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

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

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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## BANANA-BASED CROPPING SYSTEMS IN UGANDA

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The edible banana is probably derived from the wild-seeded forms *Musa acuminata* and *Musa balbisiana* or is possibly a cross between the two (Simmonds 1966). It probably originated in Southeast Asia but the time and route of its introduction into East Africa is not clear. In Uganda, the crop is believed to have been brought into the country by the legendary ancestor of the Baganda people, Kintu, suggesting that the cultivation of bananas in Uganda extends beyond the written history of the country.

Today, the banana crop forms a large proportion of the diet of millions of Ugandans. It is estimated that more than 75% of the farmers grow bananas, with the crop occupying the largest cultivated area of all the staple food crops in the country. The banana is the staple food in the majority of the districts of Uganda. Simmonds (1966) also noted that Uganda was the largest producer of bananas for local consumption and that the domestic crop amounted to more than 15% of total world production.

In Uganda, four main categories of bananas are recognized: (1) the cooking banana, locally known as Matooke, forms the largest proportion of the bananas grown; (2) the roasting banana, locally called Gonja; (3) the beer banana, grown for producing a juice and a wine-like beverage and locally known as Mbidde and Kisubi; and (4) the sweet banana or dessert banana, locally known as Ndizi, Sukali, and Bogoya. Within these major categories there are distinct varieties. Traditionally, the crop is grown on small holdings, often less than 0.5 ha and invariably near homesteads. A typical grove of bananas comprises a mixture of varieties of cooking bananas and a few roasting bananas, the beer and dessert type being grown mostly on the outside of the main plantation. The crop is usually grown mixed in varying proportions with other crops. During the early stage of establishment, maize, beans, cassava, and groundnuts form the major intercrops with banana, whereas at later stages of growth other crops such as *Dioscorea* spp. taro, tannia, coffee, cocoa, and pineapple are usually interplanted.

In recent years, the hectareage under bananas has been increasing steadily. This is particularly true of the areas within 30 km of major cities. There are perhaps a number of reasons for this. Firstly, because of the growing urban population, the greatest



proportion of whom feed on Matooke, the demand for Matooke has correspondingly risen. Secondly, the industrial alcoholic beverages have become unbearably expensive and the demand for them has, consequently, declined. The wine-like beverage (Mwenge) produced from bananas has, therefore, become an increasingly important alternative in the banana-growing zones. Thirdly, there is an increasing awareness among Ugandan farmers and traders of the demand for sweet bananas in the external market.

#### DEFINITION OF THE PROBLEM

The banana is known for imposing a great demand on the soil for its nutrients (Rimington 1964). In the past, the Ugandan farmer was partly able to overcome this problem by planting only on virgin fertile land and once the yields began to decline the farmer would establish another grove on a new piece of land. Because of the growing population pressure on land, however, this practice is no longer possible in most of the banana-growing zones. As a result, there has been a general reduction in soil fertility and increased disease and pest incidences. The most important of these are the banana weevil, nematode infestation, and sigatoka leaf spot and panama wilt diseases. In addition, there is generally poor crop management under the peasant situation, particularly with respect to plant density, weeding frequency, and planting time of the component species. Because of these factors, the yields from farmers' plots are low and are continuing to decline. The current banana yields in the country are estimated at 3.2-4.0 t/ha/year, which compares unfavourably with those of most banana-growing countries. In Honduras, for example, up to 30.4 t/ha/year are possible with high levels of inputs; whereas in one experiment carried out in Uganda, up to 16.2 t/ha was achieved (Nkedi-Kizza 1973), suggesting that there is considerable potential for improving banana yields in the country.

The Faculty of Agriculture at Makerere University, in collaboration with the Ministry of Agriculture, has recently proposed a research project on bananas. The aim of the project is to develop and test strategies for quickly increasing the yield of banana crops in farmers' plots. In this paper, some aspects of the methodology to be used in the study will be discussed. It should be emphasized at this stage that our problems are unique; unique in that we are virtually starting from scratch. Although the banana is an important staple food crop in Uganda, very little research effort has been devoted to the crop in the country.

#### OBJECTIVES OF THE PROPOSED STUDY

The general objective of the proposed banana-based cropping systems research at Makerere is to develop appropriate technologies aimed at increasing the productivity of the small farm holding. It has often been argued that farmers are sometimes reluctant to adopt recommendations because such recommendations may be inappropriate for them. This situation may arise because of the traditional research approach in which research goals are generally formulated within disciplines rather than between or among disciplines.

In the proposed research project, an interdisciplinary approach will be adopted and the research will be conducted both at the



university farm, Kabanyolo, and on selected farmers' plots. The advantage of this approach is that it will establish the desirable link between the researcher, extension worker, and farmer, which is so often lacking in a traditional research approach. The overall objectives of the project will be: (1) to devise a means of economically controlling the decline in banana yields per unit area, and (2) to devise a means of improving the productivity of bananas and the component crops beyond present levels.

## METHODOLOGY

### Research Team

As mentioned earlier, the project will require a cooperative effort among disciplines. In other words, the project calls for an integrated approach in which there is constant interaction and feedback of information among participants. One essential requirement of such a team is that it should be small and comprise scientists who are willing to cooperate closely in carrying out the project. Each of the participants should be knowledgeable in the discipline for which they will have primary responsibility. In this regard, our project will be made up of seven participants, which will include two plant pathologists, an agronomist, a soil scientist, an entomologist, a nematologist, and an economist/farming systems expert. Most of the participants have worked together as colleagues in the Faculty of Agriculture as lecturers and in various research programs and we feel, therefore, that they will cooperate in the proposed project. Because of the need to maintain a small and manageable team, we have, reluctantly, omitted a number of possible disciplines. For example, we have omitted a plant breeder, who is a key person in any crop improvement program. Our reasoning is that, at least during the initial phase of the project, we can manage without a plant breeder because we do not envisage any breeding work. The initial phase would also be utilized by the physiologist and agronomist to study and understand the crop and by so doing identify the desirable characteristics that can be incorporated by the plant breeder in a later phase. There is also a need to have a farm management economist, a biometrician, and a sociologist associated with the team. These, however, will be consulted when the need arises.

In addition to the above team, we propose to have seven research assistants hired on a full-time basis -- one for each discipline. These will be, preferably, BSc degree holders with some working experience in extension. They will assist during the survey and in carrying out on-farm trials.

### Germ-Plasm Collection

To achieve our objectives, we feel that one of the immediate priorities is the identification of high-yielding banana varieties that will, at the same time, perform well under the farmer's situation. Because there has not been any serious research carried out in the country, the Ugandan farmer has not had the opportunity of growing some high-yielding varieties. Therefore, we plan to assemble a collection of banana varieties both within and outside Uganda. There are already a number of research centres carrying out some work on bananas, e.g., in Nigeria, the Philippines, and Jamaica. These

countries, we believe, have some improved banana varieties that may be of interest to Ugandan farmers, although disease aspects may limit the use of germ plasm introduction.

We propose to explore the possibility of using tissue-culture methods, particularly for importing germ plasm from outside the country. As mentioned earlier, the initial phase will be used by the physiologist and agronomist to understand the crop and identify the desirable characteristics. Most important of these will be the growth habits, such as the number of suckers (tillers) per stool, height of the plant, size of the girth at different stages of growth, leaf size and arrangement, time to shooting, and bunch habits. The initial screening exercise will be carried out at the university farm, Kabanyolo. Because the Ugandan farmer traditionally grows bananas in combination with other crops, an important aspect of the screening exercise will be to assess how the different types respond to intercropping situations. The promising lines will then be tested under the farmer's situation on selected farms.

### Farm Survey

As stated earlier, the primary objective is ultimately to be able to assist the small farmer in solving some of the numerous problems associated with banana production and, hence, improve the productivity of the crop. It is important, therefore, that the participating scientists be acquainted with these problems right from the initial stages of the project. In this connection, we realize that the farmer's own experiences can provide very useful guidelines in the process of identifying some of the problems. Thus, a baseline survey will be conducted to obtain systematized information on the common agronomic practices used by the farmer and other problems associated with banana production.

It is planned that sites for the baseline survey should be selected from those areas with the greatest concentration of bananas. These areas will include some parts of the Western region, the Lake Victoria crescent, and some parts of the Eastern region. Ecologically, these areas differ considerably, particularly with respect to soil types and the amount and distribution of rainfall. Thus, although banana is the main food crop in all of these areas, the component crops in the banana grove and even the cropping patterns differ from one region to another. In all, there will be six sites: Mbarara (Western region); Masaka, Mpigi, and Mukono (Lake Victoria crescent region); and Tororo and Mbale (Eastern region).

In this type of project, we consider a presurvey to be an essential exercise before a detailed farm survey can be conducted. This will simply involve reconnaissance visits to the selected sites with a view toward collecting background information that will then be used to design a questionnaire. It is planned to have at least one visit per site to acquaint the team with local problems. During such visits, informal discussions will be arranged with groups of farmers and agricultural officials of the area.

The team has not yet decided how to select the farmers to be interviewed in the detailed survey. There are some fears associated with using a completely random sampling procedure. One obvious problem with such a procedure is that it tends to give rise to an extremely heterogeneous group of farmers, ranging from the illiterate

to those who can read and write to the well-to-do. It appears, however, that the best approach will be to adopt the concept of "target groups" (Collinson 1980). In Uganda are what we often refer to as "progressive farmers." These are farmers who can generally read and write and who are rapidly responding to recommendations. We feel our sampling should be confined, initially, to this group of farmers. However, the exact details of how these are to be identified and how many will be sampled from each site will be finalized after the presurvey.

For the plant physiologist and the agronomist, the purpose of the survey will be to gain some understanding of the range of banana varieties grown, method of establishment, type of crop mixtures, planting arrangement and time of planting of the component species within a banana grove, and frequency and time of weeding. For the entomologist, plant pathologist, and nematologist, the purpose of the survey will be to identify the common pests and diseases affecting farm crops and make an estimate of yield losses due to the pests and diseases on the existing crop/crop mixtures to assist in determining the economic threshold level for subsequent control measures.

The soil scientist will determine the soil problems and, consequently, the remedial technological package the farmer needs to overcome the problems. In addition to the questionnaire, the soil scientist will take soil samples for analysis to assess the levels of the major nutrients. The economist will collect all relevant information in connection with resource utilization and costs of inputs and returns, as well as information on the marketing infrastructure, bottlenecks, and possible alternatives facing the farmer. Other information that will be of value will include the farmer's allocation of production and consumption preferences and existing customs and beliefs in relation to existing farming practices.

#### On-Farm Trials

It is estimated that the presurvey, design of the questionnaire, its implementation, and analysis of the data collected should be completed within 1 year. Based on the results of the survey, priority problems will be identified.

In addition, some farms will be selected on each site and these will be used for on-farm trials. The following criteria will be used as guidelines during the selection: (1) accessibility of the farm, (2) availability of enough land with uniform soil, and (3) farmers' willingness to cooperate in the trials.

The trials will be carried out on each of the selected farms and at the university farm, Kabanyolo. The existing cropping pattern will be examined using the farmers' management techniques and improved management practices, e.g., size of the holes for planting bananas, weeding frequency, mulching practices, use of improved varieties and fertilizers, and improved crop protection procedures. The overall purpose of the trials is likely to be: (1) determine the optimum yield per unit area of the bananas and the component crops and to measure the impact of different agronomic practices on the output; (2) determine the economic levels of crop protection procedures;

(3) examine the fertilizer needs of the banana; and (4) monitor the economics of the cropping patterns, e.g., labour required for planting and weeding.

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