SADCC/ICRISAT Regional Groundnut Improvement Program

G.L. Hildebrand, K.R. Bock[1], and S.N. Nigam[2]

The Southern African Development Coordination Conference (SADCC)/ ICRISAT Regional Groundnut Improvement Program was established at Chitedze Research Station near Lilongwe, Malawi in 1982 in response to an invitation by the Southern African Heads of State at the Lusaka Summit Conference in 1980.

In 1984, the SADCC Consultative Technical Committee for Agricultural Research approved the subsuming and the future expansion of the ICRISAT Regional Groundnut Program into a regional Grain Legume Improvement Program (GLIP), with ICRISAT retaining responsibility as executing agency for regional groundnut research. Cowpea and bean make up the other components of GLIP with the International Institute of Tropical Agriculture (IITA) and the Centro Internacional de Agricultura Tropical (CIAT) acting as the respective executing agents. The program is presently staffed by a pathologist and a breeder. The program serves the nine SADCC Member States including Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe, covering an area of 4.9 million km^2.

Agroecological conditions and production constraints are many and varied. Two of these affect all countries and are the most amenable to improvement by a modest regional program. These are early leaf spot and groundnut rosette virus disease, and the lack of cultivars suitably adapted to the varied agroecological conditions. More than 75% of the region is semi-arid.

Objectives

We acknowledge the smallholder farmer as our principal target. These farmers have limited financial and other resources. Our research is therefore conducted under conditions of low input. Our experiments are grown rainfed, without any form of crop protection. To ensure a reasonable substrate for growth we apply a minimal level of phosphorus.

We recognize also that national programs are our immediate clients and that their needs are of paramount importance. At our regular workshops and group meetings, steering committees discuss the needs and priorities of the region and make recommendations for regional program inputs.

---

1. Principal Groundnut Breeder; Team Leader and Principal Groundnut Pathologist, SADCC/ICRISAT Regional Groundnut Improvement Program, Chitedze Research Station, P.B. 63, Lilongwe, Malawi.
2. Principal Groundnut Breeder, Legumes Program, Patancheru, A. P. 502 324, India.

ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). 1990. Summary Proceedings of the First ICRISAT Regional Groundnut Meeting for West Africa, 13-16 Sep 1988, Niamey, Niger. Patancheru, A.P. 502 324, India: ICRISAT.

Research Activities

Breeding

Germplasm evaluation. We have built up and continue to broaden our genetic base and have evaluated about 3500 accessions over the six seasons since the program began.

Hybridization. We are concerned by the lack of adaptability to southern Africa of much of the germplasm introduced from elsewhere and we consider the generation of segregating populations locally to be a priority. We have trained 20 field assistants who have assisted in making more than 800 crosses for yield and quality, adaptability, early leaf spot tolerance, and for rosette resistance. The team will soon be expanded and we plan to make 150-200 crosses each year. We have responded to requests by national programs for specific hybridizations and to date have made crosses for Malawi, Mozambique, and Zimbabwe. We continue to offer this service to national programs.

Breeding for disease resistance. We continue to place major emphasis on selection for yield under severe and uniform early leaf spot pressure, a condition that occurs every year at Chitedze.

We have evaluated material from our own program and from ICRISAT Center for resistance to foliar diseases. This material has included populations from crosses made for early leaf spot resistance and from crosses made at ICRISAT Center involving late leaf spot and rust-resistant parents. Interspecific derivatives were also included.

We have perfected a technique to screen breeding populations for rosette resistance, which has reduced the exercise to a routine procedure. With this, it is possible to induce an overall incidence approaching 99% in susceptible genotypes. We have selected symptomless plants from these nurseries for further evaluation.

We have investigated the inheritance of resistance, previously reported to be determined by two recessive genes, and are satisfied that the resistance available to us and which has been exploited in Malawi is controlled by duplicate recessive genes. We have now purified a West African source of resistance in short-season material.

Breeding for high yield and quality. We have evaluated populations from crosses between high-yielding and bold-seeded genotypes. A number of crosses involving indigenous cultivars and promising ICRISAT material performed poorly. We see great need for the development of, and selection from, locally generated segregating populations.

We recognize the need voiced at the Third SADCC Regional Groundnut Workshop for assistance with quality assessment and for setting up a facility within the program for regional quality assessment.

Early maturity and drought resistance. We have identified a few promising early maturing lines from ICRISAT Center and have noted the performance of 55-437 in trials in Niger and Botswana. We plan to use these genotypes in crosses in 1988/89 to generate segregating populations for possible screening in Botswana.

If phytosanitary regulations permit we intend to strengthen cooperation between the SADCC and Sahelian Center Programs in order to undertake off-season multiplication, and evaluation for adaptability.

Pathology

The regional pathology program is concerned largely at this stage with research on early leaf spot and rosette, although some effort has recently been directed toward groundnut streak necrosis disease (GSND).

Early leaf spot. Genotypes which showed promise in India for early leaf spot resistance were screened at Chitedze in 1987/88 but none were worthy of exploitation. We intend to repeat the screening of some of the ICRISAT Center germplasm over the next few seasons.

In 1985/86 we intercrossed several lines which appeared to retain their leaves longer under conditions of severe disease pressure. None showed any promise for resistance but several were selected for other desirable characteristics.

Research in the Zambia national groundnut program has shown that one fungicide application at about 75 days after planting has resulted in economic control of early leaf spot. We have investigated responses to a factorial combination of up to five sprays at varying dates with encouraging results.

Groundnut rosette virus (GRV). Field screening for rosette resistance continues, greenhouse reared, rosette infected, and heavily aphid-infested seedlings are transplanted into susceptible spreader rows. Single spreader rows are sown after every pair of test rows and infector plants are introduced into spreader rows at 2 m intervals. In 1987/88 we screened 15 000 F_3 plants in a nursery where we were able to induce a 99% incidence of rosette.

We collaborated with the Scottish Crop Research Institute in further studies on groundnut rosette assistor virus (GRAV). All rosette resistant varieties are susceptible to GRAV but infection is symptomless or inapparent. The seasonal origins of rosette remain obscure. We cannot rule out the possibility of long-distance immigration but the possible importance of resident dry-season populations and alternate vector and virus hosts warrants continued investigation.

Groundnut streak necrosis disease (GSND). We have confirmed that this disease, hitherto assumed to be caused by tomato spotted wilt virus, is caused by sunflower yellow blotch virus (SYBV) transmitted by *Aphis gossypii*.

Regional Cooperation

Regional trials. We have supplied new material in the form of regional trials for the past five seasons and, in all, 36 alternately branching and 79 sequentially branching breeding lines have been entered in regional trials for testing against locally recommended varieties. More recently, valencia types have been entered in a separate trial.

These trials have provided useful data on varietal adaptability and a number of selections have shown good potential and wide adaptability across the region. ICGMS 42 has been approved for prerelease evaluation in Zambia.

Hybridization. We have made crosses for Mozambique for leaf spot tolerance and adaptability; for Zimbabwe for leaf spot tolerance and rosette resistance; and for

Malawi for confectionery quality. We will continue to provide this service to national programs.

Training. We offer specialist training in breeding and pathology methodology at the technician level.

Funding. ICRISAT Center has made funds available for the past two seasons for direct allocation to national programs. This year we assisted Tanzania, Zambia, Mozambique, Swaziland, and Zimbabwe. Funds are spent on the management of field experiments but are also used for the purchase of equipment and supplies.

Networking Activities

We have developed an effective regional network, linking together groundnut scientists of the SADCC countries. We organized three multidisciplinary workshops, the first and third in Lilongwe in 1984 and 1988; the second in Harare in 1986. These have been most successful and have afforded close and sustained professional contact between all research scientists engaged in groundnut research programs. These workshops function effectively as Steering Committees where national program scientists are able to discuss problems and priorities and formulate recommendations for regional program action. We supplement these workshops every alternate year with specialist group meetings. We have initiated a newsletter in order to facilitate exchange of information on research results, experimental techniques, and methodology.