The International Exchange and Testing of Cassava Germ Plasm in Africa

Proceedings of an interdisciplinary workshop held at IITA, Ibadan, Nigeria 17-21 November 1975

Editors: Eugene Terry and Reginald MacIntyre

Cosponsored by the International Development Research Centre and the International Institute of Tropical Agriculture
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Contents

Foreword 5
Participants 9
Welcoming Address, S. K. Hahn 11

Theme Papers
Possibilities for economic research into cassava production systems in Africa, J. C. Flinn 15
Improvement of cassava at the International Institute of Tropical Agriculture, S. K. Hahn 21
Cassava bacterial blight in Africa, E. R. Terry 23
Advances in research on the economic significance of the green cassava mite (Mononychellus tanajoa) in Uganda, Z. M. Nyiira 27

Country Presentations 31
Summary of General Discussion 35
Appendix 1 Agronomic aspects of the International exchange and testing of cassava germ plasm
Part A Cooperative testing and selection 39
Part B Germination and pollination 41
Part C A rapid multiplication technique, A. K. Howland 42
Part D Guidelines for the establishment of a cassava improvement project: the Zaire model, H. C. Ezumah, S. Kabonyi, K. Beya 45

Appendix 2 Phytosanitary aspects of the international exchange and testing of cassava germ plasm
Part A Suggested guidelines relating to the international movement of cassava planting materials 51
Part B Description and evaluation of cassava mosaic disease in Africa, E. R. Terry 53
Part C Major pests of cassava in Africa and preliminary guidelines for screening of resistance, K. Leuschner 55

Appendix 3 A note on the IITA training program 57
Improvement of Cassava at the 
International Institute of Tropical Agriculture 

S. K. Hahn 
International Institute of Tropical Agriculture 
Ibadan, Nigeria

The major biological constraint to cassava production in Africa is disease, especially cassava mosaic disease (CMD) which exists only in Africa and India, cassava bacterial blight disease (CBB), and anthracnose disease. Insects (e.g. green mite recently introduced into East Africa, and mealy bug, recently identified in Zaïre and the Congo) are potentially serious pests in Africa. Most of the local cassava cultivars are susceptible to these diseases and yields are low, being about 5-10 tons of fresh yield per hectare in 12 months compared with potential yields of more than 20 tons.

Although cassava is a very important staple food crop in tropical Africa, and has very serious problems, improvement of the crop had been given very little attention. Realizing this, the International Institute of Tropical Agriculture (IITA) established the Root and Tuber Improvement Program in 1971. This program covers cassava, yams, sweet potato, and cocoyams, with cassava receiving the highest priority. The broad objectives are to develop improved cultural practices and varieties with high stable yields, high quality, and plant characteristics suitable for efficient cropping systems. The ultimate goals and interactions among the disciplines are presented in Fig. 1.

Program objectives

The specific objectives for cassava improvement at IITA are: 1) high yield in terms of dry matter production per unit of land and time in both monoculture and mixed cropping systems; 2) resistance to, and cultural control of, economically important diseases and insects; 3) improved quality in terms of consumer acceptance, nutritional value, and processing characteristics; 4) improved plant type; canopy and root characteristics; and 5) adaptation to a wide range of environments.

At IITA a large germ plasm has been assembled in seed form from Africa, Latin America (especially from Brazil and CIAT), and Asia. This has been evaluated for resistance to the major economic diseases and for agronomic traits. Sources of resistance to the diseases including CMD, CBB, and anthracnose disease have been identified. Resistance to both CMD and CBB showed a positive genetic relationship.

Extensive hybridizations among selected parents are made and about 100,000 seedlings are raised and screened for disease resistance and root characteristics every year. About 2000-4000 seedlings are selected annually in five different locations in Nigeria and 19 different locations in Zaïre for clonal selection, and for further evaluation for resistance to diseases and lodging, for root and plant characteristics and for high yield potential. Promising clones have been put forward for advanced yield trials and the most elite clones from these trials have been tested in three different ecological areas. A few clones which have shown consistently superior performance over the years in terms of disease resistance, yield, resistance to lodging, and plant characteristics have been multiplied and planted in farmers' fields in Nigeria. We can then observe performance under local conditions and farm practices, and test farmers' reactions to improved materials thereby making the best clones available to farmers. Some selected seedlings have also been evaluated on farms in Zaïre.

Significant progress has been made in producing improved cassava clones with resistance to diseases (especially CMD and CBB), higher yield, improved root characteristics, and resistance to lodging. Their gari quality has been tested and is acceptable.
Our disease-resistant (CMD, CBB) cassava in Nigeria maintains its resistance when planted in Zaire. Resistance of our material to CMD was also confirmed in Sierra Leone, Liberia, and Togo. Our material showed a high level of resistance to anthracnose disease in Zaire where the disease is a serious problem.

Cassava from exotic sources has been successfully improved for resistance to CMD, CBB, and lodging without sacrificing desirable agronomic traits.

By continuous selection for three generations, cassava has been improved for low HCN and many low HCN clones have been selected.

Many seeds containing sources of resistance to CMD, CBB, and anthracnose and possessing desirable agronomic characters have been supplied to countries in Africa and Asia.

IITA’s headquarters site in Ibadan is an excellent place to evaluate breeding material for resistance to CMD, because of a large population of the white fly which is a vector of the disease. Also, because the area has a relatively high rainfall, resistance of cassava to CBB can be readily evaluated. Environmental conditions at IITA are fairly representative of the major cassava-growing areas in Africa.

A large number of cassava seeds can be successfully germinated without scarification by sowing them directly in the field during the dry season, when soil temperature is very high, followed by daily irrigation. The key factors for good seed germination are high soil moisture and a soil temperature of between 30 and 35°C. This germination method has enabled the program to deal with large plant populations. The breeding method which we have successfully used is a half-sib family selection method in combination with a polycross method. It has been possible to incorporate genes associated with resistance to diseases and lodging and good root characteristics. This method also makes possible the introgression of exotic sources into our breeding populations. Methods of selection have been developed based on some genetic information.

The key factors which have made cassava improvement work successful are favourable environmental conditions for evaluation, large population sizes, appropriate breeding methods, and good teamwork among the relevant disciplines.

A number of national cassava workers from many countries in Africa and Asia have spent time at IITA to become better acquainted with our cassava improvement technology. Most have returned home with improved seeds and have established national cassava improvement programs in their own countries.

The Root and Tuber Improvement Program now consists of a core program at IITA and two cooperative cassava programs in Nigeria and Zaire. There are 13 professional staff and several postdoctoral fellows within the program. Through staff visits and the exchange of information and material, the program has established cooperative links with many national programs and institutions in Africa, Asia, and Latin America (particularly CIAT).