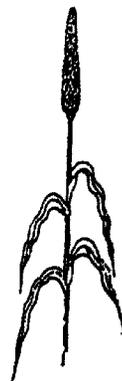


**SADC/ICRISAT
SORGHUM AND MILLET IMPROVEMENT PROGRAM**

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**SORGHUM AND PEARL MILLET
TECHNOLOGY TRANSFER AND
RESEARCH PLANNING MEETINGS
1993/94**



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TECHNOLOGY TRANSFER AND
RESEARCH PLANNING MEETINGS**

1993/94



**SADC/ICRISAT Sorghum and Millet Improvement Program
P.O. Box 766, Bulawayo, Zimbabwe**

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Acronyms and Abbreviations

ADC	Agricultural Development Center (Namibia)
ADD	Agricultural Development Division (Malawi)
ADMARC	Agricultural Development and Marketing Corporation (Malawi)
AGRITEX	Agricultural Technical and Extension Services (Zimbabwe)
ALDEP	Arable Lands Development Program (Botswana)
ARD	Agricultural Research Division (Lesotho)
BAMB	Botswana Agricultural Marketing Board
CIAT	Centro Internacional de Agricultura Tropical
CIDA	Canadian International Development Agency
CSC	Christian Service Committee (Namibia)
DAR	Department of Agricultural Research (Botswana)
DNDR	National Directorate for Rural Development-Extension Services (Mozambique)
DR&SS	Department of Research and Specialist Services (Zimbabwe)
EARCAL	Eastern Africa Regional Cereals and Legumes Program (Kenya)
EARSAM	Eastern Africa Regional Sorghum and Millets Network (Kenya)
ENDA	Environmental Development Activities (Zimbabwe)
FAO	Food and Agricultural Organization of the United Nations
FMFI	Farmer-Managed Farmer Implemented Trial
FNDC	First National Development Corporation
FSR	Farming Systems Research
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
ICRISAT	International Crops Research Institute for the Semi Arid Tropics
IITA	International Institute for Tropical Agriculture
INIA	Instituto Nacional de Investigação Agronómica (Mozambique)
IPM	Integrated Pest Management
MAWRD	Ministry of Agriculture Water and Rural Development (Namibia)
MOAC	Ministry of Agriculture and Cooperatives (Swaziland)
NARS	National Agricultural Research System
NGO	Non Governmental Organization
NPGRC	National Plant Genetics Research Center
NSCM	National Seed Company of Malawi
OFR	On Farm Research
PSP	Production Systems Program (Botswana)
RCC	Regional Coordinating Committee (Botswana)
RIIC	Rural Industries Innovation Center (Botswana)
RMFI	Researcher Managed Farmer Implemented Trial
SACCAR	Southern African Center for Cooperation in Agricultural Research
SADC	Southern African Development Community
SG-2000	Sasakawa Global 2000
SMIP	Sorghum and Millet Improvement Program (ICRISAT)
SSC	SMIP Steering Committee
UNICEF	United Nation's Children's Fund
USAID	United States Agency for International Development
WLF	World Lutheran Foundation
ZAMS	Zambia Agri-business Management Service
ZFU	Zimbabwe Farmers' Union

Introduction

The SADC regional Sorghum and Millet Improvement Program (SMIP) was established in 1983 with an anticipated 20 to 25 year life span. This commitment of time was viewed as necessary to develop strong national capacities to conduct research on sorghum and pearl millet. In addition, this time frame accounted for the lengthy periods of research and development necessary to create and disseminate improved cropping technologies. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) was identified as the principal implementing agent for the regional program.

During the first two phases of SMIP (1983-1993), substantial progress was made in training scientists and in developing new varieties suited to the agro-ecologies of southern Africa. The SMIP Steering Committee correspondingly suggested that greater priority should be attached to the transfer of improved technologies to small-scale farmers during the 1993-1998 Phase III period.

At the SMIP Steering Committee meeting of May 1993, ICRISAT's regionally based scientists were requested to participate in a set of national planning meetings prior to the 1993/94 cropping season. The committee proposed that these meetings should highlight the theme of technology transfer. By sponsoring a set of national meetings, instead of the usual regional research and planning meeting, a larger number of national scientists could attend. Participation could also be sought from many of the institutions concerned with the dissemination and adoption of improved technologies, such as extension agents, input suppliers, grain traders and processors, non-governmental organizations (NGOs), and farmers. A component of the discussions would then concentrate on evaluating constraints on the rapid dissemination of technologies and reviewing priorities for longer term technology development.

The Sorghum and Pearl Millet Technology Transfer and Research Planning Meetings were initiated through the leadership of the Department of Research and Specialist Services (DR&SS) in Zimbabwe in early July 1993. Between July and early November, the meetings were held in nine of the ten SADC countries including Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia, and Zimbabwe.

In most countries in the region, these meetings provided the first opportunity for research scientists to interact closely with such a wide range of individuals and institutions interested in the development of the sorghum and pearl millet cropping system. The linkages between institutions involved in technology development and those involved in technology dissemination were undoubtedly strengthened. Several national research programs received offers of assistance with the final stages of technology testing and dissemination. Non-governmental organizations in particular, offered their services in hosting on-farm trials and disseminating new technology. Many expressed interest in supporting seed multiplication in the fields of small-scale farmers. Seed companies offered assistance with the provision of seed inputs for on-farm trials and demonstration programs. Grain processors offered to clarify quality standards and target the purchase of new varieties developed by national research programs. The meetings revealed that assistance is often available for achieving research impact, though scientists still need to work hard to harness these diverse offers of support.

In those meetings encompassing participation of farmers, questions invariably arose about why new technologies were not immediately available. Farmers expressed appreciation for the opportunity to participate in research planning, but impatience with the years of additional testing necessary to verify the performance of a given set of technologies. They attached priority to on-farm work and requested stronger efforts to resolve constraints on technology dissemination.

The emphasis of the third phase of SMIP on technology transfer and the frequent expressions of concern about research impact, led national and regional scientists to highlight technology verification in the planning and collaborative research during the 1993/94 season. Priority was attached to on-farm trials necessary to

complete the testing of new varieties targeted for release. Breeding efforts are increasingly targeting the selection and use of germplasm with specialized grain and plant traits. Plant protection research is starting to emphasize assessment of evolving pest and disease pressures associated with the dissemination of new varieties. Economics work encompasses a combination of diagnostic survey work where knowledge of farmers' practices remains deficient, and impact assessment where technologies are being adopted.

ICRISAT views the full set of Technology Transfer and Research Planning Meetings as a successful introduction to SMIP Phase III. The research priorities underlying the collaborative relationship between scientists from the regional and national programs are evolving. Efforts to verify the technological accomplishments of the past ten years are guided by the objective of research impact. The research agenda of the regional program is taking a more strategic focus with efforts to backstop national scientists who have returned from overseas degree training. Linkages between research scientists and the range of institutions affecting technology adoption are being strengthened.

This document briefly summarizes the results of the national Technology Transfer and Research Planning Meetings. Each national report was prepared by one of the SMIP scientists attending each meeting. These reports give a flavor of these discussions and the outcomes of some of the planning sessions. They are not meant to provide detailed descriptions of the deliberations of each meeting. Such detail may be found in the proceedings volumes derived from the meetings which are being published by each national research program.

Some of the highlights of particular national meetings are briefly summarized below.

Highlights

Botswana. Research scientists and farmers agreed on the need to complete the verification of the performance of the best available sorghum cultivars in preparation for their official release.

Lesotho. This was the first meeting of its kind to bring together a large number of farmers and research scientists to discuss the relevance of research findings. The Permanent Secretary for Agriculture, Mr. R. L. Ntokoane, stated the government's renewed commitment to support transfer of the technologies developed for sorghum. Priority was placed on verifying the performance and acceptability of the best available sorghum varieties in smallholders' fields in preparation for release.

Malawi. The Principal Secretary for Agriculture, Mr. J. H. A. Maida, reaffirmed the government's support of sorghum and pearl millet technology development and transfer. There was discussion of the importance of releasing new sorghum varieties for production by smallholder farmers. The varieties were officially released several weeks later. There was also agreement to verify the performance and acceptability of the best available pearl millet varieties in on-farm trials in preparation for official release. The participants agreed that research, extension, and NGOs should work together on seed production and distribution in Malawi.

Mozambique. Given the limited information base on the sorghum and pearl millet subsector, a broadly focused diagnostic survey was proposed to target national sorghum and pearl millet priorities. The participants committed themselves to verifying the performance and acceptability of the best available sorghum and pearl millet varieties in smallholders' fields in preparation for their release.

Namibia. There was agreement on the strategies for re-targeting pearl millet breeding in Namibia based on information gathered in adoption surveys of the popular Okashana 1 variety. Participants expressed their commitment to broad diagnostic surveys to re-target pearl millet development priorities.

Swaziland. The Principal Secretary in the Ministry of Agriculture and Cooperatives (MOAC), Mr. M.M. Bhambele, made clear the government's commitment to support sorghum production and technology transfer in Swaziland. There was agreement that NGOs and research must work more closely together on the distribution of seed for the newly released varieties in drought relief programs.

Tanzania. There was a renewed commitment to verify the performance and acceptability of the best available sorghum and pearl millet varieties in smallholders' fields in preparation for official release.

Zimbabwe. An agreement was reached on the strategy for research, extension, NGO, and SMIP collaboration in the testing and verification of the performance and acceptability of the best available varieties of sorghum and pearl millet in Zimbabwe. NGOs are contributing resources to this applied research. There was also agreement on the value of and the strategies for phenotype assessment trials to better characterize smallholder demand for alternative grain and plant trials. This information will help re-target breeding priorities.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING BOTSWANA 28-29 October 1993

Highlights

The Botswana Sorghum and Pearl Millet Technology Transfer Meeting was held at the Gaborone Sun Hotel, Gaborone, on 28 Oct 1993. This was followed on the next day by a Research Planning Meeting between the NARS and SMIP scientists at the Sebele Research Station.

The Technology Transfer meeting generated extensive dialogue between the farmers, researchers, agricultural extension and production officers, and representatives from government parastatals. The dialogue established understanding and awareness among participants regarding the development, dissemination, and adoption of new sorghum and pearl millet technologies.

The participants expressed the need for quicker release of new cultivars of sorghum and pearl millet and the provision of new and additional agronomic technologies. The participants accepted the need for additional on-farm research and wider verification of new technologies.

The seed issue took center stage in the lengthy, open, and frank discussions and was also the first significant item on the recommendations list. In addressing the complex problem of seed production and procurement in Botswana, an option of small-scale farmer-level seed production was suggested. The possibility of setting up a small consultative task force as a working group under the Department of Agricultural Research (DAR), in order to come up with concrete approaches to solving the problem was also suggested. In addition, the participants offered recommendations on input supplies (mainly seed and machinery), grain pricing, and utilization. Recommendations were also offered for strengthened interdepartmental linkages within and between appropriate ministries in order to obtain more rapid research impact.

The participants recommended the release of one or two of the cultivars (Macia, SDSL 87019, SDS 2583, SDSH 409, and SDSH 48) now in on-farm testing.

Participation

The meeting was attended by 49 participants involved in research, production, and utilization of sorghum and pearl millet. The participants included five farmers, research staff from the Department of Agricultural Research (DAR), regional crop production and agricultural officers, food technologists, and cooperative societies. The DAR was represented by Dr. Gakale, the Director, Dr. Mazhani, the Chief Arable Research Officer, Dr. Manthe, the Team Leader of the Cereals Improvement Program, and Mr. Modiakgotla, Team Leader for the Production Systems Program (PSP). SMIP was represented by Dr. Rohrbach, Leader of the Resource Management Unit, Dr. Obilana, Leader of the Cereals Improvement Unit, Dr. Gupta, coordinator for SMIP's collaborative on-farm research activities, Dr. Leuschner, leader of SMIP's crop protection research, and Dr. Monyo, the pearl millet breeder.

Presentations

There were six presentations that provided an overview of sorghum and pearl millet research in Botswana. These highlighted the research collaboration between the SADC national programs and SMIP. The presentations reviewed the impact of the crop production program and the status of sorghum and pearl millet milling in the country.

The importance given to the regional Sorghum and Millet Improvement Program (SMIP) by the Botswana government was declared in the opening speech of Dr. Gakale, the Director of Agricultural Research. He referred to SADC/ICRISAT SMIP, based in Matopos, as the model program of SACCAR and described it as the oldest project which is still surviving and productive in Botswana. He expressed satisfaction with the meeting's success in bringing together the farmers and other key players in the improvement and production of sorghum and pearl millet in Botswana. He also expressed appreciation for SMIP's research collaboration with SADC national programs and cited the importance of technology transfer linkages. Finally, the director expressed the wish that such meetings would promote better linkages between research and farmers.

In his opening remarks, Dr. L. Gakale identified sorghum as the most important crop in Botswana, comprising 53.4% of the total area planted to six field crops. Pearl millet covers only 4.2%. He cited corresponding 1993/94 seed requirements for these crops. Sorghum takes the biggest requirement for seed (59%), while maize takes 37%, and pearl millet takes only 4.5%. Dr. Gakale noted his interest in obtaining Okashana 1 pearl millet seed from Namibia.

Dr. L.M. Mazhani, the Chief Arable Research Officer, reviewed the status of sorghum and pearl millet in Botswana. In the limited cultivable land area (5% of total available land), sorghum covered 206 000 ha in 1990, while maize covered 80 000 ha and pearl millet covered only 12 000 ha. Sorghum yielded 38 000 t, maize yielded 12 000 t, and pearl millet yielded 1 700 t. Dr. Mazhani identified heat and drought as the biggest constraints on production, followed by the use of traditional varieties and unimproved cultivation practices, including untimely weeding and lack of draught power. The limited markets for surplus crops was also cited as a constraint. Finally, he traced the research progress made in Botswana for sorghum and pearl millet. He noted that cultivar selections and crop management research led, in 1954, to the selection of Segalane and Kanye Std from local sorghum collections, and to the release of 85D and 8D from introductions. Serere 6A pearl millet was introduced from Uganda and was selected for release. Segalane and Serere 6A remain among the most popularly grown sorghum and pearl millet selections in the country. Recent breeding activities have selected 5 cultivars out of about 5 000 introductions, (3 open pollinated varieties and 2 hybrids) for early maturity, heat and drought resistance, and yield potential. These are being tested on-farm. Dr. Mazhani cited the value of recent agronomic research on population size and row planting. He noted the importance of improving linkages between research, extension, and the farmer.

Dr. A. B. Obilana presented an overview of SMIP's research collaboration with SADC national programs, the priorities for SMIP Phase III, and the importance of technology transfer linkages in the region, on behalf of Dr. L.K. Mughogho, the Executive Director of ICRISAT's Southern and Eastern Africa Programs.

Mr. E. Modlakgotla highlighted the impact of the national Production Systems Program (PSP) on research and extension in selected districts. There are farming systems teams located in four regions: Mahalapye, Francistown, Pelotshethla, and Maun. He reported results of an on-farm processing and palatability trial. Three new cultivars were compared with Segalane. The variety Macia was most palatable and acceptable for porridge. The varieties SDSL 87019 (creamy white) and SDS 2583 (brown) do not crack with dehulling, but are less palatable in porridge. The farmers liked the stay-green robust plant character of Macia. Mr. Modlakgotla pointed out that linkages between PSP and extension can be strengthened through existing Regional Coordinating Committees (RCCs), including research, extension, NGOs, marketing boards, such as the Botswana Agricultural Marketing Board (BAMB), and other related parastatals.

Dr. D. D. Rohrbach reviewed the need for research impact and discussed approaches for assessing research impact in Botswana

Mr. P. Maribe, the Assistant General Manager for the Rural Industries Innovation Center (RIIC) Kanye, discussed the status of sorghum and pearl millet milling in Botswana. There is both hand (mortar and pestle) and mechanical dehulling prior to hammermilling of sorghum in Botswana. Commercial products were listed as traditional porridge, instant fermented porridge, malt, snack and weaning foods, sorghum flour (amabele), and instant beer powder (Matabela). According to Mr. Maribe, there are 56 sorghum mills in Botswana with a capacity of 73 000 t. Production of sorghum grain is below the demand by processors. Mr. Maribe believes that due to the milling industry, there has been an increase in the consumption of sorghum, especially in urban areas. The higher consumption of sorghum flour has unfortunately led to increased prices of mills.

Mr. Maribe identified the main problems within the milling industry as drought (which leads to a low supply of sorghum grain), poor milling quality of imported grain, constant shut-down of mills due to shortage of supplies, and competition from imported sorghum products, mainly from South Africa.

Discussions

The discussions treated a wide range of issues including problems of input supply, grain marketing, research-extension linkages, and research impact.

In response to requests by farmers for more adaptable sorghum varieties and suitable cultivation implements in the extremely dry western region, the Ministry of Agriculture staff present at the meeting said that the Phase I Arable Lands Development Program (ALDEP) did not include the western region, but in Phase II, ALDEP has included this region in their activities. Regarding the policy of the Botswana government on sorghum production, it was mentioned that the government is promoting diversity in crop production. Farmers requested seed of improved sorghum varieties as well as seed of high value crops like cowpea and jujube beans.

In the discussion on seed, it was explained that demand for seed fluctuates with the weather year to year. After a good rainy season, the demand may be only 2 000 t, but after a drought year, the demand rises to over 6 000 t. The Director explained that normally farmers do not come to buy seeds. But that they expect seed to be distributed free after seasons of drought. Seed availability, demand, and the policy of distribution are all difficult problems. Complicating the seed issue is that storage facilities at Sesele Research Station are not very good. However, the Director emphasized that the seed issue is being seriously addressed.

Workplans 1993/94

During the morning of 29 October scientists from the Department of Agricultural Research (DAR) met with SMIP scientists to discuss collaborative workplans for the 1993/94 season. The group focused on two major items: technology exchange and back-up research. Under technology exchange the group discussed the technologies in the pipeline for release in the next 1-3 years.

The Department identified a number of sorghum and pearl millet technologies in the pipeline including: seed dressing, stand establishment (still being tested on-station), tillage experiments (released technology but still being tested for adoption), double plowing (released technology which may need more data), deep ripping, and new varieties. The sorghum varieties Macla, SDSL 87019, SDS 2583, SDSH 48, SDSH 409 are in on-farm trials, and seven new cultivars are in advanced station-based testing.

The national program requested continued assistance from SMIP for the evaluation of varieties and strategies for their release. Breeder seeds were also requested for Macia, SDSH 408, SDSH 48, and their three parents to continue the in-country increase and bulking up of seed. The NARS and SMIP will collaborate on hybrid seed productivity tests and male sterile parent line development using Segalane.

The implementation of on-farm trials will be the responsibility of the national program with assistance for data analysis and joint field visits on farmers' plots from SMIP. There are 15 technicians who are involved in on-farm trials and who require in-service training. There is also the need to develop in-service training courses for extension staff and farmers (especially women farmers).

It was suggested that the national program should have two Germplasm Observation Nurseries for farmer participatory selection, one for sorghum and one for pearl millet. The nurseries for sorghum could be sited at four locations: Sebele, Mahalapye, Francistown, and Pandamatenga. For pearl millet, two locations, including Francistown and Gumare, were suggested. Feedback from these nurseries on genotype selection and comments from farmers on priority plant and grain traits would assist the national program in re-targeting their breeding programs.

For entomology work in the national program, it was suggested that an Integrated Pest Management (IPM) component should be built into the on-farm trials, and that planting date trials should be organized to study the pressure of insects in Pandamatenga. The monitoring of incidence, severity, and possible control of *striga* through management should be a national activity and should be built into the on-farm trial set up. Observations on *striga* should be included in the 1993/94 on-farm trials. It was noted that *striga* is not too serious a problem, except in Mahalapye and in some eastern regions where sorghum is grown.

Variety trials to observe new options for genotypes with different plant and grain traits will be continued by the national program.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING LESOTHO

10-12 August 1993

Highlights

The Lesotho Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting was highlighted by the large participation of farmers and development support institutions. The meeting involved the presentation of research findings and development issues for discussion with the farmers. The meeting was conducted in the Sesotho language, allowing the farmers to participate fully and consistently.

In general, the meeting evaluated the limited availability of improved technologies for sorghum production and noted the interest of small farmers in improved seed and processing technologies. Farmers also expressed concern about limited market opportunities and low grain prices.

During the last day of the meeting farmers discussed priorities for research on production, plant protection, and grain marketing. A rough consensus developed around three major priorities for government assistance: the development and timely delivery of improved production inputs, particularly improved seed, the need to protect the sorghum crop from animals and theft, and the need for assistance with grain marketing.

The farmers generally expressed satisfaction with the meeting. Many noted that this was the first time they had the opportunity to contribute ideas directly to research prioritization and government development policy. They expressed a desire for similar meetings in the future. At the end of the meeting, 160 kg of seed of four different varieties of sorghum (SV 1, LARSVYT-19, SDS 2690-2, and DC 75) was distributed to farmers. The production of these sorghum varieties will be monitored during the 1993/94 cropping season and will provide a basis for both the verification of farmer interest in new varieties and the initial distribution of improved seed.

In a final discussion of collaborative workplans, it was agreed that the Agricultural Research Division (ARD) needed more time to prepare its own research plan and to identify how it could make the best use of SMIP support. In this context, the ARD indicated an interest in seeing model collaborative workplans developed by SMIP in collaboration with other SADC national programs. Nonetheless, it was agreed that SMIP should collaborate with efforts to verify the best available cultivars on the fields of small farmers in preparation for official release. It was also agreed that the SMIP coordinator for on-farm research activities would visit to complete the collaborative planning in September.

Support for the meeting was provided by SMIP, two local agricultural development projects (Mateile Rural Development Project and the Semonkong Project), and the private wholesale/retail trading company, Frasers.

Participation

The participants included more than 35 farmers composed of representatives from all districts in the northern, southern, and mountain regions of the country. In addition, the meeting included 24 representatives of the ARD and a cross-section of extension officers, cooperative society representatives, regional agricultural officers, representatives of several NGOs, and delegates from several private companies. In total, more than 100 people attended the three day meeting.

SMIP was represented by Dr. A.B. Obilana, Leader of the Cereals Improvement Unit, and Dr. D.D. Rohrbach, Leader of the Resource Management Unit.

Presentations

Fourteen presentations were made on a wide range of topics including sorghum production policy, research strategy, development strategy, and economics.

The meeting was opened by the Permanent Secretary for Agriculture, Mr. R.L. Ntokoane. The Permanent Secretary expressed concern about the nation's experience of three consecutive drought years and suggested the need to reinforce the production of traditional drought tolerant crops, such as sorghum. He stated that government policy is to promote food self-sufficiency in all parts of the country.

Mr. Ntokoane, reaffirmed his belief in the importance of sorghum in the economy and in the nation's agricultural policies. Sorghum is principally viewed as a means to offset food shortfalls in the event of drought, especially in southern Lesotho. He expressed a need to improve the profitability of the crop in the hope that sorghum might reduce the country's dependence on cereal grain imports.

Mr. T. Namane, Director of Research, reviewed historical production trends, noting that sorghum is the country's second most important grain in terms of cropped area and the third most important grain in terms of household food supplies. Sorghum production has been declining in recent years in comparison with maize, but area under production may expand with the distribution of improved varieties. Mr. Namane expressed particular interest in cold tolerant sorghum for the mountain regions.

Dr. A. B. Chaudhry, Agronomist with the Agricultural Research Division, reviewed the results of on-farm tillage trials conducted during the past cropping season and noted the high returns to ripline planting as a soil and water conservation method. Inter-row ripping during the season may increase water use efficiency.

Mr. M. Mokoto, an entomologist with the Agricultural Research Division, gave a general overview of plant protection problems affecting sorghum producers, and identified pests and diseases found in Lesotho. He noted that the ARD prefers to avoid regular insecticide application in favor of pesticide application when pest incidence reaches threshold levels.

Mrs. M. Molupe, nutritionist with the Agricultural Research Division, noted that a sorghum dehuller had been tested in various parts of the country with good results, but sorghum consumption lags because of a lack of alternative food recipes and poor prices in the formal market. She displayed dehulled samples of SV 1, DC-75, SDS 2690-2, SDSL 87019, and LARSVYT 19 during the meeting.

Mr. M. Khoabane, from the Department of Crops in the Ministry of Agriculture, hypothesized that low formal market prices discouraged production of sorghum and led to low yields. He noted the potential value of mechanical processing and the need to encourage the use of sorghum for foods other than traditional beer.

Mr. M. Tsiu, representing the Pioneer Hybrid International Seed Company, noted that his company does not currently sell sorghum seed but will likely begin selling a Pioneer hybrid seed (PHB 8262) next season. He cited the difficulty in competing with South African seed supplies sold directly through the national retail network.

Mr. L. Lepheana, of the Lesotho Seed Multiplication Unit in the Ministry of Agriculture, summarized the responsibilities of his program and its involvement in wheat and potato seed production. The Seed Multiplication Unit rents land from farmers for seed production. Given demand, this facility could be extended

to sorghum production.

Mr. Lilelu, a farmer representing the northern region, reviewed his experiences in testing six sorghum varieties (SDS 2690, SV 1, SDSL 87021-1, LARSVYT-19, DC 75, and PNR 8311) in an on-farm trial last season. The analytical results of this trial were not presented, but Mr. Lilelu explained that he had multiplied two bags of each grain for research. Many farmers expressed interest in participating in this program.

Mr. Mohlokonye, a farmer representing the southern region, expressed strong interest in participating in on-farm trials. He also indicated the need for tractors, irrigation, and grain threshers.

Mr. M. Phoololo, of the Lesotho Agricultural Development Bank, noted the Bank's willingness to extend seasonal and longer term loan facilities to sorghum producers.

Mr. T. Jobo, the Economist with the Agricultural Research Division, summarized methods of economic analysis of new technologies.

Mr. S. Pule, another northern region farmer, summarized the main difficulty of commercial sorghum production as the lack of a ready market at competitive prices.

Mr. K. Cekwane, from the Marketing Division of the Ministry of Agriculture, reviewed the results of a short survey on sorghum marketing. This survey indicated that most sorghum is sold in the informal market because prices are much higher than in the formal, government regulated market. Following the 1993 harvest, the informal market price was M 140/70 kg bag compared with a formal market offering of less than M 43.91/70 kg bag. The current maize price is M 50/70 kg bag. Sorghum can be purchased in parts of neighboring South Africa by Lesotho traders for about M 35 per 70 kg bag. Though local farmers demand higher formal market prices, it is much cheaper to import grain from South Africa.

Mr. S. Molapo and Mr. V.M. Haisi of Frasers, Ltd. discussed how trading costs affect the setting of grain and input prices. They noted the willingness of Frasers to purchase sorghum if it is competitively priced.

During the last day of the meeting, farmers were asked to identify and prioritize their most pressing farming problems. They were asked to highlight priorities for research and technology development. In the mountain region, farmers cited difficulties of winter ploughing, land tenure constraints (which allow animals to damage early planted fields), shortage of implements, lack of pesticides, shortage of seed, and theft of grain from the fields by other villagers.

In the southern region, farmers cited the following priority problems: shortage of equipment for tillage, lack of seed and agro-chemicals, poor formal market prices, not enough buyers in the informal market, crop damage by stray cattle, and theft.

In the northern region, farmers cited the following priority problems: lack of equipment for timely ploughing, lack of timely delivery of seed and fertilizer, soil acidity, grain losses in storage, and difficulty of threshing.

Workplans 1993/94

The Agricultural Research Division was not fully prepared to discuss its annual workplan or priorities for collaboration with SMIP. Nonetheless, it was agreed that SMIP would provide technical assistance with on-farm trials.

The Director of Research expressed frustration at the levels of staff turnover experienced by the Agricultural

Research Division during the past 10-15 years. Since 1980, the Agricultural Research Division has had six Ph.D. scientists, of whom two remain on study leave and four have left. Out of 21 M.Sc. scientists, four have gone on to Ph.D. training, five remain on study leave, and 12 have left. The Division currently has no Ph.D. scientist on post. Two of the four M.Sc. scientists on post are research administrators. In response, the ARD is seeking to establish itself in 1983/84 as a new Department with the degree of budgetary independence believed necessary to attract and maintain scientific staff.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING MALAWI

19-20 October 1993

Highlights

The Malawi Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting was held in Blantyre on 19-20 Oct 1993. It was highlighted by concerns to promote the verification and release of improved sorghum and pearl millet varieties and to multiply seed for distribution to smallholder farmers. Optimism was expressed that new varieties would be quickly adopted by farmers.

The meeting established a dialogue between farmers, researchers, extension representatives, non-governmental organizations (NGOs), and marketing institutions concerning the development and dissemination of new technologies. The meeting offered important recommendations for improving the implementation of on-farm trials and catalyzed tentative agreements to guide the sharing of responsibilities for seed production and distribution.

The importance attached to the meeting by the Government of Malawi was indicated in the official opening offered by the Principal Secretary for Agriculture, Dr. J.H.A. Maida. He cited the need to develop and distribute improved technologies targeted towards the almost one million people farming in drought-prone regions of the country. He noted progress in the sorghum and pearl millet research program and expressed satisfaction with the meeting, which was aimed at developing plans for the transfer of improved sorghum and pearl millet technologies to smallholder farmers. Dr. Maida stressed the importance of research links with NGOs and the private sector.

Participation

The meeting drew participation from all of the sorghum and pearl millet growing regions of the country. The Department of Agricultural Research (DAR) was represented by the Chief Agricultural Research Officer, Dr. J. T. Munthali, and all of the scientists working principally with sorghum and pearl millet in the country. There was representation from each of the Agricultural Development Divisions (ADDs) where sorghum or pearl millet are planted. Several NGOs with interests in agricultural activities in drought-prone regions attended, as well as representatives of the principal seed and grain marketing parastatals in the country. Several farmers represented major sorghum and pearl millet growing areas.

SMIP was represented by Dr. D.D. Rohrbach, Leader of the Resource Management Unit, Dr. A.B. Obilana, Leader of the Cereals Improvement Unit, Dr. S.C. Gupta, coordinator for collaborative on-farm research activities, and Dr. E.S. Monyo, the pearl millet breeder.

Presentations

Sixteen presentations were made reviewing the current status of sorghum and pearl millet research. Possible strategies were examined for improving the efficiency of research, for summarizing the production potential for sorghum and pearl millet in various parts of the country, and for assessing the role of the public and private sector in technology transfer. A few highlights of the presentations are summarized below.

The Principal Secretary, Dr. J.H.A. Malda, affirmed the importance of sorghum and pearl millet for the Malawi economy and discussed the value of productivity growth for economic development and food security. He noted the importance of intensifying production on Malawi's limited land resource base. He explained that technology transfer is necessary to achieve this goal, but that this must be based on a good understanding of the agro-ecological and socio-economic conditions towards which technologies are being targeted. This will require broad public and private participation in the evaluation and dissemination of improved technology. Dr. Malda challenged the participants to identify and establish more effective mechanisms for technology transfer in Malawi.

Dr. A.S. Kumwenda, National Research Coordinator for Cereals, reviewed the human resource and funding constraints facing the national sorghum and pearl millet research program and explained the importance of carefully targeting these resources towards high priority research. He noted that there are now about 50 000 ha of sorghum and pearl millet in the country with the potential of expanding to almost 90 000 ha. Dr. Kumwenda identified the lack of improved varieties, low plant populations, bird damage, and the lack of fertilizer use as major production problems.

Mr. E.M. Chintu, Malawi's Sorghum and Pearl Millet Commodity Team Leader, reviewed the current status of sorghum and pearl millet research in Malawi. He summarized the program's breeding objectives as increasing sorghum production for food and lager and opeque beer and developing pearl millet with high yields. Mr. Chintu identified the program's agronomy objectives as continuing research on soil and water conservation, weed management, fertilizer use, planting date, plant density, and inter-cropping. He noted that two sorghum varieties from ICRISAT (SPV 351 and SPV 475) are on the verge of release to farmers. Further variety trials are needed on pearl millet.

Dr. D.D. Rohrbach offered an overview of ICRISAT's activities in southern Africa and a summary of SMIP's Phase III priorities, on behalf of Dr L.K. Mughogho, the Executive Director of ICRISAT's Eastern and Southern Africa Programs. Dr. Rohrbach presented a summary of strategies for maintaining productive, low cost research programs. These strategies include the need to effectively use past research results, the need to link the setting of research priorities with the assessment of expected impact, the need to periodically verify the best available technologies on farmers' fields, and the need to exploit linkages with other research and development institutions.

Mr. M.W.B. Munyenembe, the Program Manager for Ngabu ADD, the most important sorghum and pearl millet growing region of the country, reviewed the importance of these crops in the hot and dry agro-ecology of the lower Shire Valley. He explained that average yields of sorghum and pearl millet remain much lower than their potential due to the continuing use of unimproved cultivars, low plant populations, and inadequate pest control. He reviewed the contributions of his ADD towards technology transfer.

Mr. Munyenembe's presentation was followed by brief comments by Mr. G.S.B. Mukunuwa, the representative from Blantyre ADD, Mr. A.G. Khumbanyiwa from Lilongwe ADD, Mr. L.S. Gumbo from Salima ADD, and Mrs. A.P. Moyo from Karonga ADD, who reviewed the relative importance of sorghum and pearl millet in their respective areas. Similar concerns were raised about the lack of improved varieties and poor crop management. In effect, extension representatives are broadly concerned about the lack of effective technologies to transfer. Concerns were also raised about low producer prices.

The farmers attending the meeting were given the opportunity to comment on the proposed research and technology transfer priorities. Concerns were again raised about the lack of improved seed. Farmers also complained strongly about the limited market opportunities for sorghum and the low level of prices offered on the formal market. Questions were raised about why the Chibuku brewing company had rejected some of the sorghum grain offered for sale in recent months. Farmers requested the opportunity to participate in government discussions on grain pricing.

Mr. P. Kwengwere, from the Agricultural Development and Marketing Corporation (ADMARC), gave a presentation on sorghum and pearl millet marketing in Malawi. He noted that during the last four years ADMARC has purchased an average of less than 70 t of sorghum and 1 t of pearl millet per year. Purchases following the 1993 harvest remain at these levels. He noted the importance of grain grading, explaining that much of the sorghum purchased is of mixed type and quality. He suggested that if quality were high and supplies more consistent, Malawi may be able to export sorghum and pearl millet.

Mr. K. Whisler, from the National Seed Company of Malawi (NSCM), reviewed the limited demand for improved sorghum seed and the low level of sorghum seed sales in the country. He attributed these constraints to dissatisfaction with the quality of the sorghum varieties (PN 3 and Seredo) on offer and the proclivity of farmers to save seed from year to year. He noted the plans of the NSCM to multiply the new sorghum varieties SPV 351 and SPV 475, if they are officially released, but indicated a willingness to see the responsibility for this multiplication taken over by ADDs, NGOs, or other development agencies.

Mr. E.L. Musopole, representing Actionaid, discussed their interest in seed multiplication and distribution. He described Actionaid's involvement in distributing sorghum and pearl millet seed following the 1991/92 drought. Mr. Musopole expressed strong interest in working with research and extension in small-scale production of the new sorghum varieties SPV 351 and SPV 475.

Mr. M. Reabold, of the Christian Service Committee (CSC), noted that his NGO had not yet been involved with sorghum or pearl millet production. He described CSC's involvement with the testing and transfer of soya, sweet potato, cassava, and agro-forestry technologies. Mr. Reabold indicated CSC's interest in assisting with the multiplication and distribution of new sorghum and pearl millet varieties.

Mr. D.E. Kanyarere, from World Vision Malawi, also expressed interest in sorghum and pearl millet technology transfer. He explained that to date they have been active in promoting nutrition gardens, food aid, and refugee relief.

Discussions

During the final afternoon of the meeting, small group and plenary discussions were held on strategies for the organization and implementation of on-farm trials, seed production, and seed distribution.

In the discussion of on-farm trials, concerns were raised about past proclivities to use farmers simply as laborers for research trials. The group agreed about the need to include the farmers in the planning of the trials and the evaluation of the trial results. It was agreed that extension staff also need to be better informed about trial objectives and procedures. Many suggestions were made for improving the training of trial participants and the participation of communities of farmers in the evaluation of technologies. An agreement was reached that NGOs should play a greater role in the financing and implementation of on-farm research.

In the discussion of seed production, concerns were raised about the need to quickly supply breeders seed to potential multipliers once new varieties are released. Alternative strategies for seed multiplication were discussed, including the use of satellite farms and farmer groups.

In the discussion of seed distribution, questions were raised about the appropriate role of the National Seed Company, research, extension, and NGOs. There was agreement, in principle, about the need for broad participation, but further discussions need to be held on measures to assure quality control and a degree of coordination. These discussions may be possible immediately after the official release of SPV 351 and SPV 475.

Workplans 1993/94

Mr. Chintu discussed the on-farm research plans for the 1993/94 cropping season. He summarized the plans for both researcher-managed farmer-implemented (RMFI) and farmer-managed farmer-implemented (FMFI) trials for sorghum and pearl millet. These trials aim to test the best available varieties under high resource and limited resource management. Concerns were raised about the availability of adequate funding for the trials and an appeal was made for collaboration with other institutions, particularly NGOs.

The meeting focused on the need to deliver improved varieties of sorghum and pearl millet to smallholder farmers. There appeared to be broad agreement that the only available improved sorghum cultivars, PN 3 and Seredo, failed to meet the needs of most farmers. It was noted that the new sorghum varieties SPV 351 and SPV 475 seem to be acceptable to farmers and the group expressed interest in their early release. Interest was also expressed in the completion of advanced testing of pearl millet varieties and the early targeting of at least one cultivar for release. The variety SDMV 89004 seems to have performed well in recent on-farm trials.

Interest in these new varieties focused much of the discussion of strategies for seed multiplication and distribution for 1993/94. The possibility of NGO involvement was viewed as an opportunity to resolve seed access constraints quickly.

Though poor crop management was repeatedly identified as a problem, there was little discussion on agronomic research priorities. Greater priority may be placed on management constraints as new seed varieties are disseminated.

Following the meeting, the four SMIP scientists travelled to Ngabu to provide extension staff most likely to be involved with on-farm trials with a one day training workshop on sorghum and pearl millet production and on-farm research methods. The workshop was organized and led by Mr. E.M. Chintu. Presentations were offered on trial objectives, site selection, data collection, experimental design, field layout, trial management, and economic analysis. The results of the 1992/93 season trials were outlined and the plans for the 1993/94 season trials were discussed. The extension staff contributed many useful suggestions for trial design and implementation.

Dr. Obilana provided brief advisory assistance with the preparation of the release application papers for the two white-grained sorghum varieties, SPV 351 and SPV 475.

**NATIONAL SORGHUM AND PEARL MILLET
TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING
MOZAMBIQUE
29-30 September, 1993**

Highlights

The Mozambique Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting took place in Maputo Sept 29-30 1993. The goal of the meeting was to develop a dialogue among interested parties on the development and dissemination of new sorghum and pearl millet technologies to small farmers and to develop collaborative workplans for research and technology transfer.

The group first identified provinces where sorghum and pearl millet are important cereals. These include Manica, Tete, Nampula, and Zambezia. Sorghum and pearl millet are also grown in some parts of Sofala, Inhambane, and Carbo Delgado.

Major areas requiring research resolution could not be identified with certainty because not enough information is available about where these crops are grown. The group agreed on a need to conduct a detailed survey and to collect information on sorghum and pearl millet production constraints before developing a significant research program for these crops. The group also agreed on a need to continue verification of already identified superior varieties under farmers conditions, in order to identify varieties for release to farmers. Other items of agreement included the need to continue testing elite varieties developed by the regional program and other SADC NARS, in order to identify varieties suitable for Mozambique. The need to work closely with the seed company SEMOC and the need for the NGOs to work with small-scale farmers to ensure that available technologies are brought to the farmer were also agreed on.

It was recommended that all future testing must include a comparison with locally planted, traditional cultivars. It was also recommended that on-farm testing should be done at sites representative of the farmer's production areas in provinces where the crop is important.

Participation

This was the first gathering of researchers, extension officers, seed companies, and non-governmental organizations working to serve the resource poor farmers growing sorghum and pearl millet, the third and fourth most important cereals in Mozambique (after maize and rice). The following organizations were represented: the Instituto Nacional de Investigacao Agronomica (INIA), The National Directorate for Rural Development-Extension Services (DNDR), Sementes de Mocambique Lda (SEMOC), World Vision International, and the United Nations Children's Fund (UNICEF). SADC/ICRISAT SMIP was represented by Dr. Oblana, Leader of the Cereals Improvement Unit, Dr. D.D. Rorhbach, Leader of the Resource Management Unit, and Dr. E.S. Monyo, the pearl millet breeder.

Presentations

The meeting was officially opened by the acting Director of Research for INIA, Mr. Carlos Zandamela, who welcomed the participants and noted the priority attached to sorghum and pearl millet in INIA's research mandate. Eight papers were presented reviewing the status of sorghum and pearl millet research and production in Mozambique. Highlights from the presentations are summarized below.

Dr. S. Dlogo, of the Directorate of Rural Economy in the Ministry of Agriculture, presented a paper on sorghum and pearl millet production in Mozambique. Sorghum and pearl millet account for roughly 20% of the total cereal production. Virtually all of this is grown by the smallholder sector, though little is known about the production base. More data are available on the small production base in the larger scale commercial sector. Here, sorghum production has been declining progressively due to the difficult security situation in the country. The price of sorghum in the free market is about 500 meticais/kg (about US\$ 0.10).

Mr. I. Mugabe, the sorghum and pearl millet commodity team leader, reviewed the current status of sorghum improvement in Mozambique. He estimated that 368 000 ha were planted to sorghum in 1990, mainly in Carbo Delgado, Manica, Nampula, Zambezia, and Tete. Production was estimated at 161 000 t and yields averaged 450 kg ha⁻¹.

Research on sorghum in Mozambique was initiated by INIA and the Food and Agricultural Organization of the United Nations (FAO) in 1986. The main objectives of the research were to identify improved cultivars, identify constraints on production, collect and evaluate local germplasm, and multiply breeder seed. However, due to the security situation not much could be done in the countryside. The following types of trials were conducted, but mainly at one location (Chokwe) due to logistical problems: variety and hybrid evaluation trials, date of planting trials, and variety x density trials. Data obtained from these trials were used to recommend the release of Macia and Mamonhe.

The sorghum varieties SV 1, Kuyuma, SDSL 88219, SV 2, SDSL 88298, ZSV 3, SDSL 89473, and ANA have been identified for further testing. Out of these, SDSL 88298, ZSV 3, SDSL 89473, Kuyuma, Macia, and ANA will be recommended for promotion to on-farm evaluation. In virtually all the trials, the farmers' local check was not included.

Dr. M. Denic of SEMOC elaborated on the status of sorghum and pearl millet seed production in Mozambique. Most of the seed grown in Mozambique is produced by SEMOC. The seed requirements for Mozambique far exceed what SEMOC can produce. This year, NGOs and donors have requested 1 750 t of sorghum and 700 t of pearl millet. SEMOC expects to supply half of the sorghum requirement and the rest will have to be imported. The seed company is trying to use the services of contract farmers, but faces difficulties controlling bird damage.

SEMOC also participates in sorghum variety evaluation trials in collaboration with INIA and ICRISAT. SEMOC has selected the following sorghum varieties from these trials for further testing: ZSV 10, SV 1, SDSL 88298, ZSV 3, SDSL 89566, WSV 387-S1, SDS 2690, PPO 2, 2KX17, SDS 6030, and SDS 6032. SEMOC has recently selected the following pearl millet varieties for further testing: SDMV 89005, SMDV 90031, SDMV 88004, and ICMV-IS 90212.

Mr. G. Piter of INIA presented a paper on sorghum fertilizer trials in Mozambique. Very limited work has been done on soil fertility in the sorghum and pearl millet production zones of Mozambique. The few N by P trials have been conducted in the predominantly sandy soils. No effect was observed for P, but a good response for N was observed for values 50-120 kg N ha⁻¹. These trials were conducted both on zero tillage (paraquat and atrazine) and conventional tillage.

Mr. F. Chilengue from the Extension Department presented a paper on the status of sorghum production in Inhambane Province. Sorghum in Inhambane is inter-cropped with maize, cassava, and cowpea, as well as sole-cropped. Inter-cropped sorghum yields approximately 0.4 t ha⁻¹, while sole-cropped sorghum yields 0.8-1.0 t ha⁻¹. Farmers in Inhambane prefer the long duration sorghums. Early maturing varieties in the province are more susceptible to diseases and pests and suffer from bird damage. Inorganic fertilizers are costly and often unavailable. Most people use organic manure on their farms.

Ms. C. Ruth presented a paper on the strengths and weaknesses of the Extension Service. The major

constraints hindering proper and effective functioning of the extension service, especially in sorghum and pearl millet production areas, are as follows: lack of infrastructure, lack of adequately trained personnel, limited financial resources, and lack of appropriately packaged technologies for extension.

Dr. L. Stich of World Vision International reviewed the programs and activities of NGOs in Mozambique. World Vision is mainly involved with the distribution of seed to small-scale farmers. This season they plan to distribute seed to 240 000 farmers, most of whom are returning refugees from Malawi. World Vision is also involved in extensive testing of varieties in farmers' fields in collaboration with INIA and the Extension Service.

In World Vision's multilocation sorghum trials during the 1992/93 season, the variety Chokwe was among the top three varieties across locations in Tete and Zambezia. Other promising varieties were WSV 387 and Macia. Chokwe is a variety selected by INIA from SV 1. In palatability tests Chokwe was rated first, followed by Macia. A common variety called ANA tested the worst. For pearl millet, trials conducted across three sites in Tete and Zambezia, the best varieties in terms of yield were SDMV 89005, SDMV 90031, and SDMV 91018. In palatability tests, SDMV 89005 was also the best and was ranked first by 75% of the 30 taste panel members. SDMV 89004 was rated worst.

This coming season World Vision is planning to multiply one sorghum variety (Chokwe) and two pearl millet varieties (SDMV 89005 and SDMV 90031) in order to have enough seed for more testing and demonstration. They also plan to evaluate both sorghum and pearl millet varieties on-farm and in collaboration with INIA on research station testing sites across Mozambique.

Dr. A. B. Obilana presented a paper on SMIP Phase III. The presentation explained that SMIP would work with national programs on the basis of equal partnership in all activities. This implies joint preparation of workplans, joint data analysis, and joint reporting of the results in the three main areas of technology transfer, breeding of improved varieties, collection and exchange of germplasm, and training. SMIP will provide technical support and assistance in human resource development.

Dr. D.D. Rorhbach offered a presentation on strategies for maintaining low-cost research. These were said to include the need to effectively use past research results, to link the setting of research priorities with the assessment of expected impact, to periodically verify the best available technologies on farmers' fields, and to exploit linkages with other research and development institutions.

Workplans 1993/94

During 1993/94 INIA and the Directorate of Rural Development and Extension Services will be responsible for the training of extension staff in on-farm research, including diagnostic surveys. These institutes will collaborate on a major national survey of sorghum and pearl millet production.

INIA, World Vision, and SEMOC will be responsible for verification of the adaptability of advanced cultivars in farmers' fields. Priority provinces include Nampula, Tete, Manica, and Zambezia for sorghum and Tete and Zambezia for pearl millet.

INIA, SEMOC, and World Vision will be responsible for the evaluation of elite varieties on research stations through the following trials: 1) Elite sorghum variety trial (ICRISAT to supply 25 entries) and 2) Acid soil tolerant variety trial (ICRISAT to supply 8 entries). The locations will include Gurube (Zambezia), Llonde (Gaza), Umbeluzi (Maputo), Namialo, Hamapa (Nampula), Chimioio (Manica), and Chokwe (Gaza).

INIA, World Vision, and SEMOC will also be responsible for the Elite Pearl Millet Variety Trial (ICRISAT to

supply 11 entries) in Casa Bamba, Inhangers, Manje (Tete) Guruve, Morua, Nicoadala (Zambezia), and Carbo Delgado (1 location).

Assistance from SADC/CRISAT SMIP has been requested in the analysis of data for trials and surveys, the provision of improved genetic materials for evaluation under local conditions, and germplasm collection for sorghum and pearl millet. INIA also requested assistance with the development of a long-term research plan for sorghum and pearl millet.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING NAMIBIA 27-30 July 1993

Highlights

The Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting for Namibia was held in Tsumeb 27-30 July 1993. This workshop was the first gathering of organizations and institutions involved in the development and extension of crops technology to small farmers. The meeting considered research priorities for maize, legumes, and fruit, and well as for sorghum and pearl millet.

Presentations from the various organizations indicated that improved technologies are available for testing in farmers' fields. The initial on-farm test results showed that farmers are keen to adopt new cultivars and agricultural practices provided the necessary inputs are available and profitable. The need for closer collaboration between government, NGOs, and private organizations was emphasized in order to overcome bottlenecks in the delivery of technologies to the farmers. Annual collaborative planning meetings were proposed as a means to resolve adoption constraints.

Participants

There were 39 participants, including representatives from the Ministry of Agriculture, Water, and Rural Development, the Extension Services, the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP), and the SADC/ICRISAT Groundnut Improvement Program (GIP). The government considered this meeting very important, as was evident in the participation of Dr. P. Shivute, Deputy Permanent Secretary in the Ministry of Agriculture. During this meeting the emphasis was placed on sorghum, pearl millet, and legumes. SMIP was represented by Dr. L. K. Mughogho, Executive Director for ICRISAT's Southern and Eastern Africa Programs, Dr. D.D. Rorhbach, Leader of the Resources Management Unit, Dr. A.B. Obilana, Leader of the Cereals Improvement Unit, Dr. S.C. Gupta, coordinator of on-farm research activities, Dr. K. Leuschner, coordinator of plant protection activities, and Dr. E.S. Monyo, the pearl millet breeder. GIP was represented by Dr. B.J. Ndunguru, Team Leader of the Groundnut Improvement Program. Mr. C.M. Malyaire, an ICRISAT advisor for on-farm research, who is based in Namibia, also attended.

Presentations

In an opening address, Dr. P. Shivute welcomed all the participants and discussed the importance of crop production in the country's development plan. Namibia wants to produce its own food. At present, Namibia has to import part of its cereal needs and most of its vegetable and fruit requirements. Dr. Shivute mentioned that while pearl millet provides 24% of the total calories to the Namibian people and maize provides 23%, cowpea is also an important crop which should get more attention. Namibia imports virtually all of its commercial seed requirements.

Dr. Shivute identified the need to understand the socio-economic environment under which the small farmer is operating in order to improve his/her economic situation. To do this, Namibia must increase the number of trained agricultural staff at all levels, but especially on the agricultural extension side. Presently there is no university in Namibia which provides degrees in agriculture. Donors are offering scholarships for post-graduate training, but the country has no candidates.

Dr. Shivute stressed that despite these problems, Namibia has moved ahead since independence three years ago to improve the situation in the agricultural sector. He expressed hope that this meeting would result in a research plan which may assist Namibia in developing a stronger agricultural economy. He noted that farmer and extension participation in agricultural research should be strengthened. Research facilities need up-grading and efficient utilization.

Finally, Dr. Shivute expressed hope that during this meeting a 1993/94 work plan would be developed that makes clear the responsibilities and accountability of all departments and individuals for the activities to be carried out.

Dr. L. K. Mughogho, Executive Director of ICRISAT's Southern and Eastern Africa Programs, presented an overview of ICRISAT and SMIP. He stated that for the next five years SMIP's activities will be in the following areas recommended by the Steering Committee: technology transfer, development of improved cultivars, pest management, human resource development, and grain quality evaluation and utilization. NARS and SMIP scientists will collaborate in all joint activities as equal partners and all activities will be jointly planned and executed, including data analysis and the reporting of results. SADC/ICRISAT would like to continue the good relationship with Namibia and work with scientists on the improvement of sorghum, pearl millet, groundnut, and pigeonpea.

Cereals Improvement Program. Mr. W. Lechner, Chief Agricultural Research Officer, stated that pearl millet is the most important staple cereal in Namibia. This justifies the establishment of a national pearl millet breeding program. Sorghum is of less importance to the country and the program can rely on selecting improved cultivars from elsewhere, including other SADC countries and SMIP.

Mr. S. Ipinge, pearl millet breeder, presented the results of the 1992/93 season. National and regional collaborative pearl millet trials were conducted at Mahanene, Ogongo, Mashare, and Utikomst. Grain yields at Mahanene were much higher than at other locations. Better soils and management were given as the major reasons.

In general, none of the entries was significantly better in terms of grain yield than Okashana 1. In the national trial, ICMV 82132 was the highest yielding entry (2.18 t ha^{-1}) followed by ZPMV 87884 and Okashana 1. In initial variety trials, four varieties, including SDM V 92039 (early maturing), TSPM 90037, ICMV-IS 90287, and ICMV-IS 90274 (mid-late maturing), were selected for further testing. The highest yielding cultivars from different regional trials included three varieties: ICMV 82132, ICMV-F 86415, and SDM V 92039 and two hybrids, SDMH 91006 and ICMH 88088. The hybrids generally showed no advantage over varieties.

In the National Sorghum Variety Trial, planted at Mahanene and Ogongo, SDSL 89426 yielded 3.19 t ha^{-1} , Sima yielded 2.75 t ha^{-1} , and SDS 3472 yielded 2.65 t ha^{-1} . The Ogongo local yielded only 1.94 t ha^{-1} . The hybrids SDSH 148, SDSH 149, and SDSH 384 and many local accessions were also selected.

Farmers have stated that they are generally satisfied with the yield potential of local varieties but that they are of long duration. The discussion revealed that farmers want a maturity range in pearl millet and sorghum cultivars for crop security and extended harvest period. Farmers also prefer longer stems for fodder. The storability of Okashana 1 was questioned.

Mr. D. Marais presented the results of the maize hybrid trials in Namibia that were run at Utikomst. Under rainfall conditions of 400 to 500 mm, grain yields of 2.5 t ha^{-1} are possible. Mr. Marais proposed an alternative maize production system which can conserve moisture in order to reduce crop failure. The system includes one year fallow with weed control. This allows storage of up to 50% of the soil moisture compound with a 25% storage rate after a maize crop is grown. This 25% extra moisture would reduce the risk of crop failure in poor rainfall years. But the system is only possible in deep soils with high clay content and good water holding capacity. Such soils are not common in smallholder farming areas.

Legumes and Oilseeds Improvement Program. This research program is concentrating on the development of cowpea and *Phaseolus* beans for grain production, groundnut for grain and oil production, and sunflower for oil production.

Groundnut and cowpea are important for small farmers, whereas commercial farmers grow *Phaseolus* beans and sunflower. Namibia only conducts variety trials for these crops. Test entries come from local germplasm and international research organizations (IITA: cowpea, CIAT: *Phaseolus* beans, ICRISAT: groundnut, seed companies: sunflower). The main objective is to select for drought resistance, yield, and insect and disease resistance.

Cowpea and groundnut have potential as components in both intercropping and mixed cropping systems and in crop rotations. Yields of 779 to 1 530 kg ha⁻¹ in early maturing IITA cowpea varieties were obtained in Mashare, Uitkomst, and Okahante. For groundnut, yields of 449 to 1 044 kg ha⁻¹ were harvested at Uitkomst and Okahante. Two drought tolerant groundnut varieties, ICGV 90121 and ICGV 90122, were selected from the Preliminary Drought Tolerant Variety Trial.

On-farm research. Mr. C.M. Matanyaire presented the results of on-farm research activities in northern Namibia, including pearl millet and sorghum variety trials, agronomic trials (fertilizer, manure, weeding), and a survey of agronomic and socio-economic constraints.

In on-farm variety trials, Okashana 1 generally performed as well as or better than landrace checks. Okashana 1 is primarily sought by farmers because of its earliness. Only one on-farm trial for sorghum was successful. SDS 89426 and SDS 89420 were selected for further testing in the Caprivi region.

In a soil fertility management trial, Okashana 1 responded to nitrogen at 20 kg ha⁻¹ and to phosphorus at 15 kg ha⁻¹. There was a 50% increase in grain yield with the use of 20 kg N and a 30% increase in grain yield with the use of 15 kg P. However, this variety did not respond to both nutrients at higher doses.

Similarly, the use of manure either by broadcasting or banding increased grain yield. There was a 32% increase in grain yield with 4 t manure ha⁻¹ using banding, whereas broadcasting with 8 t manure ha⁻¹ increased yield by 76%.

In a set of weeding, thinning, and plant population trials, no significant differences among treatments were reported. Therefore, these trials may be discontinued. Associated farm survey data indicates that most farmers use about 10 seeds per hill and they plant on hills in rows or by scattering seed. Thinning is a well established practice, except in the Caprivi region. Most of the farmers target to weed their crops within three weeks after emergence, except in the Caprivi region. There is need for improved weeding technology at affordable costs.

None of the trials with flat seed bed plus mulch treatments and ridges plus mulch treatments showed any significant yield increases. Farmers plant flat or on ridges in different regions. The reasons why they choose one or the other technology is not clear and needs further investigation.

Most farmers graze crop residues in the field before ploughing. At Oshakati farmers collect the stover for feeding to livestock.

Mr. Matanyaire prioritized the constraints on pearl millet production as follows: drought, lack of draught power, lack of improved seed, lack of a market, lack of fertilizer, poor extension, low soil fertility, and lack of manure. He also mentioned that new technology should be developed with the full participation of farmers.

Animal traction. Mr. K. Morrow emphasized the advantages of animal traction versus manual operation

in agriculture. He presented data on numbers of man-hours needed for both manual operation and for ox-drawn implements for different farm activities on different crops. He concluded that animal traction for the Namibian farmer is essential if the area under cultivation is to be expanded. The biggest advantage would be in land preparation and in the first weeding. The advantages would be less in the second weeding, as the fields are usually clean. He proposed a research program on the use of animal traction.

Pearl millet marketing and utilization. Mr. S. Keyter presented the results of a study examining the prospects for commercializing the pearl millet subsector through the development of northern grain markets. Such commercialization is expected to enhance income growth and food security. The study is being conducted in Ovambo and Kavango, the main smallholder farming areas in Namibia, where little is known about the pearl millet economy and the associated grain markets.

Early results of the study show that most farmers never sell pearl millet in Ovamboland, while in Kavango only 17% of the farmers frequently sell grain. The reason for this is low production levels. Compared with maize, pearl millet is the preferred food in both regions.

During the 1991/92 season, 37% of the farmers in Ovamboland and 14% in Kavango grew the improved pearl millet variety Okashana 1. During 1992/93, 55% of the farmers in Ovamboland and 38% in Kavango grew Okashana 1. The farmers like Okashana 1 because of its earliness and not necessarily because of high yield.

In 1988 the First National Development Corporation (FNDC) started a scheme to increase pearl millet production through the creation of a market in the Kavango area. They provided input and ploughing services to 12 progressive farmers who supply about 1 000 t to a newly established processing plant which does grain cleaning, dehulling, milling, and packing of the flour. The scheme has been constrained by low prices, high dehulling costs, transport problems, the short shelf-life of pearl millet meal, and the ready availability of cheap maize.

Challenges, options, and opportunities for sustainability. Mr. J. P. Venter, Deputy Director for Research, outlined some of the things which have led to a global decline of sustainability in agricultural production, including damage done to the ozone layer by greenhouse gases, destruction of tropical forests, which has added to global warming, decreasing soil fertility, and increasing difficulties in maintaining soil fertility.

Mr. Venter explained that high population growth, weak agricultural and industrial growth, declining social conditions, environmental degradation, mounting debt, poor export performance, and unsustainable elite-oriented development strategies, have led to declining crop yields in Africa. According to FAO statistics, Africa will have a food deficit of about 50 million t in the year 2000.

Namibia has vast dry areas with limited water resources. Economically, Namibia relies on its mineral resources. Most industrial goods are imported. The population growth rate is 3%, and infrastructure, marketing, and credit systems need urgent improvement. Mr. Venter quoted Article 95 of the Namibian constitution which states that "the state shall actively promote the utilization of living natural resources on a sustainable basis for the benefit of all Namibians both present and future".

To ensure sustainability of natural resources in Namibia the newly developed action plan should make sure that agricultural research and extension activities lead to agronomic sustainability in agriculture. In order to do this, the plan should concentrate its research and extension goals and projects on the development of the resource poor farmer and the commercial farm sector. Mr. Venter indicated his belief that if all available knowledge and technology is pooled into a detailed 5-year plan and carefully executed over this time, agricultural production could be doubled over the next 5 years.

Mr. Venter suggested that the first step should be to formulate a strategic plan for a research policy which puts the emphasis on sustainable agriculture, starting with farming systems research. Research, extension, and training facilities should be strengthened with all departments better inter-linked. There should be fewer carefully located experiment stations and fewer well defined projects. Research should be appropriate for the needs of the farmer. Farmers need better access to agricultural services and transport facilities. Finally, there should be more interaction between farmers, NGOs, cooperatives, women's organizations, the private sector, and government departments.

Mr. Venter concluded with the statement that agriculture in Namibia can be improved through improved agricultural management. Donor support should be limited, although financial support for such an ambitious program is vital. Success also depends on dedicated scientists and politicians.

The impact of collaborative research in Namibia. Dr. D.D. Rohrbach presented the results of research on the impact of Okashana 1 in Namibia and on the opportunities for additional research impact in the short and medium term. The study revealed that data from crop cuts on farmers' fields indicate that Okashana 1 does not offer consistent yield advantages over landrace varieties, although farmers were still willing to plant it in the future. When asked what farmers liked about Okashana 1, they mentioned in order of priority: early maturity, large grain size, grain yield, and drought tolerance. When asked what they did not like about Okashana 1 they mentioned stem thickness, stover yield, and poor insect resistance. Dr. Rohrbach explained that selection of new varieties for release to farmers should not be based simply on yield data. Future discussions of variety trial results could even reduce the emphasis on yield data and increase the assessment of other grain and plant traits important to the farmer.

Workplans 1993/94

Extensive group discussions of the priorities for the national research workplan considered the following issues:

- a) to better understand the natural resource base.
- b) to identify, evaluate, select, and improve suitable crops.
- c) to develop appropriate crop management techniques for appropriate crops.
- d) to better understand the existing production systems.
- e) to develop an appropriate information management system for technology exchange.

In considering the identification, evaluation, selection, and improvement of suitable crops, Namibia is primarily interested in the four ICRISAT mandate crops; pearl millet, sorghum, groundnut, and pigeonpea. However, the following crops were also considered for discussion: maize, cowpea, bambara nut, beans, sunflower, cotton, tomatoes, cabbage, potatoes, sweet potatoes, onions, and indigenous fruits and vegetables. Each crop was discussed thoroughly and the groups came up with recommendations for activities responsibilities and tentative time frames for each activity.

The activities and objectives planned for 1993/94 for the major crops discussed are summarized below:

Pearl millet

- a) Improvement of the Okashana 1 plant aiming towards an early maturing type with bold grains and improved grain storability and crop stand.
- b) Introduction of improved cultivars and evaluation of local germplasm.
- c) Improvement of the local landraces.
- d) On-farm testing.

- e) Storage trials in farmers' facilities with Okashana 1 and farmers' own varieties. These trials can also be conducted on-station.
- f) Armoured cricket control: on-farm yield loss assessment surveys to be completed by 1995.
- g) On-farm and on-station fertility trials.
- h) On-farm and on-station inter-cropping trials.
- i) On-farm and on-station crop rotations.
- j) Socio-economic surveys for all crops and farming systems in all regions of Namibia.

Sorghum

- a) Introduction and evaluation.
- b) Variety testing.

Pigeonpea

- a) Introduction and evaluation.
- b) Evaluation of varieties.
- c) Inter-cropping and crop rotation trials.
- d) Agro-forestry and fodder evaluation trials.
- e) Post-harvest processing.

Groundnut

- a) Introduction of early maturing, drought and disease resistant, and confectionery types.
- b) Varietal evaluation.
- c) Intercropping and crop rotation.
- d) Management techniques investigation.
- e) Quality evaluation.

Specific recommendations were also offered for developing an information management system on the natural resource base and distribution of production systems. These plans will be finalized and reported in Namibia's strategic plan for research.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING SWAZILAND 22-25 July, 1993

Highlights

The Swaziland Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting was organized by the Agricultural Research Division (ARD) at the Nhlanguano Sun Hotel in Nhlanguano 22-25 July 1993. The meeting was led by the Chief Research Officer, Mr P. D. Mkhathshwa, and the SMIP Steering Committee (SSC) Member, Mr J. Pali-Shikulu. The meeting was opened by the Principal Secretary in the Ministry of Agriculture and Cooperatives (MOAC), Mr. M. M. Bhambule.

Following the opening session, the state of the art of sorghum research and production in Swaziland was summarized. Session III reviewed the 1992/93 research activities. An overview of SADC/ICRISAT SMIP Phase III was presented in session IV. Institutional support activities and policies were presented in session V.

Questions were raised about SMIP's new strategy of providing support in kind and in a technical advisory capacity. The Director of Agriculture was disappointed that the national sorghum improvement program in Swaziland will not receive more financial support for its technology transfer activities. On the other hand, SMIP's emphasis on technology transfer and exchange, on-farm trials, and impact of sorghum production on Swazi farmers' fields, especially in the dry lowveld, was a welcome innovation. The Director of Agriculture, Mr. P. Lukhele, reaffirmed a full commitment to participate in the expanded on-farm testing activities at all levels.

Sorghum has been included as a priority crop in the new Seed Policy Document of the Government of Swaziland. ICRISAT was invited to give comments on the document before it is finalized.

Workplans were presented for specific activities and discussed extensively in session VI. After presentations, a working session was formed with four working groups. The groups were to work on and present plans for demonstrations, on-farm research and trials, training of extension staff and policy implications, crop nutrition and pests (including insects, diseases, and weeds), surveys, and utilization and marketing. Before the groups separated, Dr. Rohrbach presented options for maintaining low cost and collaborative interdepartmental research programs.

Participants

The technology transfer meeting brought together 32 participants and staff from the Agricultural Research Division (12 scientists, including the Chief Research Officer), the Department of Agriculture (17 agricultural officers, specialists, extension officers, and home economics officers, including the Director of Agriculture, Mr. P. K. Lukhele), non-governmental organizations (a member of the Lutheran World Federation, who is also a farmer), and SADC/ICRISAT SMIP, represented by Dr. A. B. Obilana, Leader of the Cereals Improvement Unit and Dr. David D. Rohrbach, Leader of the Resource Management Unit. The Director of Agriculture, Mr. Lukhele, expressed concern at the absence of the Swaziland Milling Company, Swazi-American Seeds Ltd. (PHI), the Central Cooperative Union of Swaziland, the World Food Program, and the University of Swaziland. He announced that he would take up the matter of their absence with the government, an

indication of how much importance the Ministry had placed on the meeting.

Presentations

In his opening remarks, the Principal Secretary in the MOAC, Mr. M. M. Bhambhule, challenged the audience to insure that the technology developed and tested by the national program reaches the farmers throughout the dry marginal areas of Swaziland. Mr. Lukhele, the Director of Agriculture, followed with the observation that there is a need to consolidate and formalize extension and research linkages, which had previously been absent. He stressed that this meeting should enhance the formalization of the linkages which have already begun. Both men expressed their appreciation for the support given by SMIP in facilitating this meeting.

Presentations on the status of sorghum showed that production of sorghum in Swaziland is declining. During the 25-year period from 1964 to 1989, sorghum production declined from 8.0% to 1.9% of production area. In comparison, cotton plantings have been variable, declining from 14.0% to 2.0% during those years, but then increasing to 21.0%. Maize, the priority crop, dropped from 75.0% to 71.0% in this same period in favor of cotton. Legumes (common bean, jugo bean, groundnut, and cowpea), which can be inter-cropped with sorghum in dry lowveld areas, comprise the third most important crop group. These now account for 7% of the crop area.

The observations on the declining production of sorghum were confirmed by two surveys carried out in 1988 and 1990. Though sorghum is widely perceived as an important crop for food and ceremonial purposes, the continuing decline in production was attributed to the effects of drought, the availability of cheap supplies from South Africa, bird damage, labor shortages at the household level, and the changing tastes and food preferences of young people.

Several suggestions were provided for removing some of these constraints. From the farmers' point of view, increased production can be achieved if the government supports marketing and if processing mills are made available through extension and NGOs. The participants were informed about the success of dehullers and small mills in Botswana and the progress made in Zimbabwe by Environmental Development Activities (ENDA-Zimbabwe) in publicizing the small-scale machines fabricated by small-scale industries.

There was substantial discussion on procedures for the release of new varieties. Two sorghum varieties released earlier, MRS 13 (red) and MRS 94 (brown), were found to be acceptable to farmers. However, a third variety, MRS 12, which was released recently, had problems with adoption since it is white. It was agreed that the new Release Committee should be given more time to develop a better set of variety release procedures.

The representative from the World Lutheran Federation (WLF), Mr. N. Sgwane, described this NGO's activities in 1992-93. The WLF distributed 10 000 kg of sorghum seed bought from South Africa for planting during the 1992/93 season. Though the seed was distributed late, 85% was believed to have been planted. Assessments of the performance of this sorghum were highly variable. During the discussions, several observers suggested the value of disseminating locally released varieties in the future. The Director of Agriculture observed that such activities should be better coordinated with the national extension service.

Ms. Zodwa Mamba, Head of Farming Systems, observed that this is the first time SMIP scientists have been involved in such detailed joint discussions and exchange of ideas at the national program level with other collaborators participating. She also noted that planning meetings had been a regional activity before now, with all SADC countries participating. This new approach will enhance the transfer of technologies developed during phase I and II.

Workplans 1993/94

It was agreed that the final workplans for the national program on sorghum would be produced by the organizers before the end of August. The program plans for research and extension activities will focus on technology transfer to farmers' fields and on-farm research. Included in the plans are milestones for the expected outputs in 1993-1994 and to the end of SMIP Phase III in 1998.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING TANZANIA 13-15 October 1993

Highlights

The National Sorghum and Pearl Millet Technology Transfer Meeting in Tanzania was held 13-15 Oct 1993 at the Morogoro Hotel. The meeting was organized by the Department of Research and Training.

On the morning of 13 October, scientists presented their research results for the 1992/93 season. In the afternoon the group discussed the workplans for 1993/94 season. The next day, there were presentations on issues such as sustainability, linkages between research, extension, and industries, and group discussions to finalize the workplans. The results of these discussions were summarized on 15 October.

The meeting emphasized on-farm research, germplasm enhancement, *striga* research, and utilization and marketing. Three varieties of sorghum and two varieties of pearl millet have been selected for on-farm testing during the 1993/94 season. In collaboration with SADC/ICRISAT SMIP, the on-farm trials will be conducted in two districts where sorghum and pearl millet are important crops, Singida Rural and Dodoma Rural.

Participants

This meeting was attended by 22 people. Dr. H. M. Saadan, Coordinator for Sorghum and Millet Research in Tanzania, chaired the meeting. SMIP was represented by Dr. D. D. Rohrbach, Leader of the Resource Management Unit, Dr. A. B. Oblana, Leader of the Cereals Improvement Unit, Dr. E. S. Monyo, the pearl millet breeder, and Dr. S. C. Gupta, coordinator for on-farm activities. Dr. S. Z. Mukuuru attended on behalf of ICRISAT's office in Kenya. The other participants were from the Department of Research and Training, the Sokoine University of Agriculture, the national extension service, and the brewing industries.

Presentations

Farming systems research. Mr. L. A. Kadenguka presented the results of a sorghum cultivar verification trial from one on-farm site and one on-station trial. Three sorghum varieties (SV 1, SDS 2293-8, and Tegemeo) were compared. The grain yield variation was from 0.6 - 0.9 t ha⁻¹ in the on-farm trial, but more data are required to make recommendations.

The research revealed that the farmers attach low value to sorghum compared to other crops, and early maturing varieties tend to interfere with other farm activities. This suggests that there is a need to involve the farmers in earlier stages of selection from a broader range of phenotypes.

Dr. H. M. Saadan clarified that there are two types of cultivars grown in Tanzania: the long duration cultivars in the eastern region and the short duration cultivars in the central region. In some areas the market price of maize and sorghum is the same. But the demand for sorghum in different parts of the country is variable. Some farmers seem to prefer sorghum, others prefer maize.

Food technology. Mr. S. T. P. Kundl presented the results of a comparison between three new varieties, SV 1, SDS 2293-8, and Tegemeo in composite flour bread. At 25 to 30% incorporation of sorghum with

wheat, SDS 2293-6 was more acceptable than the other two varieties. However, at lower levels of sorghum flour incorporation with wheat, there was no significant difference among sorghum varieties.

Mr Kundi collected some information on the processing, storage, and types of foods made from sorghum and pearl millet in Dodoma and Singida regions. In Dodoma, grain processing is a major problem, as there is no facility for mechanical dehulling. The other problem is grain storage. The types of foods prepared are stiff, thin porridges and food products like rice. In Singida, processing is not a problem because the consumers mix white sorghum with maize and mill the mixture together. Grain storage is a problem in the Dodoma region.

Striga Dr A M Mbwaga presented the findings of *striga* research. Three species of *striga* (*S. hermonthica*, *S. asiatica*, and *S. forbesii*), are common in Tanzania. Pearl millet varieties Serere 17 and Buruma are less susceptible to all three species of *striga* compared to the sorghum variety Tegemeo. Dr. Mbwaga suggested that the *striga* control strategy should include ways to deplete the *striga* seed from the soil and reduce the seed rain (annual shedding of the seed from mature plants) by increasing *striga* mortality and by reducing the fitness of the *striga* plant. This can be achieved by growing the *striga* resistant varieties, by intercropping, by applying manure, fertilizer or herbicides, and by using trap crops in crop rotations.

In *striga* infested areas, Serena, a local sorghum cultivar, is performing equally as well as SAR 19. Serena has been showing good levels of tolerance to *striga* since 1965. Another cultivar of sorghum, Sandala, is most susceptible to *striga*.

Sorghum and pearl millet marketing and utilization Dr I Minde, of the Sokoine University of Agriculture summarized the recommendations of the recent national conference on sorghum and pearl millet marketing and utilization, held in Arusha 3-5 May 1993. Conference presentations noted that:

- a) High transport costs discourage long distance movement of grain
- b) The strategic grain reserve simply functions as a stockholder of maize
- c) Most farmers do not use improved sorghum and pearl millet seed
- d) Most sorghum and pearl millet producers are not grain purchasers, only a small number of producers consistently sell grain. Marketing policies need to be geared towards serving rural grain purchasers and sellers
- e) Small grain dehullers (originally purchased from Botswana) have failed
- f) Grain market liberalization started successfully but capital constraints limit further development of grain trade by the private sector
- g) The use of sorghum in composite bread flour is technically feasible but, at best, only marginally economical in Tanzania

It should be easier to move the grain from surplus areas to deficit areas rather than looking for industrial utilization. Industries like stock feeds and breweries will use maize as long as it is cheaper than sorghum and pearl millet, however, the movement of grain can only be for short distances due to high transport costs.

According to Mr E Msangula, representing the Dar-Brew Company, his breweries are expecting to use 9 t of white sorghum and 3 t of maize per day. This production can only satisfy 30% of Dar city. Dar-Brew has farms which produce two thirds of the needs. The rest is produced through contract farmers. Good quality white sorghum with low protein content is desirable for brewing. There should be a consistent supply of raw material. The amount of sorghum and maize grain required for 1994 has already been announced. Dar-Brew will purchase 4 000 t of sorghum.

Production problems and technology distribution. In the Dodoma Region, there are certain areas where it is possible to grow only sorghum and pearl millet and not maize, particularly in Dodoma district. In Singida sorghum, pearl millet, and maize are grown together. In certain areas like Lake Victoria, brown-grained

sorghums are widely planted due to high humidity, which increases the incidence of grain mold on white-grained sorghums.

According to Dr. Saadan, breeder seed was provided every year to foundation farms, although this was not done for the past 3 to 4 years. The present seed stocks have wild sorghums. At Ilonga he is producing pure breeder seed of Tegemeo by selfing. Cargil is multiplying the sorghum variety PN 3 in 140 hectares. However, this variety was never released in Tanzania. Now that there is a seed act, seed regulations, and seed certification standards there is hope for community produced seed when there is a shortage.

Workplans 1993/94

Sorghum trials. Dr. H. M. Saadan presented the national workplans for sorghum in 1993/94. The on-going activities, such as germplasm maintenance and enhancement and progeny yield evaluation will continue. There will be three types of sorghum progeny yield evaluation trials: a) Preliminary Variety Trial (one location); b) Advanced Variety Trial (one location); and c) National Variety Trial (five locations). The selection of material from one location for the whole of Tanzania is not a good strategy. The alternative could be to evaluate only promising lines in different trials at locations where those varieties are likely to be grown.

In addition to the above trials, there are on-going collaborative workplans with SADC/ICRISAT SMIP. These include the development of improved high yielding photo-sensitive sorghum varieties and on-farm yield testing of sorghum. It was suggested that there should not be any regional collaborative trials from SADC/ICRISAT SMIP and that the selected cultivars should be included in national trials.

The new activities proposed for 1993/94 in sorghum breeding include:

- a) Collaborative research among SADC/ICRISAT SMIP and the Eastern African Regional Sorghum and Millets Network (EARSAM) to improve a local brown grained, tall sorghum variety, Wejita, for yield and to reduce the plant height. This variety is tolerant to *S. hermorrhica*.
- b) Collaborative research among SADC/ICRISAT SMIP, Farming Systems Research (FSR), and extension to conduct on-farm verification trials. Five sorghum varieties (Tegemeo, SV 1, 85-IL 208, SDS 2293-6, and a farmers' cultivar) will be included.

On-farm trials will be conducted in Dodoma Rural and Singida Rural Districts. In each district, there will be two villages and eight farmers from each village (four farmers for sorghum and four farmers for pearl millet). Farmers will act as replicates. ICRISAT suggested that half of the on-farm trials should be tested with farmer management. It was agreed that in Singida Rural district where farmers do not use chemical fertilizer, some trials with farmer management should be conducted. In Dodoma district, Sasakawa-Global 2000 (SG 2000) is providing the inputs, therefore, it may be difficult to conduct trials without fertilizer.

In researcher-managed farmer-implemented (RMFI) trials, 50 kg N and 40 kg P₂O₅ per hectare will be applied. Food technologists will be involved in on-farm trials in the screening for grain quality, palatability, and storage. Diagnostic surveys for *striga* will also be conducted.

Pearl millet trials. Mr. S.I. Mndolwa plans to continue the following on-going research in 1993/94: a) improvement of late maturing composite and local variety Buruma through recurrent selection; b) yield trials including preliminary, advanced, and national trials; and c) pearl millet adaption trials, including introductions from different countries. In addition to the above trials, four varieties, TSPM 91001, TSPM 91018, Serere 17, and a farmers' cultivar, replicated twice, will be evaluated in on-farm trials.

Plant pathology. Dr. A. M. Mbwaga has proposed three trials for 1993/94: a) screening of white sorghums for grain mold resistance, b) pearl millet ergot screening nursery, and c) *striga* nursery. It was suggested that in the surveys of *striga*, it is important to assess the yield loss due to *striga* in addition to the distribution of *striga* species.

Agronomy. Mr. E. A. Letayo proposed the following three trials for 1993/94: a) spacing and plant density trial for two sorghum varieties, b) spacing and plant density trial for two pearl millet varieties, and c) planting system trials, including planting on flat, ridge, and tied ridge systems.

The meeting discussed the need to revise extension recommendations for sorghum and pearl millet. These are old and not followed by farmers. Sometimes there are different recommendations from farming systems research and the Department of Research and Training. There is no proper recommendation on the use of manure by farmers. It was agreed that researchers and extension staff should jointly plan their bi-monthly workplans.

Food technology. Mr. Kundi proposed the following experiments for 1993/94: a) sorghum and pearl millet grains as a substitute for maize in maize-soy feeds for poultry and b) simple parboiling to improve food processing, storage, and food quality in sorghum and pearl millet grains. It was suggested to evaluate for grain quality, storability, food taste, and palatability in on-farm trials.

Strategies for sustaining sorghum and pearl millet research in Tanzania. Dr. H.M. Saadan informed the participants that the Sorghum and Millet Promotion Committee consisted of representatives from extension, seed companies, the Department of Research and Training, industry, The Sokoine University of Agriculture, and NGOs. This aims to facilitate communication between research, extension, farmers, industry, and marketing agents.

According to Dr. Saadan, funding sources for the national sorghum and millet improvement program include government, the Agriculture Research Fund, SACCAR, the Tanzania Commission of Science and Technology, and SADC/ICRISAT. The annual operational budget for sorghum and pearl millet research from the government of Tanzania for the 1993/94 fiscal year is 5.5 million shillings (about US\$ 11 000). It was clarified that SADC/ICRISAT SMIP is not a donor agency. ICRISAT suggested exploring other sources of funding, such as NGOs. SG 2000 is willing to support certain activities. The Kondoa Rural Integrated Program will start this year and it was suggested that Dr. Saadan should explore the possibility of collaborating with them.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING ZAMBIA 21 Oct 1993

Highlights

The Sorghum and Pearl Millet Research Planning Meeting for Zambia was held at Siavonga on 21 Oct 1993. During the one-day meeting research results from the 1992/93 crop season were reported and research plans for the 1993/94 season were made.

Participation

There was participation from the three national crop improvement programs, including 4 participants from the sorghum program, 1 from the pearl millet program, 1 from the finger millet program, and 1 from the Siavonga regional Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) development program. The SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) was represented by Dr. Leuschner, coordinator for plant protection activities.

Presentations

Sorghum. A multi-disciplinary sorghum improvement program continues in Zambia with a series of activities in breeding, agronomy, pathology, entomology, seed multiplication and distribution, extension, and marketing and utilization.

Breeding work has included the development of a range of hybrids and varieties among white- and brown-grained types and, to a limited extent, forage types. During the year, one white-grained variety, ZVA-12, with resistance to aluminum toxicity, was pre-released for the high rainfall zone. One early maturing dwarf white-grained hybrid, MMSH-928, was pre-released for drought-prone areas. This hybrid is likely to replace WSH-287 due to its ease in hybrid seed production. The first forage hybrid, FHS-22, has been proposed for testing in 1993-94.

Agronomic research continues to emphasize demonstrations and comparisons of improved sorghum cultivars with traditional types at different levels of fertilizer inputs. In addition, this research compares the productivity of sorghum, maize, and pearl millet in different agro-ecological regions of the country. Until now, the project had emphasized the development of sorghum technologies for the resource-poor, small-scale farming community. As a result of ongoing economic structural adjustments in the country, the removal of subsidies on fertilizers, and the liberalization of crop marketing, improved sorghum cultivars are also becoming popular with the commercial sector.

The 1992/93 season was unfavorable for entomological and pathological work. Anthracnose was the only disease showing good expression. This was much more widespread than normal. Low insect pressures limit the opportunity for meaningful screening under natural infestations. However, sporadic occurrence of *Heliothis* and army worm created some concern. The *quelea* birds were almost absent.

In cooperation with the Zambia Agri-business Management Services Project (ZAMS), a seminar on sorghum

marketing and utilization was conducted in May 1993. This was attended by industries in the country and region. In this seminar it was noted that Botswana Foods Ltd. imported up to about 1 000 t of improved sorghum grain. This company could be a regular buyer of some 15 000 t of improved Zambian cultivars annually. The arrangements for such a production are already underway. Similarly, National Breweries Ltd (Zambia) bought grain of MMSH 375 and MMSH 413, and found both satisfactory in brewing.

Last year's mass distribution of seed of improved varieties for drought relief more than doubled the production of sorghum to over 60 000 t in Zambia. The wide exposure of improved cultivars to farmers in the southern parts of the country has increased seed demand. ZAMSEED, in anticipation, tried to produce 1 200 t of seed, but ended up with only 450 t. The seed shortage will hamper sorghum production, but arrangements are being made to produce up to 2 000 t of seed for distribution in 1994.

Pearl Millet Mr F Nuka gave only a brief summary of activities in the pearl millet improvement program. In general, the season had too much rain for pearl millet. Improved cultivars like Kaufela, Lubasi, and WCC 75 were doing well under small-scale farmer conditions and reasonable soil fertility. They did not do well under poor fertility conditions. Grain quality was acceptable to farmers. Work on agronomy concentrated on fertilizer, intercropping, and crop rotation trials to establish extension recommendations.

Workplans 1993-94

Since seed availability of released cultivars was identified as a major constraint, the program will put emphasis on promoting seed production with ZAMSEED and other seed producing agencies.

To strengthen the sorghum grain market the program will continue to promote sorghum use by National Breweries and other possible food and feed industries.

Conventional sorghum breeding for the creation of new crosses and introductions will be scaled down because many new cultivars have already been released. For pearl millet, the present breeding program will continue as it is.

The national program places priority on bridging the yield gap between research stations and farmers' fields. The program will continue to create a base data in each region on appropriate cultivation and management practices for sorghum and pearl millet production in small-scale and commercial farmers' fields.

The national sorghum and pearl millet improvement program only needs limited inputs from SADC/ICRISAT SMIP. The pearl millet improvement program welcomes germplasm from SADC/ICRISAT on an informal basis.

Assistance is requested with a survey of insects and diseases to be run in coordination with an adoption study of the sorghum cultivar Kuyuma in Siavonga district. This will include an assessment of yield loss caused by armoured cricket.

Dr K Muniyinda, Assistant Director of Research in Zambia, has requested the assistance of the SACCAR Impact Assessment Advisor, Dr P Anandajayasakeram, on an impact assessment of sorghum in Zambia. SACCAR has requested the assistance of the ICRISAT SMIP economist with this investigation.

NATIONAL SORGHUM AND PEARL MILLET TECHNOLOGY TRANSFER AND RESEARCH PLANNING MEETING ZIMBABWE 12-14 July 1993

Highlights

The National Sorghum and Pearl Millet Technology Transfer and Research Planning Meeting for Zimbabwe was held in Harare on 12-14 July 1993. This meeting brought together a range of groups involved in the process of developing and delivering sorghum and pearl millet technology to farmers. It helped to establish a spirit of collaboration among these organizations, with a focus on increasing farm production. The Department of Research and Specialist Services (DR&SS) was able to develop partnerships to share the costs and work of taking sorghum and pearl millet technologies to farmers for evaluation and dissemination. The meeting also helped to establish collaborative relationships between government and private organizations, which will help to overcome bottlenecks in the delivery of technologies to farmers, such as improved seed.

The agronomic data presented indicated a continuing need for research designed to clarify extension guidelines for the different agro-ecological zones. The results of the on-farm testing of improved sorghum and pearl millet cultivars were also presented. A number of the cultivars were extremely popular with farmers and are likely to be adopted.

The very positive attitude of the organizations represented at the meeting was made clear by the numerous spontaneous statements by participants that it was indeed time such a meeting took place and that these types of meetings should be held on a more frequent basis.

Participants

The participants included the Department of Research and Specialist Services (DR&SS), SADC/ICRISAT SMIP, the Department of Agricultural Technical and Extension Services (AGRITEX), seed companies (the Seed Coop and Pannar), NGOs, such as Save the Children, Coopibo, Environmental Development Activities-Zimbabwe (ENDA-Zimbabwe), and Mlekweni, the Zimbabwe Farmers Union (ZFU), farmers from provinces representing different agro-ecological zones, and two SMIP donors, the United States Agency for International Development (USAID) and the Canadian International Development Agency (CIDA). SADC/ICRISAT SMIP was represented by L.K. Mughogho, Executive Director of the Southern and Eastern Africa Programs; Dr. A.B. Obilana, Leader of the Cereals Improvement Unit; Dr. D.D. Rorhbach, Leader of the Management Resource Unit; S.C. Gupta, coordinator for on-farm activities; K. Leuschner, coordinator for plant protection activities; and E.S. Monyo, the pearl millet breeder.

Presentations

The subject of on-farm research and technology transfer was discussed for the first two days, while the third day focused on on-station research activities.

The meeting was opened by Mr. R.J. Fenner, the Director of the DR&SS. In his remarks, he noted that research results that did not reach farmers were not useful. He also noted that research organizations could not do all the work alone, but that they needed partners like extension and NGOs to help deliver

technologies and return feedback from farmers. Mr. Fenner stated that the meeting was an important first step in establishing communications between all the partners. He recognized the financial and technical contribution of SADC/ICRISAT, and observed that sorghum and pearl millet were important crops in Zimbabwe and were likely to remain so in the foreseeable future.

The Executive Director of ICRISAT's Southern and Eastern Africa Programs, Dr. L.K. Mughogho, was invited to speak briefly on the role of SMIP. He expressed appreciation for the leadership role of the DR&SS in bringing together so many important organizations. He said that the primary role of SMIP was to provide technical support to national programs and to assist in the area of human resources development for SADC. He said SMIP was glad to work with the DR&SS as a partner in the joint planning of collaborative activities, data analysis, and reporting of results. He also noted that SMIP was happy to support the initiative of the DR&SS in developing linkages between research, extension, NGOs, farmers, and donors. He suggested that the term technology exchange should be used in place of technology transfer, as it reflected the spirit of the activity more accurately.

The Director of the United States Agency for International Development (USAID) in Zimbabwe, Mr. T. Morse, briefly reviewed the recent major success of the massive drought relief effort in southern Africa, the largest in recent history. However, he observed that drought would return eventually, and that everyone needed to work together to deliver technologies as fast as possible to farmers that would enhance household food security. He stated that the United States had spent 31 million dollars in southern Africa to develop a sorghum and pearl millet research capacity, and that USAID was now looking forward to the delivery of the products of this investment into farmers' fields.

The DR&SS presented the results of the collaborative on-farm research activities from the 1992/93 season. A total of 95 on-farm trials were implemented through the joint efforts of the DR&SS, AGRITEX, SADC/ICRISAT SMIP, and farmers. These included researcher-managed farmer-implemented trials at 10 locations each for sorghum and pearl millet cultivars, 36 farmer-managed farmer-implemented trials with pearl millet cultivars, and 39 farmer-managed farmer-implemented trials with sorghum cultivars. The sorghum trials included both hybrids and varieties. Pearl millet trials included only varieties. All trials included a farmers' local control.

In sorghum, the hybrids tended to rank higher than varieties in terms of mean yields. However, the yields of improved varieties were not greatly lower than hybrids, and in general, all the improved material performed better than the local controls. Regression analysis indicated that the hybrids had higher b-values, suggesting that they are more sensitive to changing environments than the varieties. Farmers at the meeting expressed appreciation for the new cultivars, particularly in that they were both higher yielding and matured earlier than their traditional varieties.

Some problems with implementation of the trials were noted by the DR&SS, including poor site selection (resulting in unnecessarily high CVs), late distribution of seeds in some cases, and the failure of some extension personnel to understand trial management procedures.

The primary conclusion was that the new cultivars showed excellent potential at the farm level. This was strongly supported by the farmers present.

The DR&SS staff also presented a report on some of the technical obstacles encountered in implementing the program and suggestions for addressing these issues. Extension personnel described the current state of sorghum and pearl millet production guidelines and noted the need for further discussion and research to better define appropriate stand densities for the different agro-ecological zones and economic rates of fertilizer application. Extension personnel also discussed the issue of seed availability for sorghum and pearl millet. It was noted that some new cultivars had been released and that seed stocks of these had been developed. Nonetheless, seed of the new cultivars was not available at the local level. Some suggestions

for addressing this issue were put forward.

At the invitation of the DR&SS, SMIP personnel presented papers to the group on the relevance of and approaches to impact assessment and ideas for on-farm research collaboration.

Other papers from the DR&SS addressed the topics of the current status of agronomic research and studies on *striga* control. A major conclusion of the agronomic research was the need for more detailed work to better define extension guidelines on improved production systems for the different agro-ecological zones.

DR&SS scientists presented a tentative plan of the work for the 1993/94 season, which included repeating the on-farm trials to verify results over years and additional work on *striga* control. They asked other organizations to comment and to suggest areas where they would be interested in collaborating or otherwise contributing to the process.

The DR&SS also reviewed the training requirements for parties participating in the trials activities (particularly extension) and indicated that they would take the lead in providing for these. The training facilities at SMIP were noted as a possible venue, with training conducted jointly by the DR&SS and SMIP staff and possibly extension staff. Training would include experimental design and lay out, planting methods, data collection procedures, harvesting, and weighing procedures. On-the-job training for extension staff and in-field training for farmers were also mentioned as possibilities.

After the presentations by the DR&SS, other organizations were asked to express their ideas on possible collaborative modes. The response was very positive. Extension personnel indicated that they were prepared to continue with the major assistance they had previously provided with implementation of trials at the farm level, and supported the need for further training activities.

Coopibo, an NGO supported by Belgium, indicated a willingness to implement and financially support trials in their catchment area in eastern Zimbabwe. They agreed to undertake the supply of all inputs (except seed), and they agreed to work with extension to identify and train farmer implementers, to monitor the trials, to collect the necessary data, and to conduct field days and discussions where appropriate. They asked that extension assist them with the monitoring activity, that the DR&SS personnel attend and facilitate a few discussion meetings with farmers, that trial designs be relevant and practical for farmers, and that seed supplies be delivered on time.

Another large NGO, ENDA-Zimbabwe, also indicated an interest in participation. They stated that they would undertake to implement a large number of trials in southeastern Zimbabwe. They would also get involved with dissemination-type activities, and noted that they were already involved successfully with the Seed Coop in seed production of small grains through small-scale farmers. They also stated that they would consider helping with travel costs of government officers who are assisting them with the trials activity. ENDA-Zimbabwe also requested that some of their own cultivars be included in the testing process and they requested assistance from the DR&SS in getting the results of soil tests quickly. They also stressed the importance of the prompt feedback of trial results.

The Seed Coop representative began by observing that it took the hybrid maize cultivars 10 years to go from 15 to 100% adoption by small farmers, and that he expected the new small grains cultivars to eventually reach the same level, despite the low rate of use at present. He recognized the responsibility of the Coop in multiplying seed of new cultivars, and promised to supply seed for the trials free of charge to the DR&SS. He also recognized the responsibility of the organization to make seed of released cultivars available to farmers in the rural areas, something which they are already working on with ENDA-Zimbabwe. In addition, the Coop is already running maize variety trials in the rural areas and would be willing to add sorghum and pearl millet trials.

The Zimbabwe Farmers Union (ZFU), which represents farmers in the communal areas, stated that they would be able to assist with dissemination activities, such as mailing pamphlets on the new cultivars to their 150 000 members, and that they could assist financially with field days. ZFU suggested that these types of technology exchange meetings also be held at the provincial level.

The two NGOs and the ZFU were unanimous in suggesting that more efforts be made to strengthen farmer participation not only in trials implementation, but also in the planning, design, and assessment of trials.

Farmers at the meeting expressed their appreciation for the new cultivars. They were also glad to participate in this type of meeting, and felt that it would be good to further improve the communication between research and farmers.

A summary of the proceedings was presented by the head of the Matopos research station (DR&SS), Mr. R.J. Fenner. In terms of the objective of strengthening linkages and sharing the work and expense of the on-farm activities, the meeting was very successful. The participants gained a better understanding of what the other organizations are doing and how they can work together. Most of the organizations involved seemed to feel that the meeting was an excellent start in developing a unity of purpose, and that it was a coordinated approach to delivering improved technology to farmers.

Workplans 1993/94

A smaller meeting was held on the last day to consider specific questions of collaborative on-station research involving SMIP and the DR&SS. Some senior extension staff also attended this meeting. Topics covered included: sorghum breeding activities, pearl millet breeding, *striga* research, on-farm research, and more general issues, such as seed production and the budget.

Sorghum breeding. The main emphasis of the DR&SS in the near term will be on revising their parent populations, particularly for hybrids. They observed that their A and B lines are old and that new sources are required. SMIP requested that the DR&SS be as specific as possible in defining its targets so that SMIP would know best where to contribute.

Pearl millet breeding. The main focus of the DR&SS will again be on developing new parent material, in this case new populations for developing varieties. Smut and ergot were mentioned as specific problems. Increasing the diversity of options for farmers was mentioned as an objective. The DR&SS also has a strong interest in grain processing issues.

In general, for both the sorghum and pearl millet breeding programs it was noted that many entries had been tested for many years which were not particularly outstanding. It was agreed that a review of the current entries would be useful and that a number of them could probably be deleted.

It was agreed that the collaborative trials that were used primarily for testing foreign materials in the past could be dropped. Instead, elite materials from external programs could simply be added to the current set in the national trials. In this case, fewer, more select materials would be tested.

An additional concern was the lack of farmer participation in the cultivar development process. It was agreed that this season genotypes representing the range of genetic diversity available would be planted at as many as five locations across the country. Farmers and researchers would jointly review the material so that farmers' ideas, perceptions, and needs could be built into the targets of the breeding programs. It was suggested that NGOs be requested to assist in this, since it was the type of activity that might appeal to them.

It was agreed that *striga* research would be confined to controlled conditions on-station. However, screening of entries would be done in the on-farm trials whenever serious infestations occurred at the trial sites. SMIP volunteered to assist with *striga* workshops.

On-farm research. It was agreed that the basic activities initiated last season would be continued. However, the DR&SS decided to rewrite the budget proposal to reflect the expected contributions from the Seed Coop, NGOs, the Zimbabwe Farmers Union, and extension. The role and inputs requested from SMIP would then be more clearly identifiable. SMIP offered to assist with rewriting the proposal, identifying funding sources among the NGOs, and training activities.

Seed production. During a spontaneous discussion of seed production issues, the DR&SS noted that the Seed Coop of Zimbabwe had the primary responsibility. The DR&SS produced seed for their own trials, and sometimes for extension demonstrations.