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PROCEEDINGS

Crop Improvement in Eastern and Southern Africa

Research Objectives and On-Farm Testing

**A regional workshop held in
Nairobi, Kenya, 20-22 July 1983**



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Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa, Canada

Kirkby, R.A.

IDRC. East Africa Regional Office, Nairobi KE

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Crop Improvement in Eastern and Southern Africa: Research Objectives and On-Farm Testing

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Editor: Roger A. Kirkby

RÉSUMÉ

Un atelier a réuni un petit groupe représentatif de scientifiques travaillant à des programmes d'amélioration des cultures alimentaires en Afrique orientale et australe, pour discuter de la planification, de la conduite et de l'élaboration de ces programmes. Le débat a porté surtout sur les aspects méthodologiques, communs à la majorité des cultures réalisées par les petits fermiers et les plus susceptibles de permettre l'utilisation des résultats de la recherche.

On s'intéresse donc ici aux cultures locales et aux pratiques culturelles, à l'organisation de l'aide institutionnelle pour améliorer les cultures, aux objectifs particuliers des programmes et au mode d'établissement de ces objectifs, enfin aux méthodes d'évaluation employées pour formuler une nouvelle recommandation sur les travaux de vulgarisation. On résume aussi la séance de discussion qui a porté sur l'organisation des programmes d'amélioration des cultures, l'établissement des objectifs techniques, l'application des critères de sélection, la méthodologie pour les essais tous terrains et sur les fermes et, enfin, l'orientation de la recherche.

RESUMEN

Este seminario reunió un pequeño grupo representativo de científicos que trabajan en programas de mejoramiento de cultivos alimenticios en África oriental y meridional con el ánimo de discutir la planificación, la ejecución y el desarrollo de tales programas. El énfasis de la discusión recayó en aquellos aspectos metodológicos, comunes a la mayoría de los cultivos sembrados por los pequeños agricultores, que tienen la probabilidad de influir más en que los resultados de la investigación sean utilizados por el agricultor.

Entre estos trabajos se encuentran breves recuentos de las variedades locales y las prácticas de cultivo empleadas actualmente, la organización institucional para el fitomejoramiento, los objetivos específicos de los programas y su sistema de establecimiento, así como los procedimientos de evaluación empleados para llegar a las nuevas recomendaciones para los trabajos de extensión. También se incluye en este volumen un resumen de la sesión de discusión sobre la organización de los programas de fitomejoramiento, la fijación de los objetivos técnicos y la aplicación de los criterios de selección y la metodología para las pruebas tanto en fincas como en localización múltiple. Varios temas de política fueron identificados.

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SORGHUM IMPROVEMENT IN SOMALIA

M. Hashi

Agricultural Research Institute,
Ministry of Agriculture,
Mogadishu, Somalia

Sorghum is the major crop grown in Somalia, with about 57% of the cropped land (517 000 ha) now under sorghum. The crop is grown almost everywhere and under rainfed conditions, as in most of the semi-arid areas. In the area between the Juba and Shebelli rivers, maize cultivation has increased in popularity over sorghum because it is easier to cultivate, has a higher yield, and is less affected by grain-eating birds such as Quelea quelea.

Sorghum will continue to be the most important crop in Somalia for the following reasons: it is the most promising and adaptable crop in the semi-arid climate, where the limited rainfall received is highly variable and generally unreliable (mean total rainfall in the area of highest potential for sorghum reaches only 350 mm per crop season); it is well accepted as the main staple of the people; research carried out in Somalia and elsewhere has shown that new sorghum types or gradual improvement of existing varieties will probably produce types that have grain qualities close to those of maize under similar semi-arid climatic conditions; and because Somalia will continue, for a long time to come, to be a livestock-producing economy, sorghum grain and stalks will be of major importance as livestock feed.

Sorghum varieties grown in Somalia include: late-maturing varieties that take 6 months to mature, commonly grown in the highland regions of the north and northwest that have a single growing season each year; and early-maturing varieties that reach maturity in 3-4 months, grown in the southern areas of the country and having two distinct annual cropping seasons. These are low-yielding varieties, naturally selected by the moisture conditions in the field over many generations. The selection criterion is stable yield under unfavourable moisture conditions. The early-maturing varieties are well accepted as being palatable and their grain stores well.

CULTIVATION METHODS

Apart from a few farmers who use tractors for land preparation, most farmers practice traditional methods of farming. The "yambo," a small hoe, is the principal instrument that Somali farmers have at

their disposal. The use of oxen is more widely spread in the northern and northwestern regions than in the southern regions. Sorghum, which is used mainly for its grain and fodder, is grown twice a year in the southern regions and only once a year in the northern regions. Sowing is accomplished either by hoeing and broadcasting or by dropping the seed in the furrow behind the plow when animal-drawn implements are used. Through continuous work and without excessive effort, the Somali farmers keep their fields in good condition all year round. Harvesting is accomplished by cutting the panicles, which are stored in an underground pit, or threshing and winnowing, if the produce is to be used quickly. The stalks may be grazed by the animals in the field or cut and conserved as forage for the animals during the dry seasons.

UTILIZATION OF SORGHUM GRAIN

Sorghum is used in different forms, either before or after fermentation. Some of the sorghum preparations widely consumed in Somalia include: soor -- a kind of thick porridge prepared by adding sorghum flour to boiling water and continually stirring until a thick jell is formed; mushariyo -- similar to soor but not as thick and made with oil, sugar, and pepper; anjero -- a leavened, round, flat bread made from sorghum to which some wheat flour is added; mufo -- round flat bread plus sour unfermented sorghum baked in a special oven called "tinaar"; kibis -- sometimes called "mufo-daawo," made from fermented sorghum to which some wheat flour is added and then baked in a pan rubbed with some ghee or any vegetable oil; and anbuulo -- made by putting the sorghum grains alone or with cowpea or mung bean in water and boiling until no water remains.

SORGHUM RESEARCH

Agricultural research in Somalia is the responsibility of the Agricultural Research Institute (ARI), established by the Ministry of Agriculture in 1975. The institute has its headquarters in Mogadishu. Its main research station, the Central Agricultural Research Station (CARS) is located at Afgoi, about 30 km west of Mogadishu. There are three substations to support CARS activities, enabling the testing of the technology and crop varieties under development for wider applicability and adaptability in the major agroecological zones. The Jilib substation, near Kismayo in the middle of Juba Region, is chiefly concerned with irrigated agriculture. The Bonka substation, in Baidoa, Bay Region, is in the area with the best potential for sorghum production. It is concerned with rainfed production over a wide area of the southern uplands region and the upper plains land of adjoining regions and is the national coordinating station for sorghum improvement. The arid to semi-arid area in the northwestern region is served by a substation at Aburein, near Hargeisa.

The Agricultural Research Institute is assisted by a United Nations Development Programme/Food and Agriculture Organization of the United Nations (UNDP/FAO) project that aims at strengthening national research capability in soils, agronomy, maize breeding, and farming systems research. The substations are, as yet, inadequately developed, but they are receiving increasing attention. There is a need for more staff at these stations, particularly in the field of breeding.

NATIONAL SORGHUM IMPROVEMENT PROGRAM

The National Sorghum Improvement Program of the ARI has been reorganized based on clearer objectives and with the cooperation of different agencies or development projects, including the Bay Region Agricultural Development Project (BRADP) and Northwest Region Agricultural Development Project (NWRADP), with the support of the International Development Research Centre (IDRC). The program's main objective is promoting the production of sorghum for food under rain-fed conditions in different agroecological zones of Somalia through the provision of improved varieties with good yielding potential, excellent grain quality, desirable agronomic characteristics, and resistance to insects and diseases.

For these improved varieties to be accepted by the traditional sorghum growers and consumers in Somalia, they must have excellent grain quality with prolonged grain storage life, as found in indigenous varieties. To achieve these objectives, the program has several components.

Screening and Selection of Varieties Using Local and Exotic Germ Plasm

Local cultivars, partially collected in 1979, and varieties received from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and from other sorghum improvement projects are evaluated for their adaptability, yield, and quality of grain under Somali conditions. The selected varieties are evaluated further before they are released or crossed with promising local lines to improve the local varieties. Selection of materials derived from crosses is expected to give rise to promising lines for further testing and eventual release.

The major criteria for selection include: early maturation, to escape drought during the short, low-rainfall periods and minimize bird damage; medium plant height, to reduce lodging; high yield; resistance to disease, especially smut; resistance to pests, especially shootfly and stalk borers; grower and consumer acceptability; resistance to bird damage; and better grain storage ability.

Breeding

The breeding program, initiated as part of the varietal development program, aims at incorporating the desirable characteristics of the most promising introduced varieties into the best local varieties while maintaining the superior drought and pest tolerance demonstrated by the latter varieties in on-farm tests. The actual hybridization is carried out at Bonka, but selection is conducted in different locations.

The work includes breeding for resistance to drought and stem borers. At present, we are in the preliminary stages of screening for resistant or tolerant varieties.

Sorghum Agronomy

Research conducted by ARI has shown that improved cultural practices, such as timely planting, weeding, pest and disease control,

soil moisture conservation, and bird control, can more than triple sorghum yields. Hence, there is a need for more research and extension work in the various agroecological zones.

Date of Planting

Usually, the farmers wait for the first rains to soften the soil before starting to sow. The time of planting is very important because the rainy period is short. Studies on planting dates will help growers determine the appropriate time to sow to maximize use of available moisture. Localized studies have shown that timely planting can increase yields by 50-80%.

Plant Population

Plant populations observed in farmers' fields are much lower than optimum. Preliminary studies have shown that populations of 30 000-50 000 plants/ha produce higher yields. The farmers' practice of sowing 4-6 seeds/hill and not thinning is being discouraged. A better distribution of the plant population over the field is expected to increase yields by making more efficient use of available moisture.

Moisture Conservation

A traditional method of accumulating moisture in the soil is through the use of basins and bunds. Basins are made on sloping land and their size varies from 2 m x 2 m to 25 m x 25 m, depending on the slope. Bunds are built along parallel lines, 20-30 m apart. Tests conducted in bunds and on open land have shown significant differences in favour of bunds.

Crop Protection

The most important disease affecting sorghum is smut. Studies have shown that up to 60% reduction in yield can be attributed to attacks of smut. Research is attempting to identify the best and safest seed treatment chemicals to prevent or reduce losses due to smut until such time as varieties with genetic resistance to smut are available.

Anthrachnose and leaf blight may cause some damage but their economic importance is very low. The most important insects causing extensive damage are stem borers and shootflies. For the time being, the only treatment available is through the use of diazinon in granular form. Research is also attempting to identify varieties that are resistant or tolerant to these pests. The work on disease and insect pests is being carried out in cooperation with such major centres as ICRISAT and Texas A & M University.

Protection from birds is another problem under study. The Quelea is the most important among the birds feeding on sorghum grain. The Quelea control program of FAO is trying to limit the population of these birds over the Eastern African Region.

ON-FARM RESEARCH

On-farm research in a farming systems context is a new approach to research in Somalia. Systematic work and technology testing under

actual farm conditions, refining of research findings into recommendations, and economic evaluation of recommendations began in October 1982 with the establishment of a farming systems and economic research section at the Central Agricultural Research Station, Afgoi.

The research activities of this section comprise two components:

The first involves the selection of two representative benchmark villages, in both the irrigated and rainfed areas. A farm survey to analyze the present farming conditions of small farmers has been conducted with reference to resource endowment and allocations, farm practices, and farm management analysis. During the first season, emphasis was placed on labour management and the farmers' attitude toward adoption of new technology. A representative sample of 15 farmers in each village was used and information was collected through multivisit interviews and group discussions, accompanied by regular field visits and direct observations of farm operations. Crucial information has been cross-checked in other locations.

The criteria used for the selection of the villages were that they should be typical of the main maize- and sorghum-producing areas, respectively, and that activities of other institutions, such as extension and irrigation projects, should be limited in order to study prevailing traditional systems. It must be stressed that the study is neither statistically valid nor applicable countrywide. It is intended as an in-depth case study.

The second component involved on-farm trials in the two selected villages to test research recommendations. The trials are managed entirely by the farmers, using their own cultural practices. The selected farmers should not cultivate more than 5 ha, but the main criterion is their willingness to participate in the experiments. During the 1983 season, 38 trials were planted by the farmers to test new maize and sorghum varieties. A new cowpea variety was planted as a pure crop and groundnut was planted as an introduction into the cropping system. In addition, chemical stalk borer control in maize and sorghum was evaluated. Finally, some hand tools for weeding and maize shellers were tested. Observations on the trials are made regularly but emphasis was placed on the mutual training of researchers and farmers. The trials will be evaluated both in agronomic and economic terms.

To establish a continuous flow of information from research through extension to the farmers, a cooperative on-farm program between research and extension workers has been initiated for further on-farm testing of research findings that have already reached the stage of recommendation.