *Observações feitas durante dois anos, sobre os padrões de dispersão do virus da roseta do amendoim (GRV) nos campos de cultivo, sugerem que as infecções primárias originadas da migração de vectores infecciosos, que ocorreu poucos dias depois da emergência da planta, e que uma significativa dispersão radial foi a única fonte de infecção. Estas condições foram simuladas no estabelecimento de viveiros de selecção para a resistência ao GRV, nos quais foi induzida uma incidência da doença de cerca de 90%.*

Estudos preliminares sobre herança da resistência ao GRV confirmaram que ela é regulada por genes recessivos. Eles confirmaram uma razão aproximada de 15 (quinze) plantas susceptíveis para 1 (uma) resistente, em descendências do cruzamento de plantas resistentes com susceptíveis

* Team Leader and Principal Plant Pathologist, ICRISAT Regional Groundnut Improvement Program for Southern Africa, Chitedze Research Station, Private Bag 63, Lilongwe, Malawi.

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Ensaios de enxertia indicaram que o cultivar RG 1 resistente ao GVR é imune à ino[illegible]ão do virus por vectores e também mostrou carência de sintomas de infecção sistêmica. Isto realça a necessidade de exame critico dos métodos de resistência das linhas que são usadas como progenitores resistentes nos programas de melhoramento.

Aphis craccivora *Koch, vector do GRV, foi capturado em pequeno número durante a estação seca, sugerindo a presença de populações residentes no local. A actividade dos afideos durante a estação seca, foi maior na zona central do Malawi do que na zona sul. Num dos locais, o virus da roseta do amendoim apareceu em Outubro antes do inicio das chuvas.*

*Em estudos preliminares sobre a mancha foliar temporã (*Cercospora arachidicola*), o número de foliolos retidos pela planta foram contados aos 70 e 88 dias depois da sementeira num grupo de genótipos. Em todos os ensaios do ICRISAT, com tipos de ramificação sequencial, a linha com maior rendimento reteve mais foliolos que as variedades de controlo. Contudo, o mesmo ocorreu com algumas das linhas de mais baixo rendimento. A retenção foliar nos tipos de ramificação alternada foi aparentemente mais uniforme.*

The regional pathology program is concerned almost exclusively with research on groundnut rosette virus (GRV) and early leaf spot (ELS), *Cercospora arachidicola*. An endorsement of this priority is contained in recommendations arising out of the first regional workshop (ICRISAT 1985). One of the regional program's broad objectives is to develop high-yielding cultivars containing resistance to these two diseases.

Sources of resistance to GRV in the cultivated groundnut are well known. It has also been established that this resistance is most probably governed by recessive genes. It has already been successfully exploited, notably in Malawi and in West Africa. In spite of these advances, few commercially acceptable varieties exist, and resistance has not yet been transferred into short-maturing, spanish-type varieties, which are of great importance over extensive areas of southern Africa. The challenge in this regard lies not with the generation of resistant × susceptible crosses but in the screening of the large number of hybrids that this program demands. GRV is a disease which, though devastating, is sporadic in occurrence, often with intervals of several years between pandemics. Reliance cannot, therefore, be placed on natural incidence, and an alternative strategy must be devised. The development of GRV-screening nurseries is one such means, and our progress in this direction is reported briefly here.

We remain ignorant of the seasonal origins of GRV, the resolution of which must involve studies on the ecology of the vector, *Aphis craccivora*. We also report on progress in this direction.

Identification of resistance to ELS in Africa has thus far proved elusive. The disease is very severe every season in our experimental fields at Chitedze Research Station. Our strategy has been one of selection for high yield under conditions of high disease pressure, and in this we have been eminently successful. If the ICRISAT 9-point field scale for assessing ELS resistance is used, all cultivars, including the highest yielding entries, score 7, 8, or 9, and must thus be classified as susceptible. It seemed possible that visual scoring systems were too coarse to detect small but perhaps important differences in at least one parameter, leaf retention. We consequently adopted a more laborious assessment of leaf retention by counting leaves lost and leaves retained. Results of these preliminary studies are also given in this presentation.

Groundnut Rosette Virus

Pattern of Spread within Fields and Disease Nurseries

We studied the occurrence and patterns of spread of GRV in fields at Chitedze in 1983/84 and 1984/85. Primary foci were marked with stakes, and subsequent spread from these first infections of the season was recorded on a 6 × 6 m grid. In 1983/84, average incidence in 6 × 6 m plots containing the primary source was 38.3%; for the 8 adjacent similar plots, 6.3%; and for the 16 plots adjacent to the latter, 0.4%. Incidence in the remainder of the field was 0.3%. Disease gradients associated with primary sources were thus exceptionally steep, and secondary infections, whatever their origins (from primary foci within the field or from an external source), did not give rise to patches of high incidence. Similar observations were ma[illegible] 1984/85. We deduced from these observations that primary infections apparently originated from one period of migration of infective vectors, which occurred within days of emergence, and that significant radial spread from point sources of infection occurred only in these circumstances.

We attempted to simulate this natural sequence of events in the establishment of a GRV-screening nursery in 1984/85. Prior to the onset of the rains, 1000 groundnut seedlings were raised in the greenhouse and inoculated by means of viruliferous aphids. We planted one infector row of the susceptible Malimba cultivar between every two contiguous rows of test lines. Two weeks after the emergence of plants in the field we transplanted, at 2 m spacing in each infector row, the diseased seedlings that were, by this time, heavily infested with vectors. We harvested several thousand viruliferous aphids from a second batch of greenhouse-grown seedlings and seeded the nursery with them on two further occasions. We induced an overall level of 89% incidence (Table 1). Of the 5912 F_2 plants exposed, 5234 became infected with GRV and were eliminated in the field. Of the remaining 678 plants, 272 were discarded by the breeder as being poor agronomically, thus leaving 406 plants.

Three seeds from each of these were sown in the greenhouse and inoculated twice using viruliferous aphids. Individual plant tests were considered valid only where all three seedlings grew, were inoculated, and survived until final unequivocal records were taken 6 weeks later. On this basis 379 of the 406 greenhouse tests were valid, from which 134 plants emerged as having resistance. These will be included in the 1985/86 disease nursery.

Whether such disease nursery management is successful every year, and whether it will be possible to improve upon the overall incidence of about 90% obtained in 1985, remains to be seen.

Table 1. Field and greenhouse screening of progenies of susceptible × resistant crosses for resistance to groundnut rosette virus, Chitedze, Malawi, 1985.

Cross	Field screening (F_2)		Greenhouse screening (F_3)		
	No. plants rosetted	No. plants symptomless	Tested	Susceptible	Resistant
RG 1 as male parent					
Robut 33-1 × RG 1	220	24	24	14	10
Spancross × RG 1	22	2	2	2	0
SAC 58 × RG 1	52	10	5	2	3
Malimba	90	6	3	1	2
L.No. 95A × RG 1	95	8	8	4	4
Chalimbana × RG 1	53	10	8	0	8
RG 1 as female parent					
RG 1 × RRI/24	87	10?	3	3	0
RG 1 × Ah 114	57	5	4	0	4
RG 1 × EPT 14	42	1	-	-	-
RG 1 × E879/6/4	35	5	5	4	1
RRI/24 as male parent					
E879/6/4 × RRI/24	17	1	1	0	1
Chalimbana × RRI/24	142	22	9	6	3
Robut 33-1 × RRI/24	610	78	73	53	20
Malimba × RRI/24	144	25	25	20	5
Spancross × RRI/24	55	10	10	10	0
JL 24 × RRI/24	118	8	8	6	2
SAC 58 × RRI/24	193	24	13	10	0
L.No. 95A × RRI/24	127	5	3	2	1
Shulamith × RRI/24	139	7	7	2	5
SPI × RRI/24	247	29	15	4	11
Egret × RRI/24	124	15	4	4	0
Makulu Red × RRI/24	20	4	4	3	1

Continued

Table 1. *continued.*

Cross	Field screening (F_2)		Greenhouse screening (F_3)		
	No. plants rosetted	No. plants symptomless	Tested	Susceptible	Resistant
RR1/24 as female parent					
RR1/24 × A 1176	73	9	3	3	0
RR1/24 × EPT 14	30	0	-	-	-
RR1/6 as male parent					
Chalimbana × RR1/6	36	9	2	2	0
Robut 33-1 × RR1/6	73	10	5	3	2
JL 24 × RR1/6	271	21	21	14	7
SAC 58 × RR1/6	19	1	1	1	0
L No. 95A × RR1/6	83	5	3	1	2
SPI × RR1/6	135	11	7	1	6
Malimba × RR1/6	30	2	1	0	1
Egret × RR1/6	34	6	3	2	1
RMP 91 as male parent					
E879/6/4 × RMP 91	69	8	-	-	
Egret × RMP 91	216	64	37	32	5
Spancross × RMP 91	86	9	7	6	1
JL 24 × RMP 91	260	13	13	11	2
SAC 58 × RMP 91	136	6	4	3	1
SPI × RMP 91	218	45	17	7	10
Mani Pintar × RMP 91	111	6	2	0	2
Chalimbana × RMP 91	138	11	11	9	2
SAC 58 × RMP 93	70	7	5	0	5
Malimba × RMP 93	45	6	3	0	3
Malimba (infector rows)	1906	261			
Totals (for crosses)	5234	678	379	245	134

Table 2. Rosette resistance i[illegible]nce studies on groundnut, Chitedze greenhouse, Malawi, 1985.

Set No.	Identity	No. plants inoculated	No. plants susceptible	No. plants resistant	Ratio resistant susceptible plants
I	RG 1	9	0	9	
	JL 24	10	9	0	
	(RG 1 × JL 24) F_1	8	8	0	
	(JL 24 × RG 1) F_1	6	6	0	
	(JL 24 × RG 1) F_2	217	207 (16)[1]	10	1:21
	Spancross control	43	40		
II	RG 1	9	[illegible]	9	
	Mani Pintar	10	10	0	
	(Mani Pintar × RG 1) F_1	5	5	0	
	(Mani Pintar × RG 1) F_2	199	[illegible]	[illegible]	1:11
	Spancross control	[illegible]	52		
III	RG 1	10	[illegible]	10	
	E879/6/4	10	10	0	
	(RG 1 × E879/6/4) F_2	[illegible]	[illegible]	32	1:8
	(E879/6/4 × RG 1) F_2	308	[illegible]	24	1:12
	Spancross control	51	[illegible]		
IV	RG 1	[illegible]	[illegible]	[illegible]	
	Chalimbana	10	10	0	
	(RG 1 × Chalimbana) F_2	129	[illegible]	8	1:15
	Spancross control	69	66		

1. Numbers in parentheses refer to numbers of susceptible plants with suppressed or atypical symptoms.

Studies on Inheritance of Resistance

We set out to confirm the recessive nature of resistance to rosette with preliminary studies on the proportion of resistant to susceptible progeny derived from four sets of crosses involving the resistant cultivar RG 1 and the susceptible cultivars JL 24, Mani Pintar, Chitembana, and Chalimbana. Each set was grown under greenhouse conditions and was inoculated twice using viruliferous aphids in batches of eight.

Ratios of resistant to susceptible plants for the crosses studied were 1:21, 1:11, 1:8, 1:12, and 1:15 (Table 2). The data were subjected to statistical analysis by the breeder. With one possible exception, the ratios fall within probability limits of the predicted ratio of 1:15 previously reported in the literature. The reason why 100% infection was not obtained in all susceptible control plants is not known.

Further Aspects of Resistance: Grafting Experiments

All apparently resistant plants that remained symptomless in the inheritance study experiment, together with 32 RG 1 plants, and 5 or more selected control plants from each set, were used as stocks into which a healthy scion of the susceptible Spancross was grafted.

By means of this technique we hoped to find out whether resistance to GRV was apparently absolute (no rosette symptoms developing in the susceptible scion) or whether tolerance mechanisms were operating (rosette symptoms developing in the scion, stock remaining symptomless). In the latter case, we hoped, by means of vector tests, to determine whether the symptomless plants also contained groundnut rosette assistor virus (GRAV).

None of the susceptible scions grafted to the inoculated symptomless RG 1 plants developed GRV whereas all of those grafted to various rosetted control plants developed typical symptoms of GRV in about 17 days, from which GRV was readily transmitted to healthy seedlings by aphids. These results show that RG 1 is immune to inoculation of GRV by the vector. We cannot comment on its resistance to GRAV at this stage. As with RG 1, apparently resistant hybrids of all four sets of crosses did not contain GRV because susceptible scions grafted into them grew vigorously and remained symptomless.

During 1985 we also tested the resistance of 45 introduced West African rosette-resistant lines, and selected 10 apparently resistant symptomless plants from among them for grafting. Eight grafted scions remained symptomless and we assume the plants contained resistance similar to that of RG 1. In one plant, GRV developed in only two of the eight stems after 16 weeks, and subsequently the scion also developed it. The tenth plant remained symptomless throughout the course of the experiment but the susceptible scion developed severe GRV, which was readily transmitted by the vector, an indication of symptomless systemic infection and, presumably, tolerance. This illustrates clearly the importance of a critical examination of the type of resistance contained in any line or cultivar that might be used as a resistant parent in the generation of resistant hybrids. We are at present re-examining RMP 91, RMP 93, and other cultivars in this regard.

Vector Ecology

We continued with studies on the seasonal origins of GRV by means of aphid trapping and by establishing small dry-season bait plots in the southern and central areas of Malawi.

We have abandoned the use of sticky traps in favour of yellow water traps because of great difficulties in identification of aphid species after impaction on sticky traps. Table 3 summarizes the weekly totals of numbers of *A. craccivora* caught between April and November 1985, and compares these with data given by Adams and Farrell (1967) for 1966. *A. craccivora* was trapped in low numbers consistently

Table 3. Numbers of *Aphis craccivora* trapped in Moericke yellow water traps at Chitedze, Malawi, during the 1985 dry season, compared with the 1966 records of Adams and Farrell (1967).

Month	Week	1985 Weekly total	1985 Monthly total	1966
Jun	1	62		
	2	78		
	3	249		
	4	207	596	22
Jul	1	76		
	2	17		
	3	16		
	4	4	113	20
Aug	1	1		
	2	2		
	3	7		
	4	3	13	10
Sep	1	1		
	2	0		
	3	4		
	4	5	10	3
Oct	1	10		
	2	2		
	3	4		
	4	1	17	3
Nov	1	2		
	2	12		
	3	2		
	4	1	17	1

throughout the dry-season in both these years, suggesting the continuous presence of a local resident population.

In addition to water traps, we also used bait plants to monitor populations of the vector. Twenty 21-day old greenhouse-grown groundnuts (Spancross seedlings) were exposed in the field every 3.5 days between November 1984 and November 1985, and the number of *A. craccivora* (alates, apterae, and nymphs) were recorded at the end of each exposure period. These bait plants indicated two periods of intense flight and breeding activity, i.e., the first during January and February, and the second from May to July. We continued to trap low numbers of *A. craccivora* throughout the dry-season, in August, September, and October.

In early August, when the dry-season was advanced and when there was no chance of any groundnut plants remaining in farmers' fields, we selected eight bait plot sites on the Lilongwe Plain in the Central Region and eight sites in southern Malawi. At each site a 15 × 15 m area was cleared and a 10 × 10 m plot of the Mani Pintar cultivar was established at wide (30 cm) spacing. Our choice of site was restricted to areas where water supplies could be assured, either piped or drawn from perennial streams or pools. All plots were visited on three occasions, each plant being examined for the presence of *A. craccivora* (Table 4).

A. craccivora was recorded in four out of seven plots in the south and in all plots in the Central Region by late September (about 6 weeks after emergence). There was thus ample time between the arrival of the aphids and termination of the experiment in early November for GRV to manifest itself had any migrant aphid been infective. GRV was not recorded at any site in the south, and on the Lilongwe Plain only four plants were infected at one (Chileka) of the eight sites.

Dry-season aphid activity, as measured by the number of sites infested, the number of plants infested per site, and population increase within sites, was greater on the Lilongwe Plain than in the south, where infestation was apparently confined to low-lying areas near rivers (Kasinthula), or lakes (Namiasi and Domasi), or in the single "dambo" plot (Kasongo).

In the Central Region, dambos (shallow grassland valleys with impeded drainage, which support green vegetation throughout the dry season), are both numerous and extensive. Whether this difference in land form and its associated ecology is significant or not remains to be seen, but it seems certain from water trap, bait plant, and bait plot data that *A. craccivora* is able to maintain itself locally and successfully throughout the dry season in both central and southern areas of Malawi.

The presence of GRV at the Chileka plot before the onset of the rains suggests the presence of a local source but does not indicate its extent nor significance.

Early Leaf Spot (*Cercospora arachidicola*)

Screening for Resistance

There are several likely components of tolerance or resistance to ELS which, presumably, may act independently or in various combinations. The more

Table 4. Incidence of *Aphis cracci*[illegible]d GRV on dry season groundnut plots in central and southern Malawi, Aug-Nov 1985.

Site	*Aphis craccivora*	No. plants infested/no. exposed	No. plants with GRV
Southern Region			
Lower Shire (Rift)			
Kasinthula	•	6/591	0
Southern Highlands			
Thyolo	•	0/227	0
Phalombe Plain			
Thuchila	•[1]	0/250	0
Phalombe	•	0/299	0
Kasongo Dambo	•	6/238	0
Domasi	•	46/101	0
Lake Shore			
Namiasi	•	23/123	0
Central Region			
Lilongwe Plain			
Chitedze	•	48/343	0
Chileka	•	4/311	4
Kamanzi	•	6/210	0
Likuni River	•	247/368	0
Malingunde	•	4/298	0
Chafumbwa	•	3/296	0
Nathenje	•	130/304	0
Nkhoma	•	8/285	0

1. Alatae observed but no subsequent colonization.

obvious of these may be apparent as a higher degree of leaf retention, few lesions, small lesions, and depressed sporulation. These components have all been used to assess resistance in the past.

Field assessment has generally involved visual scoring systems, such as the ICRISAT 9-point field scale. these often seek to assess at least two components simultaneously, and are inherently subjective. Few studies seem to have involved the more tedious physical measurement of one or more components, or to have sought a possible relationship between any one component of resistance and yield.

In the preliminary studies of the 1984/85 season, we measured leaf retention by counting the number of leaflets lost and retained at different sampling dates. We also examined the data in relation to yield.

In all the 1984/85 field trials, one stem of each of four plants, taken at random from an inner row of each plot of each replicate, was sampled by counting the number of leaflets absent and the number of mature leaflets present. All trials were sampled twice and most three times: 10-11, 12-14, and 16 weeks after emergence. Replicated data for each groundnut entry were pooled, and the average percentage of leaves retained for each successive sampling date was calculated. Subsequently entries were ranked for yield, and leaf data were examined in relation to ranked yield.

Tables 5, 6, and 7 summarize the results of leaf retention data. The total number of leaves produced per stem at any given sampling time was similar in high- and low-yielding lines. The higher number of leaflets retained by the former therefore did not seem attributable to a compensatory or faster rate of production of new leaves.

The data contained in Table 5 illustrate leaf retention at 88 days after emergence for varieties in the sequentially branched (S type) and alternately branched (A-type) sections, which were widely used as controls in the various trials. It can be seen that S-types retained on average about 25% of their leaves, whereas A-types retained about 32%. For the purpose of this report these figures may be assumed to represent normal values for the two botanical sections for the given period of sampling and for the particular season at Chitedze.

e 5. Mean percent leaf retention following early leaf spot infection in groundnut for control varieties 88 days after emergence, all trials, Chitedze, Malawi, 1984/85.

Genotype	Infection (%)	Mean
Sequentially branched section		
J 11	25, 34, 30, 23, 22	27
JL 24	28, 29, 25, 24, 23	26
Sellie	27, 27, 26, 21	25
Spancross	29, 26, 26, 24, 28, 19, 22	25
Malimba	26, 24, 23, 21, 28, 22, 27	24
Mean		25
Alternately branched section		
Mani Pintar	35, 38, 35, 30, 29, 39, 37, 28	34
SAC 58	34, 32, 34, 35, 32	33
Egret	34, 29, 36, 33, 28	32
RG 1	31, 31, 34, 31, 30, 28, 30	31
Chalimbana	32, 32, 31, 28	31
E 879/6/4	31, 28, 27, 29	29
Mean		32
Robut 33-1	23, 20, 27	25

A-types have often been described as showing some degree of field resistance to leaf spots. Under the conditions of severe epidemics that occur on the Lilongwe Plain, it is perhaps to be expected that the difference might not be wide, but a comparison of the overall mean is possibly suggestive and seems to reflect this inherent difference.

The data also suggest possible variations in susceptibility within each group. Robut 33-1 being an example of extreme susceptibility among the A-types and Malimba perhaps the most susceptible of the S-types tested.

Data presented in Table 6 for S-types show great differences in leaf retention at 70 and 88 days between lines. Some high-yielding lines not only retained more leaves at both 70 and 88 days after emergence, but lost proportionately fewer leaves during the 3-week period between samplings attrition proceeded at a lower rate. It seems possible that tolerance is involved, and that it will be necessary to adopt an appropriate method in order to identify

Table 6. Percent leaf retention following early leaf spot infection in groundnut at 70 and 88 days after emergence in relation to yield in certain sequentially branched selections and varieties, Chitedze, Malawi, 1984/85.

Trial[1]	Entry	Percent leaf retention at day 70	88	Pod yield (kg ha⁻¹)	Yield rank	Percent leaf retention at 88 days
1 (35)[2]	ICGMS 30	54	43	2354	1	1
	ICGMS 29	62	40	1733	14	2
	Spancross	43	29	1957	7	9
	Malimba	46	26	1660	19	12
2 (28)	ICGM 285	63	45	3297	2	1
	ICGM 281	59	45	3050	5	1
	ICGM 189	57	43	2776	6	2
	ICGM 286	56	42	3366	1	3
	Sellie	46	26	1594	23	15
	Spancross	35	28	1533	25	14
	Malimba	46	28	1458	26	14
3 (22)	ICGM 550	43	37	2312	1	2
	ICGM 473	46	39	1430	10	1
	Spancross	45	24	1319	15	11
	JL 24	42	29	1270	17	6
	Sellie	43	27	1097	20	8
	Malimba	46	21	1048	20	14
4 (22)	ICGM 525	51	47	2611	1	1
	Sellie	45	27	1708	8	10
	Spancross	49	26	1537	14	11
	JL 24	47	28	1505	17	9
	Malimba	45	23	1407	22	14

1. Trial 1 = Regional Yield Trial; 2 = Elite Germplasm Trial; 3 = Advanced Germplasm Trial; 4 = Preliminary Germplasm Trial.
2. Figures in parentheses denote number of entries.

Table 7. Percent leaf retention following early leaf spot infection in groundnut at 70 and 88 days after emergence in relation to yield in certain alternately branched selections and varieties, Chitedze, Malawi, 1984/85.

Trial[1]	Entry	Percent leaf retention at day 70	88	Pod yield (kg ha⁻¹)	Yield rank	Percent leaf retention at 88 days
1 (16)[2]	ICGMS 36	50	37	2116	3	1
	ICGMS	48	35	2438	4	3
	ICGMS 42	45	32	3211	1	5
	Mani Pintar	49	35	2911	2	3
2 (18)	ICGMS 336	51	34	3109	1	2
	Egret	48	36	3042	2	1
3 (12)	ICGM 515	45	32	2138	6	1
	Mani Pintar	49	30	2555	3	2
	SAC 58	45	32	2569	2	1
	Egret	35	29	2618	1	4
4 (41)	ICGM 623	47	37	3046	1	1
	ICGM 484	51	35	2292	2	1
	ICGM 614	46	36	2745	3	2
	SAC 58	50	34	2727	4	4
	Egret	45	34	2639		
	Mani Pintar	50	35	2421	12	3
	Chalimbana	45	32	2245	18	6
5 (15)	ICGM 42	49	35	2966	1	2
	Mani Pintar	53	39	2861	2	1
	Egret	53	33	2783	4	3

1. Trial 1 = Regional Yield Trial, 2 = Elite Germplasm Trial, 3 = Advanced Germplasm Trial, 4 = Preliminary Germplasm Trial, 5 = High Yield and Quality Trial
2. Figures in parentheses denote number of entries.

and to assess it quantitatively. At 88 days, all entries score 7, 8, or 9 on the ICRISAT 1-9 scale, and would therefore be rated as susceptible. In this particular instance the 9-point field scale appears to be too coarse a method to detect possible differences between various entries.

We have had the opportunity of analysing the data from only one experiment, that of the breeder's Regional Yield Trial (Spanish Bunch) (Table 6). Analysis of variance of arc sine transformed data showed that there was a significant difference in leaf retention between ICGMS 30 and ICGMS 29 on the one hand and Spancross and Malimba on the other. The standard error was ±1.4 and the coefficient of variation 8.3%. There was no significant correlation between leaf retention and yield. At this stage it would not be profitable to speculate further on our observations, but they seem to provide a possible lead worthy of further investigation for at least one more season.

Leaf retention in A-types (Table 7) appeared to be more uniform and, in contrast to S-types, no exceptional differences were apparent among the cultivars, or between the higher-yielding ICRISAT breeding lines and the controls.

In the next season we hope to examine this aspect more critically by sampling for leaf retention in a number of selected trials at 10-day intervals throughout the growing season. We also hope to attempt to examine other components of resistance (possible differences in lesions and sporulation) in relation to leaf retention in a number of carefully selected S-type lines.

Disease Monitoring at Chitedze

Late leaf spot (*Phaeoisariopsis personata*) and rust (*Puccinia arachidis*) appeared in trace amounts late [illegible] the season, an established and apparently [illegible] pattern for the Lilongwe Plain. Incidence of [illegible] mottle virus was appreciably lower than that [illegible] 1983/84 season. Tomato spotted wilt virus [illegible] apparently of wide occurrence but very low [illegible]dence throughout the region, was again present [illegible] traces. We marked with stakes all TSWV-[illegible] plants in the ICRISAT fields early in the season [illegible] order to monitor possible spread from source [illegible] We recorded 108 affected plants in our 7-ha [illegible]mental area, an overall incidence of about [illegible]

All infections apparently occurred over [illegible] paratively brief period, within 2 or 3 weeks of [illegible]gence, presumably a result of a migration [illegible] vector.

There was no evidence of subsequent [illegible] plant spread nor for increase in incidence [illegible] We harvested 21 affected plants together [illegible] healthy plant on either side of each diseased [illegible] and measured seed yield in healthy and [illegible] individuals. The yield of diseased plants [illegible] 30% of the yield of the controls.

References

Adams, A.N., and Farrell, J.A.K. 1967. The [illegible] occurrence of aphids in traps at Chitedze, Malawi. [illegible]sia, Zambia and Malawi Journal of Agricultural Research 5:153-159.

ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). 1985. Proceedings of the [illegible] Groundnut Workshop for Southern Africa [illegible] 1984, Lilongwe, Malawi. Patancheru, A.P [illegible] International Crops Research Institute for the Semi-Arid Tropics.

A Review of the Pr[illegible]nt Status of the Genetic Resources of the ICRISAT Regional Groundnut Improvement Program, of the Southern African Cooperative Regional Yield Trials, and of Rosette Virus Resistance Breeding

S. N. Nigam*

Abstract

The status of the groundnut genetic resource collections of the national programs in the southern African region and of the ICRISAT Regional Groundnut Improvement Program for Southern Africa is reviewed. The role of 'introductions' in the improvement of groundnut is discussed with particular emphasis on the valencia types in the region.

Two years' results from the ICRISAT Southern African Cooperative Regional Yield Trials are presented. While reviewing progress made in breeding for groundnut rosette virus (GRV) resistance, it is suggested that resistance to this disease is governed by two recessive genes. Transfer of this resistance into early maturing groundnut varieties will require large F_2 populations.

Sumário

Uma revisão do presente estado dos recursos genéticos no Programa Regional de Melhoramento do Amendoim do ICRISAT, dos ensaios regionais cooperativos para o rendimento na Africa Austral e do melhoramento para a resistência ao vírus de roseta. *É revisto o estado das colecções de recursos genéticos de amendoim dos programas nacionais da Africa Austral e do Programa Regional de Melhoramento do Amendoim do ICRISAT para a Africa Austral. A importancia das 'introduções' no melhoramento do amendoim nesta região é discutida com particular realce nos amendoins do tipo valência.*

São apresentados dois anos de resultados dos ensaios regionais cooperativos para o rendimento na Africa Austral do ICRISAT. Durante a revisão do progresso feito no melhoramento para a resistência ao vírus da roseta do amendoim, é sugerido que a resistência a esta doença é governada por genes recessivos. A transferência desta resistência para variedades de maturação precoce vai requerer grandes populações F_2.

Since the inception of the ICRISAT Regional Groundnut Program for Southern Africa in July 1982, significant progress has been made in various aspects of groundnut improvement in the region. The research requirements for groundnut improvement in the region (Nigam 1984) and the progress up to 1984, were reviewed at the previous Regional Workshop in 1984 (Nigam and Bock 1985).

This paper deals mainly with two specific aspects, i.e., genetic resources and regional yield trials, which were discussed at length in the concluding session of the ICRISAT-IDRC Regional Groundnut Breeders'

*Principal Groundnut Breeder, ICRISAT Regional Groundnut Improvement Program for Southern Africa, Chitedze Research Station, Private Bag 63, Lilongwe, Malawi.

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ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). 1987. Proceedings of the Second Regional Groundnut Workshop for Southern Africa, 10-14 Feb 1986, Harare, Zimbabwe. Patancheru, A.P. 502 324, India: ICRISAT.