

PD-ARM-652
98802

Terminal report of the Applied Agricultural Research and Outreach Project
Outreach, Bas-Zaire

Diane A. Florini

July, 1990

1. EXECUTIVE SUMMARY

One goal of the PRONAM outreach section of the Applied Agricultural Research and Outreach Project (RAU) is improving production and profitability of RAU mandate crops for the peasant farmer in Bas-Zaire. Strategies to achieve this goal include the multiplication, introduction, and diffusion of improved varieties and of new agricultural techniques produced by the crop improvement and farming systems scientists of the three national research programs making up RAU-PRONAM, PNL, and PNM. From 1985 to 1987, cassava was the only mandate crop which PRONAM multiplied and distributed in Bas-Zaire. From 1988-1990, PRONAM was also in charge of multiplication and extension of maize and grain legumes for the region.

Training agricultural extension personnel of governmental and non-governmental organizations in production technologies for SENARRAU crops and their extension methodology is the second goal for the outreach section. Through developing a corps of trained agents, PRONAM hopes to assure the extension of technological information to peasant farmers, and hence the promotion of agricultural development in Zaire. Training of these extension agents has been a key strategy especially in the diffusion of improved varieties and will play a greater role in the dissemination of improved cultural techniques as these continue to be developed by SENARRAU.

PRONAM's outreach strategy consisted of working with governmental and non-governmental development organizations, private and semi-private local agricultural companies and agencies, religious groups, and agricultural projects engaged in promoting agricultural production at the village level. In areas where no such organizations existed, outreach worked with the extension agents of the Department of Agriculture. Outreach had three main activities: 1) multiplying new varieties of cassava, grain legumes, and maize, 2) producing and distributing cuttings for multiplication and farm-level demonstration trials, and 3) training of extension personnel.

Between October 1985 and June 1990, the outreach section harvested more than 2.6 million meters of cuttings of improved cassava varieties from 250 ha of multiplication fields planted at M'Vuazi, Kavuaya, and Gimbi in Bas-Zaire. The majority of these cuttings, more than 1.2 million meters, were given to development organizations and government agencies for distribution to peasant farmers, farmers' associations, church groups, and schools. Although the total number of farm families benefitting from this distribution is not known, at least 10,000 families in 45 of the 55 collectivities in Bas-Zaire have received cuttings produced in PRONAM fields. This figure does not take into account the total number of farmers participating in community multiplication fields nor those receiving cuttings from collaborators' multiplication fields. Cuttings are also made available to farmers during harvests of demonstration fields planted with PRONAM varieties. Between 1985 and 1990, over 800 demonstration fields were planted by 4 of PRONAM's collaborators.

From 1986 to June 1990, PRONAM organized 8 formal training sessions, one non-agricultural workshop, and also provided logistic support two seminars on station. Four technical field days were organized on station. Off station, PRONAM trainers taught five formal training sessions and conducted four field workshops.

Where previously trained farmers' associations or church groups exist, combining a program of rapid multiplication, community multiplication fields, and a more formal network for passing the cuttings from one village to another could assure an adequate supply of cuttings of new varieties even more quickly than in the past. In areas where farmer's have little contact with a development group, one-time multiplication fields will continue to be the most efficient way to serve a maximum number of farmers with improved varieties of cassava, grain legumes, and maize.

List of Tables and Figures

Table 1.	Number of plants produced by rapid multiplication techniques at PRONAM, M'Vuazi from October 1985 to June 1990.	29
Table 2.	Area planted (m ²) for small-scale multiplication of promising varieties.	30
Table 3.	Cuttings of improved cassava varieties distributed by PRONAM for centralized multiplication fields (expressed as potential hectareage planted).	31
Table 4.	Cuttings of improved cassava varieties distributed from PRONAM multiplication fields to farmers or groups by development organizations (expressed as potential hectareage planted).	31
Table 5.	Hectares of cassava multiplication fields maintained on PRONAM stations in Bas-Zaire, 1980-90.	32
Table 6.	Area of multiplication fields maintained by PRONAM in Bas-Zaire from 1985-1990 and percentage of total area planted according to variety.	33
Table 7.	Allocation of cuttings in PRONAM's multiplication fields at M'Vuazi, Kavuaya, and Gimbi from October 1985 to June 1990.	34
Table 8.	Yields of cuttings harvested from the multiplication field at Kongo, (PRONAM, M'Vuazi) October 1989 to June 1990.	35
Table 9.	Allocation of peanut varieties produced in 1988-1989 in PRONAM multiplication fields.	36
Table 10.	Allocation of soybean varieties produced in 1988-1989 in PRONAM multiplication fields.	37
Table 11.	Demonstration trials planted in Bas-Zaire, 1981-1990	38
Table 12.	Area (ha) planted by collaborators for centralized multiplication fields in Bas-Zaire, 1985-1990.	39
Table 13.	Number of village groups, farmers' associations, churches, and schools receiving cuttings from collaborators in Bas-Zaire.	40
Table 14.	Training sessions conducted at M'Vuazi in Bas-Zaire.	41
Table 15.	Major agricultural field days organized at M'Vuazi, October 1985 to June 1990.	43
Table 16.	Training sessions sponsored by collaborators and conducted off station in Bas-Zaire.	44
Table 17.	Day-long field workshops conducted off station in Bas-Zaire.	45
Figure 1.	Sites where collaborating organizations are known to have distributed PRONAM cassava varieties between October 1985 and June 1990. At least 45 of 55 collectivities have received cuttings.	46
Figure 2.	Yield of tuberous cassava roots in 68 PRONAM-SENAFIC demonstration fields planted between October 1986 and December 1988.	47
Figure 3.	Yield of tuberous cassava roots in 93 PRONAM-SENAFIC demonstration fields planted between October 1986 and December 1988.	48

2. GENERAL INTRODUCTION

The Applied Agricultural Research and Outreach Project (RAU), in operation from September 1985 to September 1990, united three national food commodity research programs: the National Manioc Program (PRONAM), the National Maize Program (PNM), and the National Grain Legume Program (PNL). The project had the double goal of reinforcing the ability of the Zairian Department of Agriculture to conduct applied research on certain food crops, and of developing linkages with the agencies involved in agricultural extension of new production techniques and new varieties of these crops. The target population for the project's outreach efforts was the village-level farmer who generally cultivates less than 1 hectare per annum in Bas-Zaïre. Recently, the name of the RAU project changed when the Zairian government created the National Service for Applied Agricultural Research and Outreach (SENARRAU). RAU I is used to refer to phase I of the project and SENARRAU to refer to past and continuing activities.

The outreach activities of SENARRAU that were concentrated in the Bas-Zaïre and Bandundu regions of Zaïre were a logical consequence of two previous projects on cassava. One, the National Manioc Program (PRONAM), was created by the Government of Zaïre (GOZ) in 1974 with technical assistance from the International Institute of Tropical Agriculture (IITA) to find solutions to disease and insect pest attacks¹ in the early 1970's. PRONAM screened local and introduced varieties of cassava for the ability to produce a crop under disease and insect pressure and began a breeding program to develop varieties able to resist debilitating pest attacks. National staff received para-professional training and in 1977 higher degree training was begun for selected candidates.

In 1980, the United States Agency for International Development joined forces with the GOZ and IITA in implementing the Cassava Outreach Project (O77) in order to continue training PRONAM staff while continuing to develop PRONAM's ability to conduct applied research on cassava. This project added an outreach component to PRONAM in order to make new varieties and research results available for dissemination to rural farmers. The outreach strategy consisted of working with governmental and non-governmental development organizations, private and semi-private local agricultural companies and agencies, religious groups, and agricultural projects engaged in promoting agricultural production at the village level. In areas where no such organizations existed, outreach worked with the extension agents of the Department of Agriculture. This same strategy was adopted for RAU I.²

The outreach component of Project O77 had four main activities: 1) multiple site testing for new varieties, 2) producing and distributing cuttings for multiplication, 3) training of extension personnel, and 4) conducting farm-level demonstration trials. Outreach support activities for RAU I were similar but multiple site testing was transferred to the plant breeding section and greater emphasis was given to the distribution of cassava cuttings for community multiplication fields. During the last year of RAU I, distribution of new varieties of soybeans, peanuts, and cassava was begun in collaboration with the farming systems section. Training the extension staff of development organizations and of the Department of Agriculture was as important to RAU I as it had been to the Cassava Outreach Project. As before, trained staff were expected to train others, thus increasing the number of qualified extension agents in contact with farmers.³ Under RAU I, however, collaborators with no trained trainers called on PRONAM outreach to conduct training sessions for representatives of farmers' associations and church groups. These trained volunteers are likely to continue the linkages with the National Research programs even when the extension projects which support them are discontinued.

In part 3 of this end of project report, the outreach section activities presented include the work of Dr. S. J. Pandey who had begun the extension activities of PRONAM under the Cassava Outreach Program and continued

¹ Caused by the bacterium *Xanthomonas manihotis* and the cassava mealy bug, *Pheromacoccus manihotis*.

² USAID. Document du Projet. Projet de Recherche Agricole Appliquée et Vulgarisation, N° 660-0091. 7 Septembre 1983. p.11.

³ *ibid.*, p. 9.

under RAV I, Dr. C. Bartlett who acted as interim head of the section after illness forced Dr. Pandey to leave, myself who joined the program in May of 1988, and of the Zairian outreach staff including Ir. Belawaku Ua Kanda who is the head of PRONAM's multiplication unit, Ir. Mutombo Tshibadi who came to M'Uuazi from Kiyaka in April 1989, Ir. Kamizelo Kitambala who was transferred from M'Uuazi to replace Mutombo in Kiyaka in July 1989, and field technicians Nsibandoki Lukikeba, Velino Gracia, Massamba Ndokunsadio, and Mayele Diambote not to mention the field workers of the multiplication section. Agronome Tidika Nsangu and animatrice agricole Dinamuene Mena also contributed to the accomplishments; the former left in 1988 to continue his agricultural education and the latter died in childbirth in 1987.

The reader may note certain discrepancies between this report and previous PRONAM reports. One reason is that there was some overlap in reporting periods. Collaborating organizations did not always make clear whether the data they provided were organized by calendar year or by agricultural year. The other reason is that PRONAM works with a wide range of developmental organizations and government agencies, many of whom are poorly equipped to keep accurate records of their extension activities. When faced with limited resources, most collaborators prefer to concentrate on delivering PRONAM planting material to their target populations rather than on recording distribution dates, number of farm families receiving cuttings, and amounts of cuttings distributed. In many cases, collaborators choose new target areas each year and have neither lists of the populations to be served nor good maps showing the geographic location of the villages. The maps currently available for Bas-Zaire date from the colonial era with few updates; whole villages and even roads have changed their location over the years further complicating the ability of collaborators and PRONAM to make a complete map of where improved planting material has been distributed. Data presented in this report include only those which could be presented with confidence based on field notebooks, original distribution lists, and collaborator reports; therefore, these data represent only a fraction of the actual figures for amounts of cuttings of improved cassava varieties distributed and numbers of farm families reached with the new varieties.

3. ACTIVITIES CARRIED OUT AND RESULTS OBTAINED

3.1 On-station multiplication of improved cassava, grain legume, and maize varieties

3.1.1 Introduction

One goal of the outreach section of PRONAM is improving production and profitability of the SENARRAV mandate crops for the peasant farmer in Bas-Zaire. Strategies to achieve this goal include the multiplication, introduction, and diffusion of improved varieties produced by the crop improvement and farming systems scientists of PRONAM, PNL, and PNM, the three national research programs making up SENARRAV. From 1985 to 1987, cassava was the only mandate crop which PRONAM multiplied and distributed in Bas-Zaire. PRONAM outreach became responsible for multiplication and extension of maize, grain legumes, and cassava within Bas-Zaire when SENARRAV decided that commercial seed multiplication and extension for all its mandate crops should be the responsibility of the national program headquarters found within the area. Multiplication of maize and grain legume seed began in 1987 at the M'Uuazi station.

During the 1987-88 agricultural season, the multiplication unit at M'Uuazi was made independent of the outreach section and reported directly to PRONAM's Director. The unit was again integrated into outreach at the beginning of the 1988-1989 agricultural campaign.

In the region of Bas-Zaire, multiplication activities also take place at the adaptation centers Kavuaya and Gimbi (recently relocated to Kinzau-Vuete) under the supervision of the PRONAM technician who manages the centers' research fields. At Kimpese, a third adaptation center, the multiplication field of 1 hectare is planted and maintained by PRONAM every year in exchange for use of land for research trials at the Centre de Développement Communautaire de l'Eglise du Christ au Zaire (CEDECO), so harvest of cuttings and tubers

roots from this hectare is the responsibility of CEDECO.

The multiplication fields produce planting stock of improved varieties of cassava, and maize and grain legume seed for:

- a) distributing to peasant farmers through collaborating organizations,
- b) furnishing commercial seed and cuttings to farmers, and
- c) the research needs of other institutes and the other sections of PRONAM.

There are three main tasks for the multiplication section within the extension section: 1) rapid and small-scale multiplication of cassava, 2) large-scale multiplication of cassava, and 3) small-scale multiplication of maize and grain legumes.

3.1.2 Rapid and small-scale multiplication of cassava on station

Rationale and previous work:

Rapid multiplication techniques use all parts of the cassava stem to permit the production of large quantities of planting materials in a relatively short period of time. When new varieties are first selected for advanced testing on station, plant stems are given to the multiplication unit for propagation. If there is a reasonable amount of planting material, say 10-20 stems, small plots are planted with hardwood cuttings of ordinary length (25-30 cm) in a nursery. The nursery is near a river so that the new varieties can be watered during the dry season. Should there be an urgent demand for planting stock, two-node cuttings of the hardwood stems are planted in perforated black plastic sacks and the immature shoot tips cut into 10 cm lengths are planted in humidity chambers. The multiplication rates of the three methods have been estimated at:

- ≈ 5 for farmers⁴
- ≈ 10 for normal cuttings from plants grown under good management
- ≈ 25 for two-node hardwood cuttings
- ≈ 40 for combined use of shoot-tip and two-node hardwood cuttings

Methodology:

The plant breeders can usually give only a few meters of a new variety to the outreach section. Rapid multiplication techniques are used to obtain a few hundred plants with which to begin normal multiplication. Two methods originally described by Heys are used at M'Uuazi for rapid multiplication:

a) two-node hardwood sections

The mature part of the cassava stem is divided into cuttings with two nodes. These short cuttings are planted horizontally at a depth of 3 to 4 cm in black plastic bags full of topsoil and composted manure (1:1). Four to five weeks later, the young plants are transplanted to the field, after the bags are ripped open to permit rooting.

b) shoot-tip cuttings

The immature shoot tips of the cassava stem are divided into cuttings of approximately 10 cm. These are planted at a spacing of 10 cm X 10 cm in 10 cm of sterilized sand layered over 10 cm of gravel in humidity chambers. The young plants are transplanted four to five weeks later.

A third method which obviates the need for planting media has been recently described by Otoo⁵ and will be tested by the multiplication unit at

⁴ Akoroda, M. O., A. E. Oyinlola, and T. Gebremeskel. 1987. Plantable stem supply for IITA Cassava Varieties in Oyo State of Nigeria. *Agricultural Systems* 24:305-317.

⁵ Otoo, J. A. 1989. A new method for rapid multiplication of cassava. IITA

the beginning of the next rainy season. For this method, two-node hardwood cuttings and five-node semi-mature cuttings are dipped in a fungicide suspension (for example, 6 g of Benlate per liter of water) and then placed in a perforated plastic bag. The bag should not be more than two-thirds full as there must be an empty space above the cuttings to permit aeration. The bag is placed in the shade for 3-5 days to permit the cuttings to germinate. The healthy cuttings are then transplanted directly to the field and unspouted cuttings are eliminated. This method can also work without the use of fungicides and is being pursued as potential tool for stimulating rapid multiplication of improved cassava varieties during the rainy season by farmers' associations.

When enough stems of a new variety are available, standard-sized cuttings (25 cm-long) are used to plant small areas. Researchers use the cuttings produced in these blocks to plant tests on station and in farmer fields. Varieties performing well in these tests are then moved into large-scale multiplication. The multiplication team may maintain varieties in small-scale multiplication for several years pending evaluation by crop improvement and farming systems scientists.

Results and discussion:

The last year that IITA varieties were rapidly multiplied on station was 1985-86. Since then promising varieties have been developed by PRONAM's breeding section using IITA's disease-resistant material. Table 1 clearly shows that rapid multiplication is currently being used only to produce enough cuttings of these new varieties to begin small multiplication plots. For example, 40230/3 is now planted on 1.6 ha at M'Uuazi and in small blocks at Kavuaya and Gimbi; this area produces more than enough cuttings for the farmer tests conducted by the Farming Systems group.

From 1985 to 1987, PRONAM multiplication planted small blocks of several varieties at Mankewa and Ntampa (Table 2) pending the outcome of observations by the research sections. By late 1987, most of these varieties had been returned to the breeding section's germplasm collection. The multiplication unit is now concentrating on the most promising breeding materials, three of which are currently being distributed to farmers for on-farm tests, and on a group of yellow-fleshed varieties being observed by the crop scientists to determine their pest tolerance and yield capability.⁶

3.1.3 Large-scale multiplication of cassava, maize, and grain legumes

Rationale and previous work:

Commercial seed production is generally the mandate of the Service Nationale de Semences (SENASEM--formerly Bureau National de Semences, BUNASEM) but SENASEM has not yet taken over the production and extension of commercial-grade planting stock of improved cassava varieties largely because of the problems inherent in transporting bulky cassava cuttings. Consequently, PRONAM has continued to plant commercial multiplication fields at M'Uuazi, Kavuaya, and Gimbi. Large-scale multiplication permits PRONAM to furnish cuttings of improved cassava varieties through free distribution or by sale to collaborating organizations, directly to peasant and commercial farmers, and to researchers in Zaire.

When PRONAM's research team identified the first disease-resistant varieties, there was no infrastructure in place for multiplying and distributing them. In the early 1980's two parastatal organizations--Groupe

Research Briefs 9(2):5.

⁶ Yellow-fleshed varieties contain more carotene than white-fleshed varieties but generally have lower yields of tuberous roots. The fresh roots with yellow flesh are usually eaten as snacks with peanuts and attract a higher price than those with white flesh. Most farmers in Bas-Zaire grow a limited area of such varieties. Members of peasant associations have expressed interest in improved yellow varieties during three different field days at PRONAM.

Economie Rural (GER) and ZAIROM, a Zairian-Rumanian venture--planted large areas with the variety 02864 originally selected by INERA. By the time Kinuani was released in 1983 these agencies no longer existed in Bas-Zaïre. At that time PRONAM contacted a group of development organizations and companies who were willing to multiply or distribute this new variety. Projet Italo-Zairois, the Centre de Développement Communautaire, and several factories planted centralized multiplication fields (Table 3) but most of the other groups distributed the cuttings to individual farmers (Table 4). At the beginning of the RAV project, therefore, PRONAM continued to plant large multiplication fields to meet the needs of collaborators and farmers (Table 5).

PRONAM's multiplication of maize and grain legumes began when M'Uuazi became responsible for farming systems research and extension of these crops. Multiplication began in late 1987 for maize and peanut and in late 1988 for soybeans and cowpea. Seed produced from these multiplication fields was intended for the research sections of PRONAM, for future multiplication fields, and for collaborating organizations. The excess was sold because PRONAM does not yet have adequate storage facilities.

Methodology

The multiplication staff plant the most healthy of the cassava cuttings and seed produced the previous year on land PRONAM rents from villages adjacent to M'Uuazi, Kavvaya, and Gimbi. The land is plowed, limed (for maize and legumes), and harrowed by tractor and, when fertilizer is available, 50-50-50 kg/ha of N, P₂O₅, K₂O are applied by tractor to multiplication fields. Most other operations including weeding and side-dressing with fertilizer are done by hand. During both 1988-89 and 1989-90 a few blocks of maize were intercropped with F100. During the latter agricultural year some of the peanut hectareage was also intercropped. In 1989-1990, some of the maize and the legumes fields were planted in the Mankewa valley where the soil is more fertile and has a better moisture-holding capacity than that at M'Uela, the site of the rest of the multiplication fields for that year.

Results and discussion

Between late 1985 and mid 1990, more than 250 ha of cassava were planted in PRONAM fields in Bas-Zaïre with an additional 10 ha at CEDECO, Kimpese in 1985-86 (Table 5). Not all this area was used to produce cuttings for extension purposes; 34 ha were planted in exchange for renting land for research and multiplication fields, and approximately 18 were devoted to varieties being developed or tested. Just over 198 ha were covered with the three varieties released for extension: F100, Kinuani, and 02864 (Table 6). The proportion of fields planted with F100 increased with respect to Kinuani from 1985 to 1990. Although F100 was selected at Kiyaka, tests in Bas-Zaïre showed that it performed well and that its non-branching habit allowed it to fit easily into mixed cropping systems of the region.

RAV I distributed or sold over 2 million meters between October 1985 and June 1990; most of the 830,000 m which were distributed to the public in the first year of RAV I were harvested from 72 hectares of Kinuani planted under Project 077 in the 1984-1985 agricultural year. During its mandate, RAV I gradually increased the amount of F100 being produced and tested the variety 40230/3. F100 distribution is following the system established for Kinuani--cuttings are distributed to collaborating organizations for demonstration or multiplication plots. The new variety 40230/3 will begin the same pattern in 1990-1991. A small amount of Kinuani and 02864 continue to be planted on station for distribution to areas which have not received them.

The area planted for cassava multiplication on station has decreased steadily since 1985-1986 paralleling reductions in PRONAM operating funds. Two tactics have been adopted to assure a supply of cuttings to the public. Normally, PRONAM hires temporary workers to help weed and harvest the multiplication fields. In order to maintain the same area without seasonal workers, part of the area planted at M'Uuazi for multiplication of released

varieties was turned over to sharecroppers who will weed and harvest their plots in exchange for keeping part of the tuberous root harvest. All cuttings produced in sharecroppers' plots will go to PRONAM for distribution in 1990-1991. The second tactic has been to contact collaborators who have received and multiplied PRONAM varieties, who would be willing and able to sell cuttings to interested farmers. Between 24 and 35 % of the cuttings produced on station are sold (Table 7). Sales declined slightly from 1985 to 1990 reflecting the policy of the outreach section to limit the quantities sold from the station to any one buyer while encouraging sales by farmers around the station. The limit is also intended to show buyers that PRONAM is not a substitute for their own multiplication. Allowing collaborators to supply cuttings for sale will permit PRONAM to concentrate on getting older varieties to new areas and new varieties to all collaborators. La Fondation Hanns Seidel, the Centre de Développement Communautaire (CEDECO), the Centre de Développement Rural Intégré de Madimba (CEDERI), and the Projet d'Appui des Associations Villageoises de la Vallée d'Inkisi (PAVI) have agreed in principle to help farmer organizations within their target area to contact PRONAM in order to work out procedures for official multiplication of PRONAM cuttings. Other multipliers who could be contacted include the Groupe Technique d'Encadrement Régional (GTER) who offered 30,000 m in 1989-1990 to development groups from its field planted in February 1988, and companies such as the Cimenterie du Zaïre (CIZA) or the Office National du Transport (ONATRA) who have been planting improved varieties for many years and have already supplied cuttings to clients who came to PRONAM too late to buy mature cuttings.

Approximately 70-80 % of cuttings produced on station were delivered to the public either by sale or by free distribution. Most of this is given to the major collaborators and to the Department of Agriculture's extension agents. Others--including miscellaneous development agencies, factories, schools, churches, and individuals--benefit from 6-22 % of total production. Although the percentage of total production distributed free to these three groups has not changed appreciably since 1985, the actual amount of cuttings being distributed is about a third of what it was in 1985. The decrease in the amount of cuttings produced on station is understandable in view of the cutbacks in PRONAM support. What is alarming is that, from 1985 to 1988, the production of cuttings from on-station multiplication fields decreased per hectare.

One reason was the lack of equipment for digging drainage canals. Despite the canals that the farm management crew dug by hand in the 1988-1989 multiplication field at Kongo, 31-46 % of the plants were missing in some blocks which were flooded (Table 8). The cassava in the 1987-1988 field at M'Vele was also stunted because of a high water table. Because the farm management crew activities were hampered, they have only been able to institute a 3-year rotation this year. The 1988-1989 and 1989-1990 fields followed only one year of fallow. This is perhaps desirable for the plant breeders who would like to select varieties capable of tolerating weed competition and poor soils, but it is not advisable for multiplication. Most blocks at M'Vele had to be weeded five times since they were planted in October 1989.

The primary reason for declining yields, however, was lack of close supervision of field workers because of difficulties with transportation alternately caused by lack of vehicles and lack of fuel. The trend of declining yields can be reversed and, in fact, the multiplication unit was able to improve the yield of cuttings in the field planted in 1988-89 despite the problems with flooding. Although the field is not yet completely harvested (cuttings from the rest of this field are being reserved for 1990-1991 when the government of Zaïre intends to begin large multiplication fields in regions other than Bas-Zaïre, Bandundu, and Kasai), the average yield was almost 12,000 m/ha for what has been cut and about 15,000 m/ha for F100 (Table 8). One reason for this improvement was that the multiplication unit began to keep better records and so was able to see how to evaluate its own performance. The evaluation also suggested that first priority be given to replacing non-germinated cuttings in order to increase production per man-hour.

The maize variety Kasai 1 and the peanut varieties P43 and Mandingu were multiplied for the first time by PRONAM in 1987-1988. This was the period during which multiplication was divorced from the outreach section; the staff who planted these fields say that the yields were negligible as they were

planted late. Of the seed produced, 16 kg of P43 and 37 kg of Mandingu were saved for planting in October 1988.

In 1988 and 1989, half of the area planted with Kasai I was intercropped with F100 so the staff could measure differences in manpower under the two systems; unfortunately, the plots were flooded in 1988 and data collection in 1989 was sketchy. In 1989, 0.6 ha of Kasai I was planted at M'Vele (0.5 ha intercropped with F100) and 0.4 ha were monocropped on an alluvial soil at Mankewa. Yields at Mankewa were 3.7 T/ha--three times higher than those of monocropped maize at M'Vele where the soil has much poorer native fertility and water-holding capacity. Yields per hectare for mono-cropped maize at M'Vele were 1.5 times higher than those for intercropped maize. Although these were not experimental plots, they support the outreach section's plea for land suited for maize if it is to continue maize production. For the coming year, 20 ares of maize or less will be planted as only the collaborators in Madimba Zone show any interest in maize and many of the farmers there received seed of Kasai I in 1988 through a government-sponsored program. When PNM finds another high-yielding variety suited to Bas-Zaire, outreach will again increase the area planted to maize.⁷ Except for 1000 ears donated to PNM to begin their half-sib multiplication and the seed kept for the next season's multiplication, all maize was sold for food; there were 42 buyers for 1807 kg of maize produced in season A 1988 and 31 buyers for 1825 kg produced in season A of 1989.

Peanut yields were substantially higher in 1989-90 than in 1988-89 mostly because, despite transport problems, an effort was made to ensure adequate field supervision. In 1988-1989, there was little difference between Mandingu yields in season A and season B, but P43 produced better in season A. Preliminary results from 1989-1990 showed JL24 yields were 1.3 times higher in season B than season A. The harvest of peanuts planted in season B of 1989-90 was underway when this report was written; but, if the same holds for P43, it would argue for planting peanuts in season B in order to minimize manpower constraints in season A which is the most important season for cassava. This recommendation is, of course, contingent upon having a fertile site. Of the 704 kg of unshelled peanuts produced in seasons A and B 1988-1989, 84.5 were given to three collaborators for multiplication in 47 associations or church groups, 1 kg each of JL24 (from PNL) and Mandingu were given to two church groups to test, and 7 kg were given to the farming systems section of PRONAM (Table 9). PRONAM M'Vuazi used 209.9 kg for further multiplication and sent 25 kg of P43 to PRONAM Kiyaka to begin their multiplication. Forty people bought 256 kg of unshelled peanuts and 7 others bought 20 kg of shelled peanuts.

Soybeans were multiplied at M'Vuazi for the first time in 1988-89. Although yields were twice as high in season A as in season B, the main multiplication of soybean must take place in Season B because there is a rapid decrease in germination rate for soybean stored under the humid conditions of M'Vuazi. Only enough should be planted in season A to provide clean planting material for season B. Part of the production from season A, 1988-1989 was replanted in season B and the rest was sold. In season B, 157 kg of quality seed were produced: 84 kg was distributed to three collaborators for testing in 29 farmer's associations, church groups, and village health committees, 4 kg went to the farming systems section, 12 kg were sent to Kiyaka to begin their multiplication, 25 kg were saved for planting in October 1989 and 32 kg were sold to three farmers (Table 10). A small amount of each of the crops (peanuts, maize, and soybeans) was planted before the on-station training held in October 1989 so the trainees would have plant material in the field to examine. Most of the 111 kg of food-grade soybean produced in season B were sold, but 7 kg were used to demonstrate the steps in soybean preparation for the annual meeting of representatives of PAVU in January 1990. Representatives tasted several different soy recipes and practiced choosing good seed.

In the future more emphasis will be placed on multiplication of the legumes in season B provided a suitable site can be found. Maize production will be reduced until new varieties are ready for testing from PNM. The area planted to cassava will remain small, approximately 30 ha, but efforts will be made to ensure that no more than 5 % of the plants are missing.

⁷ Traditionally, most maize consumed in Bas-Zaire is white; but, during field days, representatives of farmer's associations indicated they would be willing to test new varieties regardless of the kernal color.

3.2 OUTREACH

3.2.1 Introduction

The outreach section of PRONAM is not an agricultural extension program but rather a liaison between PRONAM's researchers and those private or public organizations concerned with agricultural extension including the extension agents of the Department of Agriculture and Rural Development (AGRIDRAL agents). Because these organizations' extension goals, strategies, and resources differ, PRONAM has been flexible when developing joint activities with each of them. Regardless of the particular activities carried out with them, however, PRONAM's overall goal is to foster systems through which new ideas and technologies can be made available to farmers and through which farmers can make their needs known to the national programs within SENARAU. Unfortunately, many of the collaborators do not keep complete records of their extension activities. This has hampered PRONAM's efforts to quantify the number of farmers who have received PRONAM varieties. Data on the amount of cuttings distributed from collaborators' multiplication fields are particularly rare. The figures presented below, therefore, underestimate actual distribution because data include only those which could be verified from collaborator reports and from original PRONAM records.

3.2.2 Types of Collaborators

There are two main types of collaborators who are the bridge between farmers and PRONAM: 1) the Zairian Department of Agriculture and Rural Development (AGRIDRAL), and 2) development organizations. In the early years of PRONAM, the agricultural services of private or parastatal companies were also included as collaborators because they were capable of multiplying and distributing improved varieties to their large work staff as well as to villages near the factory. They continue to produce cuttings and have helped serve clients when PRONAM stocks are depleted.

AGRIDRAL has agents in all of the collectivities and in some localities.⁸ These agents must ensure that all able-bodied farmers plant fields required by the AGRIDRAL. In Bas-Zaïre, cassava and peanuts are the mandated crops. The collectivity and locality agents are supervised by the agricultural inspector for their zone and he, in turn, reports to the sub-regional inspector. PRONAM consults with the inspectors for the three sub-regions in Bas-Zaïre when programming activities with AGRIDRAL agents. These activities are similar to those for development organizations, but concentrate more on training, distribution, and multiplication fields as opposed to demonstration fields. Though PRONAM does not have the funds to support a full-scale extension campaign, it attempts to plant at least a nucleus of new varieties in each collectivity seat. The collectivity agent responsible for the multiplication field is then able to plant fields in each of the localities and eventually in many of the surrounding villages. In most cases, the collectivity agents are invited to a training session at M'Vuazi before receiving cuttings for a multiplication field; occasionally, an agent will receive cuttings before he is trained because of logistic or political exigencies. During RAU I, PRONAM has worked primarily with agents from Cataractes and Lukaya sub-regions which depend on manioc both as a staple and cash crop. PRONAM may participate in motivational planning meetings in villages close to M'Vuazi. Demonstrations planted by AGRIDRAL agents are directly supervised by the Service Nationale de Fertilisants et Intrants Connexes, although PRONAM has helped with fields in the M'Vuazi area.

Development organizations have two major extension strategies. One strategy is to target village groups (churches or peasant associations) and to

⁸ A locality, also called a "groupment," consists of several neighboring villages. A collectivity unites several localities. AGRIDRAL agents at the locality level are also known as "moniteurs agricoles." Both collectivity agents and locality agents can be called "Agronomes d'Etat."

train them to help themselves. The support organizations adopting this strategy have no formal extension agents on the local level but work with village volunteers who encourage their group to experiment with new techniques. The other strategy is to post trained extension agents in a village within a given target area; these agents work with farmers in the surrounding villages who may or may not be organized into groups. PRONAM's interactions with development organizations include training both the organizations' core staff and representatives of their farmers' groups, distribution of cuttings for demonstration plots or multiplication fields, and follow-up visits when possible.

A brief description of the principal collaborators in the region of Bas-Zaïre between 1985 and 1990 follows:

- The Association pour la Promotion du Développement Endogène des Communautés de Base (APRODEC) was created by Zairians interested in stimulating grass-roots development activities. It has a small staff and documentation center in Mbanza Ngungu and publishes a periodical in Kikongo to which peasant associations can subscribe for a nominal fee. APRODEC has no extension staff in the villages—not even volunteers—rather, it responds to requests from village groups anywhere in Bas-Zaïre for help with special projects or for training in self-evaluation techniques. Some projects include domesticating wild plants and rodents, teaching village women to read, and improved production techniques for making soap, clay bricks, and stoves. APRODEC sponsors meetings to foster communication among representatives of farmers' associations and has invited development organizations to participate in these meetings to better coordinate development aid to these associations. One such meeting united representatives from 10 "foyers de développement"⁹ all of which have received PRONAM cassava varieties through PRONAM's collaborators. As of November 1989, nine of these development associations were serving a population of 469 families.

APRODEC did not feel there was a need to create yet another agricultural support project in Bas-Zaïre and, therefore, did not have someone with agricultural training on its staff until recently. PRONAM provided trainers for the cassava training session financed by APRODEC. APRODEC delivered cuttings of improved cassava varieties from PRONAM to three development associations, two of which united several farmers' associations with a total membership of 216.

- The Centre de Développement Communautaire (CEDECO) de l'Eglise du Christ au Zaïre (ECZ) was one of PRONAM's earliest collaborators conducting multilocational yield trials and planting centralized cassava multiplication fields. CEDECO has a crop production department at Kimpese which uses PRONAM varieties; however, it is not clear how many of the cuttings are given to the extension section. The extension section operates through a system of "posts" scattered throughout Songololo Zone. These posts are often cooperative groups of farmers who hire agricultural support services such as a tractor or a truck from CEDECO, Kimpese. As of 1989, there were 121 members in the six previously established CEDECO posts. At least three new posts were created in 1989, but their membership is still in flux.

When a post is created, one or two farmers attend a 9-month training in general agriculture at Kimpese. The trained volunteers then receive periodic training updates which help them stimulate farmers in their posts and in the surrounding villages to use improved agricultural techniques and improved varieties. PRONAM has trained members from four of the posts as well as staff members from the extension and crop production departments at the Kimpese center. The six posts established before 1989 have multiplied and distributed PRONAM cassava varieties to at least 30 villages or other posts.

⁹ A "foyer de développement" is a development association uniting farmers or farmers' associations from several adjoining villages. Often the members of these development associations have been trained by and have worked with non-governmental development projects or organizations such as OXFAM.

• The Communauté Baptiste du Zaïre Ouest (CBZO) is also a member of the ECZ, the protestant church network that includes CEDECO. It, however, has no development structure in the villages but offers the services of an agricultural advisor to all its member churches. The church members can buy tools, seeds, and tree seedlings through the advisor who provides transport to the villages and advice for planting and maintenance of the new crops. The current advisor has no Zairian homologue and but has begun to train his handyman to help out. The advisor is responsible for all of Bas-Zaïre and cannot give intensive support to any one church and so has called on PRONAM to organize meetings or training sessions for representatives of several churches in areas where there is a perceived need for cassava improvement. For example, CBZO organized a meeting between a multi-disciplinary team from PRONAM and 101 church and community leaders from villages around Sona Bata in November 1986. After the meeting, 9 church groups, 1 school, and 168 farmers in 10 villages received PRONAM cuttings. Recently, CBZO sponsored a training session for 124 members of 16 parishes in Kimvula Zone (and for parishes just across the Bandundu border in Popokabaka Zone) and helped finance the distribution of cuttings to 23 of its parishes serving 31 villages in Kimvula and Popokabaka and to 3 parishes in Madimba Zone. Although the population of all the parishes served is not known, there are well over 1554 members of the 14 parishes that PRONAM was able to contact during a follow-up trip with the CBZO agricultural advisor.

• The Groupe Technique d'Encadrement Régional (GTER), based in Matadi, is the branch of the ECZ which supports other church-sponsored development agencies or projects throughout Bas-Zaïre. As with CEDECO and CBZO, it works primarily with church groups but does not restrict participation in its development activities to Christians. In the past, it has planted centralized multiplication fields with PRONAM varieties at Kimpese as well as at Kisonga in Seke Banza Zone. In 1988, it began working with peasant associations as well as church development groups in Bas-Fleuve sub-region and much of the distribution in this area has been accomplished with its truck or with the help of its financing. It has no fixed target population but is known to have provided cuttings to 10 farmers' associations in 1987, to have helped PRONAM provide cuttings to more than 22 farmers' associations or churches in 1988, and to have offered 30,000 m of cuttings to development groups in 1989.

Some of the development projects or churches who are presently multiplying PRONAM cassava varieties in collaboration with GTER include:

- Promotion des Associations Villageoises (PRONAVI) in Tshela Zone
- Bureau d'Etudes pour un Développement Intégré (BEDI) de la Communauté Evangélique de l'Alliance au Zaïre (CEAZ) with headquarters in Boma and a training center in Tshela
- Centre d'Encadrement Paysan (CEP) with a soybean processing center in the city of Boma and an agricultural center in Boma Bungu collectivity
- the CBZO churches in Mbanza Ngungu and Gombe Lutete
- the CEAZ churches in Luozi Center and Nkundi

• The Projet Agricole Apicole de l'Armée du Salut (PAA) works with farmer's associations, Salvation Army churches, or village health committees in four zones: Kasangulu, Madimba, Mbanza Ngungu, and recently Luozi. Its main emphasis is on bee-keeping, reforestation (with some experimentation in alley-cropping), and improved crop varieties; however, its goal is to help community groups to get organized rather than to stimulate production. It has no staff in the villages but its trainers teach village volunteers to pass along what they learn through specific community activities such as planting a cassava demonstration. The Salvation Army was planting demonstration plots with PRONAM varieties before the PAA I project began but turned to multiplication fields when people were convinced that Kinuani was a good variety. Since 1986, PAA has returned to demonstration fields including F100 and Kinuani; the fields combine a local variety and the new varieties planted under two densities. The demonstrations introduce both improved varieties in villages working with PAA for the first time and introduce F100 in villages which had previously received Kinuani. In much of Mbanza Ngungu and Madimba Zones farmers traditionally plant cassava closely-spaced in double rows on each ridge--the density ranging

from 16,000 to 19,000 plants per hectare or more. Since 1986, PAA has suggested that farmers compare the traditional spacing with the less dense 10,000 plants per hectare recommended by PRONAM.

- The *Projet d'Appui des Associations Villageoises de la Vallée d'Inkisi* (PAVI) is a 3-year extension and training project sponsored by the Zairian Department of Rural Development and the French government. Its target area is the Inkisi river valley which includes parts of several collectivities on the border between Madimba and Mbanza Ngungu Zones. PAVI does not organize farmers' associations but supports those that exist or those that are just getting organized. At its creation in 1988, PAVI began working with 22 associations, has worked with as many as 44, and currently works with 37. On average, there are 12 members per association but the maximum number of members has been as high as 660.

PAVI operates by training association members, who must then relay the information learned to their group. PAVI has minimal staff and generally invites other organizations to conduct training: PRONAM for food crops, PAA for bee-keeping, *Projet Fruits-Vivres* for pruning and grafting of fruit trees, and a veterinarian for vaccination of chickens. Their core staff visits each association once a month to train the members in simple accounting and management techniques; all inputs to the association, including cassava cuttings donated by PRONAM or technical leaflets, are expected to be registered or filed in the association's notebooks. The trained members of each association sign a contract with PAVI specifying the activities to be accomplished after training; for example, they must plant a demonstration field from which the cuttings of the best variety will be used to plant a multiplication field. After the association has had the chance to plant two demonstration fields, it is considered self-sufficient in cuttings of the varieties used.

- The *Projet d'Appui des Associations Maraichères de Mbanza Ngungu* (PASMAM) headquartered at Mbanza Ngungu was formerly the *Projet de Développement Rural Intégré de Mbanza-Ngungu* (PRODERIM) and before that was the *Projet Agricole de Mbanza Ngungu* (*Projet Agricole* or *Projet Français*). When it was *Projet Agricole*, each of its extension agents was responsible for introducing and increasing vegetable and cassava production in a particular group of villages within Mbanza Ngungu Zone. Each group of 4-6 extension agents was supervised by a sector chief who visited regularly. Between 1982 and 1984, *Projet Agricole* was instrumental in conducting demonstration trials for PRONAM varieties in over 200 sites in the zone. When French funding ended, it changed into PRODERIM which began to work more with peasant associations than individual farmers. Because PRODERIM had to rely only on government funding it could no longer afford most of its extension agents in the field. In 1988 PRODERIM was evaluated and reformulated, emerging as PASMAM. PASMAM maintains only 6 extension agents, each of which is responsible for giving technical advice to 5-6 village associations. It has a core staff for training but concentrates on management techniques for farmer's associations in hopes of getting the farmers well organized before PASMAM ends in 1991. As in the past, it concentrates on vegetable production but still supports cassava extension by distribution of cuttings to individuals and farmers' associations.

- The *Projet Luala de la Coopération Italo-Zairois de Nkundi* (Italo-Zairois) is a government-supported integrated rural development project as PRODERIM once was. Its activities were once limited to the Luala valley in the Mongo Luala collectivity of Luozi Zone; it has since created at least one sub-center in another area. Italo-Zairois has several activities including encouraging animal traction and crop production. The extension section has only existed since 1987, but the production section of the center regularly planted multiplication fields at Nkundi until it lost most of its material in brush fires. Italo-Zairois has come to PRONAM to get another nucleus of F100 and Kinuani which should serve as a source of planting stock for its extension program.

- The *Service Nationale de Fertilisants et Intrants Connexes* (SENAFIC) was formerly the *Programme National Engrais/FAO* (PNE/FAO). For many years, it limited its activities to the Cataractes and Lukaya sub-regions of Bas-

Zaire; in 1988, it opened a sub-regional office in Boma to serve the Bas-Fleuve sub-region. SENAFIC has no extension agents of its own but rather works with AGRIDRAL agents who are given a bicycle and periodic short courses on fertilizer use. In addition they get a bonus for every demonstration field which they successfully manage. Generally one farm family is responsible for each demonstration but farmers in the village are invited to participate in field visits with SENAFIC staff during crop growth and at harvest.

PRONAM and SENAFIC conducted a cassava training course for 29 AGRIDRAL agents in 1983; since then the periodic courses are fully taught by SENAFIC staff. PRONAM continues to participate in field days with SENAFIC trainees. Until PRONAM resources became limited, PRONAM staff would help plant and harvest the SENAFIC demonstrations. PRONAM entomologists and pathologists would also rate insects and diseases in most of the fields. Between 1988 and 1990, PRONAM could only deliver cuttings to Mbanza Ngungu and visit a handful of fields. There was a changeover in SENAFIC staff between 1989 and 1990 so future collaborative activities will have to be redefined.

- Technoserve has provided improved cassava varieties and technical advice to two large farmers' cooperatives in Kasangulu Zone, COOPLAZALU and COOPAZAS. In 1987, Technoserve brought PRONAM cuttings to 237 COOPLAZALU farmers in 14 villages and in 1988, it brought cuttings to two villages in each of the cooperatives. It can respond to requests for help from cooperatives throughout Bas-Zaire but has not recently been in contact with PRONAM except to send a report from COOPLAZALU on the performance of Kinuani, F100, and 40230/3.

- The Centre de Développement Rural Intégré de Madimba (CEDERI) [formerly Centre du Développement Communautaire de Madimba (CEDECOM)] supports organized farmers' groups in Madimba Zone. Crop improvement is only one of its interests which include improving water supplies, public health, and village technologies for bread-baking, soap-making or other activities. CEDERI began formal collaboration with PRONAM's multiplication and distribution efforts in 1990.

- The Fondation Hanns Seidel (Hanns Seidel) is a German-funded "back-to-the-land" initiative in Mbankana which is in Kinshasa Region not Bas-Zaire. The project provides young farmers each with 20 ha of land that are planted in a systematic rotation. PRONAM is interested in reducing its on-station multiplication and Hanns Seidel's farmers are located in the area where many farmers want to buy cuttings of improved varieties so PRONAM gave Hanns Seidel a nucleus of F100 and Kinuani to multiply in October 1989. PRONAM staff intend to inspect the multiplication field to certify that the cuttings are in good health and are of PRONAM origin before the farmers sell them.

Other groups which have worked with PRONAM since 1985 but which did not have joint projects during 1988-1990 included two projects which support local development initiatives, an agricultural technical school, and two parastatal companies:

- OXFAM is a British-based non-governmental organization whose role in Bas-Zaire has been to finance training and other development projects. Before 1987, its advisor was partial to agricultural projects and suggested that PRONAM train the leaders of rural health projects and several cooperative farmers' groups. OXFAM then helped deliver cuttings to the groups in Luozi, Mbanza Ngungu, and Madimba Zones; for example, in 1986, OXFAM delivered at least 44250 m of Kinuani cuttings to over 386 farmers in 8 villages or farmers' associations and gave 7500 m to the Centre du Développement Endogène Paysan (CDEP) which later contacted PRONAM directly for planting material of F100. Many of the groups which received early training through OXFAM are among the more active farmer's associations in Bas-Zaire. Recently, OXFAM has concentrated on public health and nutrition and would fund training sessions oriented along these lines.

- In its early years, the Centre de Développement Endogène Paysan (CDEP) had been one of the projects supported by OXFAM. Some of its staff were

trained at PRONAM and have planted multiplication fields in Kintete and Luozi Center for distribution to farmers' associations. Its four agriculturally-trained agents work in four sectors composed of several villages. The agents rotate between sectors to keep stimulating the exchange of new ideas between CDEP staff and the farmers.

- The Institute Technique Agricole de Gombe Matadi (I.T.A./Gombe Matadi) is an agricultural technical school whose students were working with a PRODERIM extension agent to learn extension techniques. The school received PRONAM cuttings in 1984 and 1987 and has continued to plant a multiplication field on the campus. The students use the cuttings when they practice extension techniques in the surrounding villages.

- The Cimenterie du Zaire (CIZA) in Lukala, Songololo Zone and the Office National de Transport (ONATRA), Lufu Toto, Mbanza Ngungu Zone were among the first large-scale multipliers of Kinuani. Their PRONAM-trained staff distributed cuttings to the families of their numerous workers. They have also provided cuttings to private farmers and other groups of workers when PRONAM stocks were low.

3.2.3 Types of Extension Support Activities

Rationale and previous work

The extension support activities conducted by RAU I include three of the four activities carried out by its predecessor project, the Cassava Outreach Project: 1) distributing cuttings for multiplication, 2) conducting farm-level demonstration trials, and 3) training extension personnel. As new varieties created by PRONAM were still in the testing stage during that project, the outreach component worked with governmental and non-governmental organizations to test promising varieties in multiple sites. Under RAU I, this multiple site testing was transferred to PRONAM's breeding section and the farming systems section was responsible for following these multilocal trials with on-farm "technology-verification" tests in different sites while outreach concentrated on multiplying and distributing the varieties Kinuani, F100, and 02864. From 1988 to 1990, however, when reduced funding limited the number of sites for on-farm tests of new varieties, the outreach section helped the farming systems section to distribute small quantities of new cassava, peanut, and soybean varieties to collaborators for the on-farm verification tests. The varieties were planted as the farmer wished next to a locale variety of the farmer's choice. Farming systems asked collaborators for qualitative feedback only and intends to follow up on a sample of the tests in 1990-1991.

When determining the types of extension activities to be carried out with each of the collaborators, PRONAM took into account that collaborator's objectives and resources. In general, the types of activities are the same: preliminary joint planning, distribution of cassava cuttings for either demonstrations or multiplication, follow-up visits, and distribution of soybean and peanut seed for verification tests. Drafts of a limited amount of documentation have also been produced.

3.2.3.1 Planning Meetings

During most of RAU I, PRONAM and each of its collaborators met individually to determine the collaborator's need for training and/or planting material. Target areas were chosen for demonstrations and multiplication fields. When possible PRONAM would match zones targeted for AGRIDRAL agents with those of one of the collaborators so that distribution and follow-up might be combined in the same trip. For example, when PRONAM delivered cuttings to the farmers' associations at Ngidinga for APRODEC, it also provided cuttings for the AGRIDRAL agent in Mfidi Malele, the collectivity seat located farther along the same route. Similarly, AGRIDRAL agents in Kimvula Zone received

cuttings when PRONAM delivered cuttings to the CBZO parishes in the zone. In early 1989, the support organizations and agencies with extension agents working in Mbanza Ngungu and Madimba zones began bimestrial meetings to avoid duplication of effort in villages where more than one collaborator was working. These meetings enabled several different collaborators to pool resources for certain activities, such as training. Training schedules were shared and dates for follow-up visits with various partners were set. The bimestrial meetings also facilitated communications between PRONAM and the peasant groups working with PRONAM's collaborators. For example, farmers at Nenga volunteered to host one of PNL's multilocational variety trials after PRONAM asked collaborators to contact farmers on behalf of PNL. The Farming Systems section used the bimestrial meetings when locating villages in which farmers had problems with empty pods on peanut. After the collaborators polled their target zones, the researchers were put directly in contact with villages who wanted to host on-farm tests. PRONAM outreach used the meetings to remind collaborators to stress certain timely themes such as the importance of multiplication fields for providing planting material (rather than for producing food) and the importance of planting soybeans in both of the agricultural seasons so farmers would always have viable seed. For collaborators working in other zones, planning continued to be done on a bilateral basis.

When collaborating with AGRIDRAL agents in villages around M'Uuazi, outreach staff often participated in the motivational meetings that take place from June to September preceding the beginning of the Season A rains. These meetings aroused farmer interest in new crop varieties or techniques. Sites were chosen for multiplication fields and usually the outreach staff helped lay out individual plots for all the farmers who would be planting at the same site. Dates for distribution of cuttings and for follow-up visits were set in meetings with village officials. Occasionally, a collaborator with no extension agents would call PRONAM to a motivational meeting. CBZO, for example, called together representatives of churches and villages around Sona Bata for a 1986 meeting with a multi-disciplinary team from PRONAM. As a result of the meeting, 168 farmers in 10 villages and 9 christian associations received 4550 and 1350 m of cuttings, respectively, for multiplication fields.

3.2.3.2 Provision of Cuttings for Collaborators' Extension Programs

The outreach activity most requested by collaborating agencies is the provision of plantable stems of improved cassava varieties. The cuttings are then redistributed to groups or individuals for multiplication or demonstration.

Methodology for providing cuttings for distribution or sale

Most of the planting material went to collaborators as soon as the long rainy season A began, since one of the best cultural techniques for improving cassava yield is planting early. Season A typically runs from October to January. A smaller amount of planting material was distributed in Season B at the beginning of the shorter and more capricious rainy season that usually lasts from late February to early May.

Cassava cuttings were usually prepared in bundles of 50 stakes each measuring slightly over 1 meter on average. Occasionally, bundles of 25 m were used, especially when new varieties were distributed for verification tests. Bundles for SENAFIC included 80 stakes to allow for replacement cuttings in their demonstration plots.

Because the schedule for the collaborator's planned distribution had already been agreed upon in planning meetings, it sufficed for those who had transportation to confirm their arrival at M'Uuazi or one of the satellite stations a few days in advance of the scheduled date. Their cuttings were prepared the day prior to their arrival when possible. As certain collaborators possess only small pick-up trucks, PRONAM arranged to deliver large loads to a central location from which these collaborators continued the distribution. For those with operational funds but no truck, PRONAM donated its truck in exchange for the per diem of the driver and his assistant and the price of the fuel. Some collaborators, such as the AGRIDRAL agents, had

neither funds nor transportation. PRONAM delivered their cuttings on the way to other collaborators when possible.

Cuttings were provided free of charge to schools, hospitals, churches, miscellaneous development projects, individual peasant farmers who came directly to PRONAM stations, and a few commercial farmers who share-cropped cassava with peasant farmers around their farm. Most commercial farmers bought cuttings for a nominal fee.

Commercial farmers and the diverse development groups would usually notify PRONAM of their arrival several days in advance. Sometimes planting material dried up when clients' trucks broke down; therefore, firmer policies were adopted to try to avoid this waste. Currently, even though non-collaborators still schedule their arrival ahead of time, no planting stakes are cut until they arrive. While the cuttings are prepared, these groups can receive advice on planting and maintaining the varieties and on the specific characteristics of PRONAM's varieties.

Demonstration methodology

Two main types of demonstration plots were used during RAV I to compare promising cassava varieties selected by PRONAM researchers with local cultivars. The SENAFIC-type demonstrations, which were usually planted by one farm family, measured 6 ares and included a control with no fertilizer and two levels of fertilizer (50-50-50 or 100-100-100 N-P₂O₅-K₂O) for the local and the improved variety. (Projet Agricole's demonstrations were a variation on the SENAFIC-type demonstrations, measuring 4 ares with only a control and the lower dose of fertilizer for each variety.) During crop growth, joint field visits were made by both PRONAM and the collaborating project staff. PRONAM pathologists and entomologists evaluated the tolerance of the varieties to disease and pests. Members of the village were invited to participate in the harvest and share the stem cuttings; the tuberous roots belonged to the farm family that conducted the demonstration. The PAA-type demonstrations were usually planted by a group of farmers led by one of the trained village volunteers. These demonstrations did not include fertilizer but compared two improved varieties to a local variety. All three varieties were planted at two different densities. One density was somewhat less than the 10,000 plants/ha recommended by PRONAM and was obtained by using spacings of 1 m X 1 m or 0.75 m X 1.20 m. The other density was the traditional plant spacing used by farmers in the area; most often the group planting the demonstration used double rows of cassava along each ridge with 0.5 m between plants in the row and 0.5 m between the rows on the ridge. This system usually resulted in densities ranging from 16,000 to 19,000 plants per hectare depending on spacing between the ridges. In demonstrations conducted after 1988, three rows of peanuts were also planted on each ridge with 0.25 m within and between the rows. Some demonstrations included *Calliandra* and *Leucaena* spp. seedlings for PAA's future experiments in alley-cropping.

Multiplication methodology

No special methodology was used for multiplication fields; recently however, PRONAM asked those receiving cuttings to plant community rather than individual fields to facilitate meetings in which the importance of the field was discussed. In villages where community spirit was not developed enough to make a community field feasible, the farmers were asked to choose a single site where each farmer could be responsible for the plants in part of the field. This technique was most commonly used with farmers working with AGRIDRAL agents. Collaborators including AGRIDRAL agents were asked to hold periodic meetings with the theme of good management of multiplication fields, emphasizing the importance of harvesting the field only when the cuttings could be used for planting. Those participating in multiplication fields were reminded that they were expected to donate cuttings to neighbors within the same village or in a neighboring village at the time of harvest and to pass along the advice on cultural techniques that they had learned.

Results and discussion

Provision of cuttings for distribution or sale

From October 1985 to June 1990, approximately 2,653,000 m of cuttings of the three released varieties--Kinuani, F100, and 02864--were harvested from multiplication fields planted between 1984 and 1989 at M'Uuazi, Kavuya, and Gimbi (Table 7). Over 2,022,000 m (76 %) of these cuttings went to collaborators or directly to farmers. The remaining amount was used for replanting the multiplication fields on station or provided to research sections of PRONAM, to other research institutions, or to landlords. An additional 21,450 m of cuttings were distributed or sold by the outreach section: 14,450 m were produced at M'Uuazi by the Projet Fruit-Vivres in a rotation experiment using PRONAM cuttings, 5000 m were given to one of PRONAM's landlords from the personal field of one of the outreach staff, and 2000 m of yellow-fleshed varieties were sold from PRONAM's multiplication fields. There are 7-8 ha still left to be harvested in the field planted at M'Uuazi between October 1988 and April 1989, which could provide another 90,000 m for the 1990-1991 planting season.

Collaborating organizations received 14-22 % of all Kinuani, F100, and 02864 cuttings produced on station, while the AGRIDRAL agents and peasant farmers in villages around M'Uuazi received 7-10 % except in 1988-89 when 21% went to this category. That year an exceptionally large field of F100 was planted by 529 residents of Kolo Kidezoo near M'Uuazi in response to the great demand for this variety. (Distribution statistics do not include 93 additional farm families that came to the already-harvested F100 multiplication field at M'Uuazi in 1988; each family collected 100 m of cuttings too thin to distribute to collaborating organizations. Three women even collected the stumps of F100 left after the root harvest of the multiplication field.)

Individuals who came to the station for cuttings and groups not considered major collaborators such as churches, hospitals, schools, and miscellaneous development organizations benefitted from 6-22 % of the production of PRONAM's multiplication fields. The quantities they received appeared in the "collaborator" column of distribution tables in past reports. These groups delivered many cuttings to rural farmers, but PRONAM has rarely obtained feedback on actual quantities reaching farmers. Attempts are being made to better record locations of their target populations in the future so that follow-up will be possible for economic surveys.

From the limited follow-up data available, it is sure that since October 1985, at least 10,000 farmers have received PRONAM varieties through development organizations, AGRIDRAL agents, and factories. The true figure is actually much higher as most collaborators have not furnished the numbers of families participating in group multiplication fields nor the number of families receiving cuttings from collaborator's multiplication fields or other farmers. At least one village in 45 of the 55 collectivities in Bas-Zaïre have received cuttings from PRONAM fields through collaborating organizations or through individual farmers. Those sites where PRONAM is sure that cuttings have been planted are indicated on Figure 1. As mentioned earlier, the actual number of sites is much greater but collaborators are not always able to pinpoint villages on a map.

Sales to commercial growers accounted for 24-35 % of the total production of Kinuani, F100, and 02864 cuttings during 1985-1989. The resources of these farmers varied--some could afford only enough planting stakes for 1 ha while others bought enough for over 60 ha. Some of these sales were to agricultural companies who brought the outreach section staff to their fields for on-site technical support. One such example is the Domaine de Ngongo which bought 156,200 m of cuttings between 1985 and 1986. Unfortunately, many of these early ventures failed because of financial problems unrelated to their cassava fields.

PAVI has been the only collaborator to provide PRONAM with specific data on the numbers of farm families possessing PRONAM varieties within their target population. At its inception in 1988, PAVI chose to work with 22 farmer's associations in the Inkisi Valley, 8 of which had previously worked with PRODERIM (PASMAM) agents, 5 which worked directly with PAA, 5 which had contact with PAA volunteers, and 4 which worked with unspecified collaborators

(probably OXFAM and CEDERI). In 1988, these associations included 225 farm families (290 individual members). Over 62 percent of the 98 families in the associations working with PRODERIM had already tried Kinuani and almost 40 % had tried the peanut variety P43, but only 2 families had tried F100. It must be remembered that PRODERIM was most active before 1987 when F100 had not yet been multiplied on a large scale in Bas-Zaïre. In five villages that had worked directly with PAA, 27 of the 47 families had tried both Kinuani and F100 (both varieties have been included in PAA's demonstration plots since 1986) while PAA's village volunteers had brought Kinuani to 12 and F100 to 3 families in five additional villages. Such surveys indicate that PRONAM varieties have reached rural farmers even in villages where development organizations do not work directly.

Demonstration

From October 1985 to June 1990, 828 demonstration plots were planted using improved cassava varieties from PRONAM, including 10 fields planted in conjunction with PRONAM farming systems and outreach demonstrating the use of lime (Table 11). Outreach planted 6 fertilizer and lime trials of the same type near M'Uuazi for which results are reported by the farming systems section. Supposing that average yield in cuttings is about 10,000 m/ha, the 725 SENAFIC fields could produce over 217,500 m of planting stock of PRONAM varieties--enough to plant 87 ha with improved varieties. Another 60,000 m--enough to plant 24 ha--could easily be produced from demonstrations planted by PAA and PAUI which contain 2 ares each (and on average 300 plants each) of Kinuani and F100.

Of the 574 fields supervised by SENAFIC between 1985 and 1989, 364 were harvested in the presence of SENAFIC core staff. Analysis of yields from 228 SENAFIC fields showed that PRONAM varieties performed better than local varieties on average. Raw data from fields planted in 1985 were not available at the time this report was written so a combined analysis was done for data from fields planted in 1986, 1987, and 1988. On average, both Kinuani and F100 produce more than local cultivars especially when fertilizer is used (Figures 2 and 3). Previous analysis of data from 58 fields showed that monocropped Kinuani yields were 23% to 35% higher than yields of local cultivars. In most demonstrations, Kinuani did not yield well when associated with peanuts confirming research findings. Collaborators have been informed that Kinuani must be planted at the same time or earlier than peanuts when it is intercropped. Associating F100 with peanuts was less detrimental to cassava yields.

Both PAA and PAUI are interested in demonstrations as a tool for teaching communities to organize their activities so neither has tried to follow up on harvests of the demonstration plots except for a qualitative questionnaire used by PAA to get farmer feedback from the fields planted in 1987. After PRONAM presented suggestions for ways to compare yields in these plots, PAA was able to get farmers to compare yields either measured as piles of roots sold in the market or as basins. The results indicate that F100 and Kinuani surpassed the yield of the local variety in four of the eight fields harvested. In three fields, the local variety was not harvested at the same time as the improved varieties. For both PAUI and PAA, volunteer farmers are responsible for setting up the demonstrations so there are often deviations from the suggested plot plans or procedures (such as not harvesting the control plot) which invalidate conclusions which can be drawn from the demonstration. PRONAM has been emphasizing the theme of "equal conditions" for different treatments within demonstration fields during training courses and planning meetings with collaborators; however, a short workshop treating only the set up and harvest of demonstration fields could be useful to collaborators. More training is obviously required if demonstration fields are to serve as more than sources of cuttings for the surrounding villages.

Multiplication

Few collaborators plant centralized multiplication fields in Bas-

Zaire. At least 45.6 hectares of PRONAM varieties have been centrally planted by five PRONAM collaborators but PRONAM has not been able to obtain regular information from many of them (Table 12). It is clear that CEDECO and GTER have distributed cuttings to many development groups and peasant associations and that they continue to plant their own multiplication fields. For example, GTER wrote a letter to development organizations, to farmers' associations, and to the ECZ church network offering to distribute 30,000 m of cuttings in October 1989 from the 4 ha field it planted at Kisonga in February 1988 using cuttings from a field GTER planted in 1986.

Although centralized multiplication of cassava cuttings by collaborators is not common, most collaborators do distribute cuttings with the understanding that the beneficiaries will continue to multiply them (Table 13). Four of the associations currently working with PAVI had received Kinuani and F100 cuttings from PAA and OXFAM (and perhaps CEDERI) before 1988, are now self-sufficient in these varieties, and have distributed cuttings to other associations and villages. Fifteen associations working with PAA have donated cuttings to other associations, one of these provided material for seven of the PAA fields planted between 1987 and 1989.

The policy of giving cuttings to groups is a particularly sound strategy in Bas-Zaire where individualism is not encouraged by the social structure. When a small amount of cuttings has been given to a group, the group will multiply it once or even twice until all the members have received cuttings for their personal fields. The strategy has not worked where groups receiving large quantities of planting material thought that they would get more the next planting season and so harvested whole fields in the dry season. This was the case for some of the groups working with PASMAM. PASMAM has since corrected its message to emphasize that multiplication is as important as production.

3.2.3.4 Distribution of cuttings or seeds for technology verification tests

Methodology

During 1988-90, in collaboration with the farming systems section, outreach staff distributed cuttings of the cassava variety 40230/3 and seeds of three soybean varieties and one peanut variety for technology verification tests. These tests are the logical sequence to on-farm trials conducted by the Farming Systems section in a few locations in Bas-Zaire. These verification tests allow varieties to be tested in a wider geographical area than is possible for on-farm tests in which data collection is the responsibility of the researchers. For verification tests, only qualitative feedback is expected from collaborators which will confirm the quantitative results of the geographically-limited on-farm tests. Most visits to farmers show that even the farmers working with the most progressive collaborators will adopt a new variety before they will adopt a new cultural technique, so the objective of the technology verification tests is to obtain qualitative feedback on the performance of improved varieties when they are grown under the farmer's traditional system. These tests are not yield trials but ways to assess farmer reaction to all the qualities of the new varieties. The farming systems section plans to follow up a sample of villages where collaborators have introduced varieties for tests. The results of farming systems evaluations will guide SENARRAV in making site-specific recommendations for distribution of varieties.

When these tests were first introduced there was some confusion as to the difference between a verification test and a demonstration of already-released varieties. To emphasize that the varieties were being distributed for tests rather than multiplication, the procedure was formalized with a simple handout called "Protocole du test paysan." By filling in the handout a farmer or an association agreed to plant the test varieties next to the local variety of their choice, and to maintain the same growing conditions for the two varieties. They were requested to send their opinion of the new varieties to PRONAM after harvest.

Results and Discussion

PAVI, PAA, and CEDECO participated actively in the program of verification tests for soybean. PAVI distributed 22 of 35 kg of TGX 814-26D to 22 associations, CEDECO distributed 3 kg to 3 posts, and PAA distributed 20 kg to 1 church, 1 association, and 2 village health committees. PAVI and PAA each received 5 kg and CEDECO received approximately 3 kg of each of the varieties UFV-1 and IAC 73-5115. These varieties were distributed to 9 of the sites which had received TGX 814-26D. Some groups that got TGX 814-26D from PRONAM received UFV-1 and SAM 86 from SENASEM through PAVI. Feedback from the three collaborators indicated that only those associations who planted early were able to harvest, dry, and replant all of the three varieties. Associations that planted late could only harvest UFV-1 before the second season rains began. Farmers noticed that because of its short stature, UFV-1 did not cover the soil adequately and have decided to plant it in rows 50 cm rather than 60 cm apart. UFV-1 was appreciated for its earliness, IAC 73-5115 for the large size of its seed, and TGX 814-26 D for its yield. Farmer reaction to the second season plantings should be available to PRONAM during the next bimestrial meeting.

Tests of soybean varieties will be repeated for those associations who wish to try all three varieties again but who were unable to harvest seed in time to replant. For those associations that are interested in soybeans but less interested in testing new varieties, PRONAM has suggested simple multiplication plots with UFV-1 since this variety matures early enough for farmers to be able to produce two crops a year.

Almost all major collaborators have received a small amount of the cassava variety 40230/3 to test at their headquarters or in a few villages. Operating funds were not sufficient to allow farming systems to follow-up on all of the 40230/3 that had been distributed for tests in 1988-89, however, based on data from two zones, PRONAM decided to include this variety in demonstration trials in Bas-Zaire next year. As operating funds may continue to be limited, farming systems should draw up a feedback form so the collaborators who have tested the new varieties can let PRONAM know the farmers' reaction to them.

Distribution of JL24 for verification tests will begin in October 1990 with the seed that has been produced in the multiplication plots planted in season B 1990. One kg of JL24 that was harvested from the first season multiplication has already been sent to one of the CBZO missionaries for delivery to one of the four parishes there which expressed interest in testing new varieties.

The distribution of varieties for farming systems variety verification tests is a useful tool for getting feedback from a wide range of villages. Collaborators participating in these tests, however, must clearly understand that the varieties are still at the testing stage and therefore should be introduced only to farmers who are capable of understanding the risks involved in a test. Many of the associations in contact with PAA, PAVI, and CEDECO have enough trained members and enough contact with the collaborator to be trusted with such tests. If PRONAM continues these tests in phase II of RAU, it could contact other well-organized groups who might be interested through APRODEC, OXFAM, and perhaps GTER.

3.2.3.5 Documentation

As outreach staff needed practice in writing basic reports, not much time was available for producing documentation for collaborators. A list of documents in various stages of development follows. Most of the documents are located in file folders in the Outreach office at M'Uuazi except for those that are on IBM disks called "florini a" and "florini b" which are located in the computer room at M'Uuazi.

1) PRONAM staff produced and translated into Kitandu a resume for the course taught to representatives of farmer's associations. The resume, titled "Malongi ma nsalulu zi dioko," was intended to remind trainees of the subjects they had discussed and of the field practice they had had during the training

course. The collaborators made copies of this resume to distribute to each of the associations present at the course. Although farmers attending the courses sponsored by PAA and PAUI said they had no trouble following the Kitandu version of the resume, it could benefit from linguistic editing. The Kitandu version was retranslated into French so collaborators who did not speak one of the Kikongo dialects could answer questions about the course. A column of technical notes should be annexed to the retranslation to give more details to trainers using the document. The typed manuscript of the Kitandu version is in the "fiche technique" file folder as is the draft of the French version containing some supplementary comments. The French translation is on IBM disks at M'Uuazi--the Wordstar file is called "COURS.F."

2) Simple technical handouts have been produced by PAA and PAUI in consultation with PRONAM. PAA produced a handout on demonstration plots for cassava-peanut intercrops and PAUI produced a similar sheet for soybean planting. The PAA document is in the PAA file folder and the PAUI handout is in the file folder called "fiches techniques légumineuses." PRONAM wrote up a brief description of soybean harvesting and storage techniques to complement the PAUI document. This latter document is on diskette at M'Uuazi and also in the file folder called "fiches techniques légumineuses." Other documents in this folder could be used to prepare handouts on either technical subjects or on soybean recipes.

3) Soybean recipes written and demonstrated by PRONAM and PAUI for the 1990 annual meeting of farmers' associations were typed up and circulated to all the collaborators by PAUI. PRONAM has since collected several recipes created by the farmers' associations who conducted the soybean verification tests. These recipes should be checked to see that cooking times are sufficient to assure maximum food value, and then they should be circulated to other groups, giving due credit to the association which originated the new recipes. These recipes are in the file folder called "fiches techniques légumineuses" and in one of the notebooks of the current outreach section head.

4) The recipes tested at the cassava cooking workshop held at M'Uuazi were edited into a pamphlet which needs to be approved by the current PRONAM director before arrangements are made to publish it. It is currently on A4 paper but could perhaps be reduced to make printing costs cheaper. The current head of the outreach section has a hardcopy and a copy is also available on Macintosh disk. A sample of several recipes has been distributed to collaborators.

The collaborators would like to have more technical documentation for all the SENARAV crops. The section collected old handouts from past training courses and worked with the researchers to streamline their presentations for the latest training course but it has not had the time to synthesize the information into a technical manual for training courses.

3.2.4 Types of training

Rationale and previous work:

Helping the agricultural extension personnel of governmental and non-governmental organizations to improve their knowledge of cassava and its extension methodology was one of the main goals of the outreach section of the Cassava Outreach Project (077). Training of these extension agents was a key strategy in the diffusion of improved varieties and cultural techniques. The trained personnel helped set up and follow multilocational tests and demonstration plots comparing several new cassava varieties under development; these plots focused on the variety Kinuani when it was selected for release in Bas-Zaïre in 1983. During Project 077, training consisted of week-long courses including lectures by staff from the research sections, each presenting theoretical as well as practical aspects of his specialty. Between 1981 and 1985, four training sessions for 64 staff of development organizations and

agricultural services of private and semi-private agencies were conducted under the Cassava Outreach Project (Table 14). Among the first trained were extension agents of the Projet Agricole of Mbanza Ngungu (PASMAM) and AGRIDRAL agents who were, and still are, the change agents of SENAFIC. But because there were no facilities for housing at the M'Uuazi research station, trainees had to be lodged in Mbanza Ngungu—an uncomfortable and slow 45 kilometers away. At the time, the collaborating agencies preferred having their staff trained on station as the field facilities were good. Since transportation was such a problem, in 1984 formal training activities were postponed until a building at the station could be rehabilitated for use as a dormitory capable of housing and feeding 14 trainees.

The dormitory at M'Uuazi was completed in April 1985 and on-station training was resumed. The training goals of RAV I were not different from those of Project 077. In addition to on-station training, however, on-site training of representatives of farmer associations or church development committees was implemented between 1988 and 1990 because several of the development organizations who collaborated with PRONAM wanted a course for their volunteer trainers in the villages. This approach to training was also adopted as it avoided the uncertainty in PRONAM funding; the collaborators organized and financed these sessions including the per diem and transport costs for PRONAM staff. Informal training was continual, taking place at every village meeting and field visit with collaborators, at agricultural field days, and daily with PRONAM extension and multiplication staff.

Methodology:

Training sessions on-station

On-station training included agricultural training for the extension agents of collaborators, non-agricultural workshops, and agricultural field days.

Training consisted of 2- to 12-day courses, including lectures by staff from the research sections. When the agents to be trained had attended agricultural technical schools, lectures presented theoretical as well as practical aspects of staff specialties. The amount of theory was reduced when groups of farmer leaders or volunteer extension agents without previous formal technical training were invited, as was the case for OXFAM-, PAA-, and CEDECO-sponsored agents. Most sessions concentrated on manioc production techniques, including rapid multiplication, although maize and grain legumes were often on the syllabus. Extension techniques were explained, including advice for stimulating interest in improved agricultural methods, for setting up demonstrations, for collecting data, and for establishing multiplication fields for the propagation and distribution of new varieties.

Beginning in 1988, funds for RAV were limited so only one training for agricultural extension agents was held per year with half the usual number of trainees. The sessions concentrated on field visits with demonstrations and discussions of extension methodology and basic production techniques for the three SENARAV crops. The trainees' approaches to helping the farmers develop new ideas were critiqued during role playing exercises. Each participant physically demonstrated land preparation techniques used in his area, then the trainees suggested possible improvements that peasant farmers might be willing to test, such as incorporation of plant material into ridges or hoeing the soil surface before construction of ridges or mafuku. No one technology was prescribed, as cultural practices differ in each area. For one of the 5-day training sessions, the trainees planned a motivational meeting on a particular theme and then visited a village close to M'Uuazi to test the success of their plan. In general, those who were trained received cuttings of improved cassava varieties for demonstration or multiplication fields.

One non-agricultural workshop was organized at M'Uuazi with the spouses of research staff of PRONAM and the Institut d'Etude et Recherche Agronomique (INERA) as well as staff of the training center as participants. Mrs. Kilumba Ndaye explained several recipes that could be prepared with low-cyanide cassava varieties and the participants divided into groups, each of which prepared the recipe using a different variety of cassava. Cooking time

and taste tests were used to determine general preferences.

Agricultural field days organized on station for representatives of farmers' associations or for AGRIDRAL agents were usually 1 day long. A representative of each of the research sections gave a brief overview of his section's current activities during a field tour of selected plots. Selected plots usually included: trials of alley cropping with *Leucaena*; alley cropping with different tree species; intercropping experiments such as pigeon pea/cassava; breeding trials for peanut, soybean, cowpea, and maize; either the cassava clonal trial or the cassava seedling nursery; the cassava disease demonstration plot; the entomology screenhouses; the rapid multiplication area. Participants viewed bacteria and/or fungal spores and mealy bugs and/or spider mites under the microscope to show them that the things making cassava sick were very small so it was necessary to be careful when selecting planting material for a new field. The plant breeding laboratory explained that it was choosing new varieties with less toxic substances, and with more carotene to improve the nutritional quality of cassava. Participants who were or who would be responsible for demonstration plots discussed the concept of equal conditions for different treatments. Throughout the day the outreach staff would ensure that visitors' comments and questions were aired and would re-orient the discussions if they seemed too technical for the particular audience involved in the field day.

Training sessions off station

Off-station training included agricultural training for the representatives of farmer groups and field workshops for groups requesting cuttings and technical advice.

Two methods were used for on-site training of representatives of farmer associations or church development committees. In one, the collaborator financed the training but left the local organization up to the association or group that requested it. In the other, the financing agency organized the training at a training center. Based on feed-back from the first of the off-station training sessions, the program for this type of training was revised to include more time for discussion and field practice after each subject. Such programs generally took three days. The themes presented by the PRONAM trainers included: the importance of the farmer in agricultural development, the importance of improved cultural techniques and timely planting, suggestions for intercropping cassava, how to recognize disease and insect damage and how to let PRONAM know if farmers suspect they have a problem, rapid multiplication techniques for cassava, how to be sure to have enough planting material of improved varieties at planting time, and how to set up a demonstration field that allows a fair comparison of the techniques being tested. Methods of preparing two-node cuttings and shoot tip cuttings were demonstrated. Planting of two-node cuttings on shaded ridges near a water source was suggested to farmer associations with some vegetable crop experience. Later training demonstrated the use of the plastic bag method of rapid multiplication as described in section 3.1.2 above.⁹

Field workshops were conducted for certain groups who requested technical advice along with improved varieties of cassava. These training sessions were 1 day long with PRONAM supporting the per diem for its trainers. A brief overview of the importance of improved cassava varieties and good planting techniques was given. Trainers emphasized the importance of the field as a source of cuttings for both the next and future agricultural seasons as PRONAM will not give the same variety twice to the same group. The group was requested to remember that they had received free cuttings and were expected to donate part of the cuttings they produced to someone else. Finally, PRONAM staff distributed cuttings and participated in planting the field.

⁹ Otoo, J.A. 1989. A new method for rapid multiplication of cassava. IITA Research Briefs 9(2):5.

Results and Discussion:

The training center was completed in April 1985 but was temporarily occupied by PRONAM staff with no housing so training did not begin until 1986. From 1986 to June 1990, PRONAM organized 8 formal training sessions, one non-agricultural workshop, and also provided logistic support for two seminars on station. Four technical field days were organized on station. Off station, PRONAM trainers taught five formal training sessions and conducted four field workshops.

On-Station Training

From 1985-1990, on-station training of extension agents with at least 3-4 years of technical agricultural training was provided for four technicians responsible for agricultural production at two companies, for 20 staff of development projects (1 from Bandundu), 18 AGRIDRAL collectivity agents (2 from Bandundu), and 8 AGRIDRAL agricultural inspectors (2 from Bandundu). In addition, 29 leaders of farmer associations or village-level volunteers who act as extension agents in surrounding villages were trained for CEDECO, PAA, and OXFAM (Table 14).

Excellent results have been forthcoming from those trained at the two companies, ONATRA, Lufu Toto and CIZA, Lukala. These companies planted large multiplication fields and have since distributed the cuttings to the families of their workers, to large farmers, and other groups. In contrast, distribution of large quantities of planting stock to agencies without PRONAM-trained staff did not result in multiplication of planting stock. For example, the Ecole de Formation et Application de Troupes Blindées in Mbanza Ngungu received over 72,000 m of plantable stems in 1986 with which they planted at least one field of 17 ha in collaboration with a village near Mbanza Ngungu. They were back at PRONAM in 1987 and 1989 to ask for cuttings again, albeit in lesser quantities.

Training of extension staff for development projects has made it easier for PRONAM to establish demonstration and multiplication fields of improved cassava varieties. Trained agents are eager to learn rapid multiplication techniques and have volunteered to host technology verification tests established in conjunction with PRONAM's farming systems researchers.

The effectiveness of training AGRIDRAL agents has varied mainly because the AGRIDRAL gives practically no financial or material support to its collectivity agents and is not able to follow up on their activities.

Untimely transfers of personnel have plagued PRONAM's attempts to work with trained agents; cuttings have been delivered to untrained agents, while those who had been trained ended up in a distant collectivity. Those who had started multiplication fields with PRONAM material often did not know what became of their efforts after their transfer to another collectivity. Collaboration with AGRIDRAL can be improved by better contact with the sub-regional inspectors, and by insisting on centralized multiplication fields. For example, the four agents sent to PRONAM by the Inspector from Lukaya sub-region did an excellent job of uniting 242 farmers in eight centralized fields for multiplying F100 and Kinuani in Kasangulu and Kimvula Zone. During visits to two of these fields, 25-30% of those receiving cuttings turned out to meet PRONAM outreach staff. It is usually rare to meet more than 10 % of the population which benefitted from cuttings distributed by AGRIDRAL agents. The enthusiasm in Kasangulu and Kimvula shows it is possible for trained AGRIDRAL agents to effect positive change when they provide good information and services to farmers. Future distribution should be easier from centralized fields in Kasangulu and Kimvula where the farmers had been well informed that the purpose of the field was to help them multiply the new varieties both for themselves and for their neighbors.

Training of PASMAM personnel has paid off. Follow-up of groups working with PASMAM showed that farmers had adopted the 1 by 1 meter spacing recommended by PRONAM for the area. The number of plants and unsprouted cuttings had been accurately recorded by the agent and forwarded to PASMAM's extension service. This is one of the few cases where collaborators have been able to provide technical feedback to PRONAM.

PRONAM's training along with CEDECO's frequent contact and training of their post chiefs has been very effective in establishing active farmers groups who have been able to multiply improved cassava varieties and distribute them to surrounding villages. For example, one post chief received 2500 m of Kinuani in 1986 and has since provided cuttings to at least 9 villages. Another post was able to build a dispensary with the proceeds of 1 ha of Kinuani and has distributed Kinuani to at least four other villages. One of two post trainers who had received varieties of soybeans to test in October 1989 and who had attended the short course on grain legumes in February 1990 had effectively transmitted the information he had learned. Follow-up showed the post families had already begun to try the recipes handed out at the February training. They were planning to plant a small area in a valley to produce seed for the next planting in October of 1990.

Field days on station

The 4 technical field days organized on station were attended by 39 SENAFIC agents and 26 representatives of farmers' associations working with PAUI (Table 15). The field discussions with these representatives helped the research staff obtain direct feedback from peasant farmers. For example, farmers from Madimba Zone produce green maize for the Kinshasa market and would be interested in trying new varieties as long as the ears were large. The farmers were happy that PNM is producing open pollinated maize as they want to be able to keep their own seed. The discussion with PNL revealed that farmers believed that late rains were responsible for empty pods on peanut. All the farmers were interested in cowpea but not in buying insecticides.

The representatives from associations who had already tried rapid multiplication explained how they had modified the technique. After participants got hands-on practice in preparing two-node and green shoot tip cuttings, they received 1 m of O2864 to multiply for their association (transportation problems prevented them from taking more cuttings).

Support for other training sessions on station

The cassava preparation workshop that was taught by Mrs. Kilumba Ndaye resulted in the preparation of a brochure of recipes for low-cyanide cassava with suggestions for appropriate varieties for some of the recipes. For example, F100 was excellent in recipes calling for a dough prepared from cassava flour as it has a floury consistency. Fifteen spouses of researchers at M'Uwazi attended as did 6 of the training center staff. The staff have used what they learned when preparing examples of nutritious cassava recipes for International fairs held in Kinshasa.

Logistic support was provided for an IITA-sponsored training on biological control of cassava pests and for a SENASEM training on quality control in seed production. The head of the outreach multiplication unit was called on to present a short lecture on quality control in the production of cassava planting material and the current distribution system for cuttings.

In September 1988, outreach staff participated in the morning session of the annual SENAFIC-FAO training course on fertilizer use. Most of the AGRIDRAL agents present had participated in the basic training before so the advanced group was able to take time to discuss their experiences with F100 and Kinuani, the two varieties which have been used in most of SENAFIC-FAO's demonstrations. PRONAM informed the trainees that Kinuani does not do well when intercropped with peanut if the peanut is planted first. They were advised to plant Kinuani the same day as the peanuts, if not before, in intercropped fields.

Off-station training

Training representatives of farmer associations

The off-station training sponsored by PAA and PAUI in 1988 and 1989 have created enthusiastic farmers' groups (Table 16). Representatives attending the two PRONAM training sessions organized by PAUI planted 25

multiplication fields for the peanut variety Mandingu; 41 demonstration fields including F100, Kinuani, and a local variety; 22 verification tests for three soybean varieties, 35 verification tests of the cassava variety 40230/3, and 12 verification tests for the yellow-fleshed cassava varieties Madame Ngunza and Dinkondo M'Uuazi 2. Five of eight of the associations trying rapid multiplication techniques succeeded in transplanting the plants they produced. PRONAM trainers taught one training session sponsored by PAA and its own trainer went on to conduct three similar sessions. Representatives were trained from six churches and 59 associations or village health committees. Seven representatives of groups working with three other collaborators also attended the training sessions. The farmers trained organized their communities to plant 24 demonstration fields comparing F100, Kinuani, and a local variety. Twenty groups multiplied the peanut variety P43, 6 tested the cassava variety 40230/3, and 4 tested soybean varieties.

The APRODEC-financed training session for the association "Nsengo a Ntuadi" resulted in a nucleus of improved varieties being planted in five villages served by the association. The members planted another multiplication field in 1989 using cuttings from the first field.

PRONAM contacted 14 of 23 parishes which received cuttings after the CBZO-sponsored training session. On average, more than a third of all parishioners participated in the field; all parishes intended to plant a larger multiplication field in 1990-91. Two of the parishes that had not attended training had invited one of the trained members of a neighboring parish to pass along the information learned during the session.

Field workshops

Four field workshops were held for groups requesting technical assistance along with cuttings in the 1989-1990 agricultural year (Table 17). Of these, three were primarily aimed at residents of Mbanza Ngungu and villages near the city where land is scarce and people have difficulty feeding their families. During the four workshops, 208 people learned good planting techniques and the importance of multiplication fields for assuring a constant supply of cuttings in the future. Those attending received 13200 m of cuttings and planted most of it the same day. Farmers present during follow-up of at least one of the groups were able to explain why they planted less densely than is traditional for Mbanza Ngungu Zone and said they were willing to distribute cuttings to others in the future.

Themes emphasized during training

Three themes got special attention in recent training, field days, and workshops: 1) rapid multiplication techniques for cassava, 2) how to be sure to have enough planting material of improved varieties at planting time, and 3) how to set up a demonstration field that allows a fair comparison of the techniques being tested.

1) Some of the farmers attending the PRONAM-taught training courses for representatives of village associations began using rapid multiplication techniques when they appropriated the few stems of 40230/3 that had been brought to the training for demonstration purposes. At first eight and later five more of the associations working with PAUI tried using two-node hardwood cuttings and one association even used green shoot-tip cuttings. By combining the two methods and repeatedly taking shoot-tip cuttings the latter association was able to produce 35 plants from 2 m of stem in the first year. From the 35 plants it produced 700 plants from shoot-tip cuttings and an additional 300 plants from hardwood cuttings. With normal 25-cm cuttings, the association could have gotten 8 plants the first year and perhaps 64 the second assuming that each plant would produce 2 m of plantable stems (a reasonable assumption considering the development of 40230/3 in their fields).

The technique did not succeed where the young plants were eaten by wild herbivores or domesticated goats and where the association did not transplant the cuttings on time. The plastic bag method could make it easy for associations to take sprouted cuttings to the field, however time constraints for busy associations could still hamper timely transplanting. The success of

some associations with the difficult two-node rapid multiplication techniques argues that PRONAM-trained leaders of grass-roots development projects or posts previously trained by OXFAM and CEDECO could easily adopt the plastic bag technique. This method should be further explored as a way to increase the on-farm multiplication rate of improved varieties.

2) One of the agricultural problems most often cited by farmers around the M'Vuazi area is the shortage of cuttings in the October-January rainy season as many fields are harvested during the preceding dry season. Similarly, many of the cuttings produced in multiplication fields started by PASMAM near Mbanza Ngungu were abandoned when the fields were harvested in the dry season thus defeating the purpose of a multiplication field. Projet Italo-Zairois did not protect its central multiplication field from brush fires and thus had to come and get a new load of cuttings in 1989 even though they had been given ample cuttings in the past. To solve this constraint to increased spread of improved varieties, the theme of conservation of planting material has been emphasized in all training sessions held since 1988. Although follow-up visits showed that the idea of cassava "parks" or "savings banks" as a source of cuttings rather than food was easily grasped by the trainers and farmers, the real test of training will come at harvest. Since groups have been warned that they will get no further cuttings of the same variety, PRONAM expects the farmers will save part of their fields for future planting.

3) The follow-up of demonstration fields often showed that test plots which should have been similar were not. The most common modification of the PAA-type procedure involved the addition of intercrops to plots planted with "PRONAM" spacing while crops planted with traditional spacing were considered too crowded to add another crop. PRONAM has reminded the collaborators to help their groups develop an understanding of what is meant by equal conditions.

4. LESSONS LEARNED

During RAV I, PRONAM worked with development organizations and AGRIDRAL agents for relaying new ideas and distributing new varieties to rural farmers. This system has been most effective for the zones in which there were development organizations with sufficient funding to permit delivery of inputs and follow-up of trained agents. In areas not served by development organizations, PRONAM has been able to get new varieties to farmers through trained AGRIDRAL agents. In the future, given PRONAM's current resources, it should concentrate on improving its support for the extension activities of its collaborators. This should include:

- 1) training and training updates for collaborators' staff including help in record-keeping skills, multiplication and conservation of planting stock for all crops (e.g., planting in second season for soybean), and rapid multiplication of cassava,
- 2) distributing cassava varieties (or soybean or peanut varieties) for community or centralized demonstration and multiplication fields with pre-planned lists of beneficiaries for the cuttings,
- 3) developing simple field notebooks and planning guides to help the farmer groups allocate parts of the field for: future plantings, distribution to members of the group, distribution to another group, and sale, and
- 4) producing thematic information sheets which the collaborators could then revise or merely translate.

Better diffusion of PRONAM cassava varieties should be PRONAM's first concern. The major hindrance to faster spread of cassava stems between PRONAM and collaborators' clientele is transport. The hardwood portion of stems constitutes the normal planting stock for cassava. The stems are bulky and perishable. Clients must be timely and have a large vehicle. Many collaborators do not arrive on station because they do not have a viable vehicle. Furthermore, up to a third of the cuttings can be damaged in transit, especially when large quantities of cuttings are delivered to distant zones such as Tshela and Kimvula. When planted soon after harvest, three to four plants can be obtained per meter, but, the number of plants can be as low as 1.5 plants per meter if buds are damaged or cuttings dry out in transport. The

only remedy PRONAM can offer is to help collaborators organize cooperative transport and to search for ways to help collaborators multiply small quantities of cuttings more quickly.

Once the planting material is introduced into an area, it must be multiplied before it can be spread to neighbors. The multiplication rate of cassava is poor, but, farmers' associations working with PAUI have successfully used rapid multiplication techniques (including the use of shoot-tip cuttings!) to produce 40230/3 and F100. Their success with this technique suggests that the plastic bag technique for producing pre-sprouted cuttings might allow farmers' groups to significantly increase the number of plants per meter of stem distributed. It is suggested that CEDECO, PAUI, and PAA be the first to try the new technique--some of the representatives of associations working with PAUI may have even tried it after the field day in June 1990. After testing APRODEC and OXFAM might be interested in financing a training campaign to spread the new technique to other collaborators. Two-node cuttings do not always produce tuberous roots of the quality to be expected from longer cuttings. Disappointment at poor yields produced by rapidly-multiplied plants would be a potential drawback to the method but should be avoided by a thorough explanation of the purpose of the technique and by using the technique on a familiar variety. Despite the suggestion that well-accepted varieties be used to demonstrate the technique, it is expected that many farmers' associations will want to rapidly multiply new varieties before they have been tested. In this case, a rapid multiplication plot should be annexed to a demonstration plot in which the new variety would be expected to prove its qualities.

Multiplication of planting material does not assure that it will reach others who were not involved in the multiplication. Much of the early distribution to individuals did not result in the desired amount of diffusion of new varieties because the families kept it for themselves or only gave limited amounts to their kinfolk. Projects working with village-level volunteers have been more effective in ensuring diffusion. In general, community-level multiplication fields are a more effective way of getting farmers to multiply and distribute varieties because it is easier to keep track of the material being multiplied. Periodic grower meetings can remind the farmers of good cultural practices and of their promise to multiply and distribute some of the cuttings. Even AGRIDRAL agents or PRONAM agents can work with village chiefs in setting up these multiplication fields which may only be one-time efforts. (In that case, the variety or technique being introduced would have to sell itself in order to spread beyond those receiving cuttings the first year.) The rate of diffusion from community multiplication (or demonstration) plots might be improved if farmer's associations or village committees decided who was going to benefit from the cuttings in advance of the harvest. Most farmers are willing to share the cuttings they produce but would find the concept less vague if they put a name to the potential beneficiary before harvest. For each group which benefits from new planting material, PRONAM should ask the collaborator to work with the multipliers in drawing up a program for the field. This program should include the amount of cuttings to be received, the procedure to be followed for their multiplication (or demonstration), and a specific target group that will receive cuttings from the first harvest. The plan should also help the farmers calculate the amount of cuttings needed for the next multiplication field.

The field workshops and training courses for representatives of farmers' associations were effective in stimulating interest in and commitment to the centralized multiplication fields. An added incentive could be the promise of new varieties for groups which are conscientious. To carry the process one step further, PRONAM and collaborators should work out ways to reward associations whose volunteers organize such workshops in other villages. Here the emphasis is on the group rather than the individual to foster the concept of community action. On-station training for extension agents provides them with new technical information, gives them a chance to interact with their peers, and stimulates them to organize community activities when they return to their post or village. PRONAM should try to organize more training and to bring back those who participated in former training to expose them to new subjects such as the new rapid multiplication technique, use of lime on maize and peanuts, and methods of soybean culture and use. The importance of equal conditions in demonstration plots should be emphasized as well as methods of

comparing yields and quality of the tested varieties at harvest. Priority should be given to visiting the trainees at least once soon after training to verify that the trainee has understood what was presented at the training. Trainees should be taught to keep better records of their distribution activities so they can constantly evaluate their effectiveness and change methods if necessary to get cuttings to all the farmers in their target area.

Information from the examination of PAA and PASMAM's distribution and training records has helped PRONAM make constructive suggestions for their extension programs; the same could be true for the other collaborators. PRONAM's relationship to distant collaborators should also be reevaluated in light of PRONAM's diminishing resources. To do this, it is important to establish a reasonably accurate history of multiplication and distribution by individual collaborators. Currently, this history is often poorly documented. PRONAM tried evaluating collaborators' activities on the basis of information sheets and recall of some of the collaborator's agents, but the information collected was too sketchy to come to any conclusions. There is no substitute for going to each collaborator and jointly reviewing its records and accomplishments. Reasonable records have been constructed for PAA and PASMAM and PAVI's own system of periodic reports is clear. It is strongly suggested that PRONAM staff go over distribution and training records with CEDECO and GTER early in phase 2 of RAU and that the other collaborators be treated in turn. Such an analysis would immediately allow PRONAM to give individual advice to each collaborator and would generally help PRONAM design better support services for its collaborators.

Despite uneven performance of AGRIDRAL agents, PRONAM should continue to work with them in areas where there are no alternative extension mechanisms. Emphasis on centralized multiplication fields and a more formal network for passing the cuttings from one village to another could make trained AGRIDRAL agents effective at distributing new varieties. In view of PRONAM's resources, this should be all that is expected from AGRIDRAL agents at the present time.

6. CONFERENCES ATTENDED

Fourth Triennial Symposium on Root and Tuber Crops, International Society for Tropical Root Crops, Kinshasa, Zaire, 4-8 December, 1989.

7. PUBLICATIONS

7.1 Conference papers

Mutombo, T. S. J. Pandey, D.A. Florini, C. Burn, W. Fiebig, Belawaku U. K., et Kamizelo K. Contribution du PRONAM à la vulgarisation des techniques améliorées de la production du manioc au Bandundu et au Bas-Zaire, 1980-1988. Communication presented at the Fourth Triennial Symposium on Root and Tuber Crops, International Society for Tropical Root Crops, Kinshasa, Zaire, 4-8 December, 1989.

Table 1. Number of plants produced by rapid multiplication techniques at PRONAM, M'Uuazi from October 1985 to June 1990.

Variety	Number of 2-node cuttings transplanted				Number of shoot-tip cuttings transplanted		
	1985-1986	1987-1988	1988-1989	1989-1990	1987-1988	1988-1989	1989-1990
30572	112						
30344/6/2	112						
40230/3		1240			170		
82/053			65				
82/469			35				
82/578			75				
83/138						210	364 *
83/561						210	
83/584							360 *
85/297				38 *			
85/527				30 *			
BULK/11			60				
Kingela			30				
Total	224	1240	265	68	170	420	724

* not yet transplanted

Table 2. Area planted (m²) for small-scale multiplication of promising varieties.

Variety	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
30555	180				
30572	600				
30344/6/2	2416	420			
30555/5C		40			
30572/004	200	30			
30572/079	200	30			
30572/093	200	30			
30572/149	200	30			
30572/155	200	30			
30572/172	200	30			
40230/3		910	450	1763	
41784/9		40			
50467/12		30			
61665/4		30			
82/053		60			
82/225		40			
82/321		40			
82/469		40			
82/510		40			
82/578		60			
83/137			141		
83/138			141		
83/214			141		
83/561			105		
83/584			175		
BULK/11	200	30			
D128	100			105	
Dimeya	250				
Dinkondo 2	250			164	
Dinkondo 3	250				
Dinkondo M'Uuazi 2			400	205	
Dinkondo Madame Ngunza			600	164	
Total	5446	1960	2153	2401	0

Table 3. Cuttings of improved cassava varieties distributed by PRONAM for centralized multiplication fields (expressed as potential hectareage planted).

Year	1980- 1981	1981- 1982	1983- 1984	1984- 1985	Total
Variety	02864	02864	Kinuani	Kinuani	
Catholic churches				2.0	2.0
CEDECO/Kimpese				2.0	2.0
EFATBL/Mbanza Ngungu				10.0	10.0
GER/Mbanza Ngungu	3.0	34.5			37.5
ITA/Gombe Matadi & Kimpese				4.0	4.0
ONATRA/Lufu Toto				5.0	5.0
Palm Oil Plantation/Kolo			2.0		2.0
Projet Italo-Zairois/Nkundi			5.0		5.0
Sugar Factory/Kwilu Ngongo			2.0		2.0
Zairom/Kisantu	1.5	8.5			10.0
Total	4.5	43.0	9.0	23.0	79.5

Modified from Pandey, S. J., "Research Review Report for IITA 1984."

Table 4. Cuttings of improved cassava varieties distributed from PRONAM multiplication fields to farmers or groups by development organizations (expressed as potential hectareage planted).

Organization	1983- 1984	Recipients	1984- 1985	Recipients	Total
AGRIDRAL			6.5		6.5
CBZO/Sona Bata			2.0		2.0
CIZA/Lukala			10.0		10.0
EFATBL & FAZ/Mbanza Ngungu			10.0		10.0
Other churches			8.0		8.0
OXFAM	4.0		10.0		14.0
PAR	1.3	4 posts	3.0	8 villages 81 people	4.2
PASMAM	5.0	>7 villages	19.0	145 villages 713 people 8 schools 13 groups	24.0
Projet Italo-Zairois			5.0		5.0
Total	10.3		73.5		83.7

Modified from Pandey, S. J., "Research Review Report for IITA 1984."

Table 5. Hectares of cassava multiplication fields maintained on PRONAM stations in Bas-Zaire, 1980-90

	M'Uuazi	Gimbi	Kavuaya	Kimpese	Landlords	Total
1980-81	17.50					17.50
1981-82	33.50					33.50
1982-83	24.00		7.50			31.50
1983-84	36.00		5.00			41.00
1984-85	68.50		8.00			76.50
1985-86	56.23		10.00	^c	10.00	76.23
1986-87	35.23		6.00		11.00	52.23
1987-88	35.64 ^a	2.55	3.99		11.00	53.18
1988-89	23.37	4.90	5.33	1.50	1.00	36.10
1989-90	24.22 ^b	3.60	3.49	0.80	1.00	33.11
Total	174.69	11.05	28.81	2.30	34.00	250.85

^a includes 6 ha of ratooned F100

^b includes 9.89 ha of sharecropped F100

^c 10 ha planted in conjunction with CEDECO at Kimpese

Table 6. Area (ha) of multiplication fields maintained by PRONAM in Bas-Zaire from 1985-1990 and percentage of total area planted according to variety.

	Area planted (ha)					Total 1985-90	Percentage of area planted				
	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990		1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
F100	4.72	14.67	21.09	14.98	19.97	75.43	7%	36%	50%	43%	62%
Kinuani	52.52	16.26	11.17	8.11	6.78	94.84	79%	39%	26%	23%	21%
'02864	4.43	8.30	6.99	6.12	2.40	28.24	7%	20%	17%	17%	7%
Subtotal released varieties	61.67	39.23	39.25	29.21	29.15	198.51	93%	95%	93%	83%	91%
Subtotal 40230/3 (PRONAM pre-release)			1.20	2.92	2.04	6.16			3%	8%	6%
Others	2.21					2.21	3%				
'30572	1.85	1.00	0.67	0.09		3.61	3%	2%	2%		
'30344/6/2				0.07		0.07					
Subtotal IITA varieties	4.06	1.00	0.67	0.16	0.00	5.89	6%	2%	2%		
82/053					0.02	0.02					
83/138					0.02	0.02					
83/584					0.02	0.02					
83/650					0.02	0.02					
Subtotal new PRONAM varieties	0.00	0.00	0.00	0.00	0.08	0.08					
Mpelo Longi	0.50	1.00	0.35	1.18	0.22	3.25	1%	2%	1%	3%	1%
Kileba			0.50	0.52	0.41	1.43			1%	1%	1%
Kisiesiekele			0.15	0.11		0.26					
Subtotal local varieties	0.50	1.00	1.00	1.81	0.63	4.94	1%	2%	2%	5%	2%
Dinkondo M'Vuazi II				0.38	0.22	0.60				1%	1%
Dinkondo II				0.17		0.17					
Dinkondo Madame Ngunza			0.03	0.27		0.30				1%	
Dinkondo III				0.17		0.17					
Dimeya			0.03	0.03		0.06					
Subtotal varieties with yellow-flesh	0.00	0.00	0.06	1.02	0.22	1.30				3%	1%
Subtotal PRONAM multiplication	66.2	41.2	42.2	35.1	32.1	216.9	100%	100%	100%	100%	100%
Landlords	10.0	11.0	11.0	1.0	1.0	34.0					
Total planted	76.2	52.2	53.2	36.1	33.1	250.9					

Table 7. Allocation of cuttings of the cassava varieties F100, Kinuani, and 02864 produced in PRONAM's multiplication fields at M'Uuazi, Kavuaya, and Gimbi from October 1985 to June 1990.

A. Area planted with varieties released for extension

	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	total 1984- 1989
F100	1	5	15	21	15	56
Kinuani	72	53	16	11	8	160
'02864	4	4	8	7	6	30
Total (ha)	77	62	39	39	29	246

B. Allocation of cuttings available from multiplication fields

Field planted in:	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	
Field harvested in:	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	total 1985- 1990

Amount of cuttings (in meters) allocated to:

Outreach	477,910	331,724	173,550	144,355	108,717	1,236,256
Sale	355,000	164,850	118,250	87,950	60,267	786,317
Total to public	832,910	496,574	291,800	232,305	168,984	2,022,573
Research	4,300	0	3,630	4,952	1,275	14,157
On-station multiplication	164,925	110,825	93,125	75,550	75,375	519,800
Landlord	25,000	27,500	27,500	11,700	5,000	96,700
Total for internal use	194,225	138,325	124,255	92,202	81,650	630,657
Total allocated (m)	1,027,135	634,899	416,055	324,507	250,634 *	2,653,230

Percentage to:

Collaborating agencies	20%	19%	14%	18%	22%	19%
AGRIDRAL agents	7%	11%	11%	21%	10%	11%
Other free distribution	19%	22%	17%	6%	11%	17%
Sale	35%	26%	28%	27%	24%	30%
Percentage to public	81%	78%	70%	72%	67%	76%

* There are still approximately 8 ha left to harvest in the 1988-89 multiplication field. These cuttings will be distributed in the 1990-91 agricultural season.

Table 8. Yields of cuttings harvested from the multiplication field at Kongo, (PRONAM, M'Vuazi) October 1989 to June 1990.

Variety	Number of analysable harvests/block	Block	Mean yield (m/ha)	Standard error of mean yield	C.V.	Mean % of missing plants
F100	5	B1	17579	8871	50%	22%
	2	B2	12318	2240	18%	nd
	6	B3	15034	5392	36%	21%
	6	B4	15389	2926	19%	15%
	5	B5	13945	5531	40%	14%
	7	B6	16314	4422	27%	13%
	4	B7	14102	1564	11%	12%
	3	C3	16957	11304	67%	nd
6	D1	13473	5152	38%	nd	
Mean			15012	5267	34%	16%
Note: Block C1 had 46% empty spaces						
Kinuani	2	D2	10396	3297	32%	31%
	3	E1	16486	9901	60%	20%
	3	E3	14409	7403	51%	nd
	4	G1	8983	3414	38%	20%
Mean			12568	6004	45%	24%
02864	7	F1	7910	2575	33%	19%
	4	F2	10739	4121	38%	nd
Mean			9324	3348	35%	19%

Table 9. Allocation of peanut varieties produced in 1988-1989 in PRONAM multiplication fields.

	P43	Mandingu (kilogrammes)	Total
Amount harvested, Feb. 1989	299.0	143.0	442.0
To multiplication	73.0	76.0	149.0
Total allocated for seed ^a	73.0	76.0	149.0
Amount harvested, July 1989	135.0	127.0	262.0
To collaborating organizations for multiplication:			
CEDECO (2 posts)	26.5		26.5
PAA (20 associations)	30.0	2.0	32.0
PAVI (25 associations)		28.0	28.0
Subtotal to collaborators	56.5	30.0	86.5
To training ^b	0.4		0.4
To multiplication, M'Uuazi	26.0	34.9	60.9
To multiplication, Kiyaka	25.0		25.0
To research		7.0	7.0
Subtotal PRONAM use	51.4	41.9	93.3
Total allocated for seed ^a	107.9	71.9	179.8

^a Remainder sold for consumption

^b Training: 0.4 kg planted for use in the October 1989 training session at M'Uuazi.

Table 10. Allocation of soybean varieties produced in 1988-1989 in PRONAM multiplication fields.

	UFV-1	TGX 814-26D	IAC 73-5115	Total (kilogrammes)
Amount harvested, Feb. 1989	30.0	63.0	33.0	126.0
To multiplication	20.0	20.0	20.0	60.0
Total allocated for seed ^a	20.0	20.0	20.0	60.0
Amount harvested, July 1989	44.0	133.0	92.0	269.0
To collaborating organizations for verification tests:				
CEDECO (3 posts)	3.2	3.0	3.0	9.2
PARA (4 groups)	5.0	20.0	5.0	30.0
PAVI (22 associations)	5.0	35.0	5.0	45.0
Subtotal	13.2	58.0	13.0	84.2
To training ^b		0.4	0	0.4
To multiplication	9.0	14.0	14.0	37.0
To research	4.0	0	0	4.0
Subtotal PRONAM use	13.0	14.4	14.0	41.4
Sale to farmers	5.0	8.0	19.0	32.0
Total allocated for seed ^a	31.2	80.4	46.0	157.6

^a Remainder sold for consumption.

^b Training: 0.4 kg were planted for use in the October 1989 training session at M'Uuazi and 7 kg of food-grade soybean were used for PAVI's annual meeting of peasant associations.

Table 11. Demonstration trials planted in Bas-Zaire , 1981-1990

Collaborator	1981- 1982	1982- 1983	1983- 1984	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	Total
SENAFIC	8	23	52	66	116	160 ^a	148	150	151 ^b	874
PASAM	-	19 ^c	193	-	-	-	-	-	-	212
PARA	-	18 ^d	-	-	-	7	11	24	20	80
PAVI	-	-	-	-	-	-	-	12	29	41
OTHERS	1	6	3	-	-	-	-	-	-	10
Total	9	66	248	66	116	167	159	186	200	1217

^a Not including 10 lime trials planted by PRONAM Farming Systems and Outreach

^b Number of fields planned.

^c 18 fields in 11 villages, 1.62 ha total.

^d Approximately 2 ha total.

Subtotal 1981-1984 = 389

Subtotal 1985-1990 = 828

Table 12. Area (ha) planted by collaborators for centralized multiplication fields in Bas-Zaire, 1985-1990.

Collaborator	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	Total
CDEP		2.6	2.8	a		5.4
CEDECO ^b	10.0	1.0	1.0	1.0	1.0	14.0
GTER	2.5 ^c	8.0	4.0	±2.0		16.5
ITA, Gombe Matadi			2.5		2.2	4.7
Italo-Zairois	4.0				1.0	5.0
Total	16.5	11.6	10.3	3.0	4.2	45.6

^a 50 m each of F100 and 40230/3.

^b Figures for CEDECO are under estimated as fields planted by the production service at Kimpese have not been included.

^c at CEDECO, Kimpese.

Table 13. Number of village groups, farmers' associations, churches, and schools receiving cuttings from collaborators in Bas-Zaïre.

Collaborator	1981- 1982	1982- 1983	1983- 1984	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	Total
AGRIDRAL (villages)					27	35	33	21	8	124
APRODEC								3		3
CBZO						9			23	32
CEDECO posts						4	6	2	3	15
CEP								1		1
GTER						1	11	21		33
Italo-Zairois					1	3				4
OXFAM groups						8	7			15
PASMAM	-	-	-	20	26	9	20	-	28	103
PAA	-	-	4	8	13	-	-	20	10	55
Technoserve								2		2
Churches and independent peasant associations					3		4	6	9	
Total			4	28	70	69	77	76	72	396

Table 14. Training sessions conducted at M'Uuazi in Bas-Zaire.

Date	Year	Number of days	Number of collaborators	Number of Trainees PRONAM	Organisation	Theme
	1982	7		8	Mbanza Ngungu Agricultural Project	cassava
	1983	7		29	National Fertilizer Program	cassava
				1	Zone Agronomist	
				1	Agropastoral Company	
	1983	7		18	Mbanza Ngungu Agricultural Project	cassava
	1983	7		7	OXFAM	cassava
subtotal 1980-1985				64		
1984-1986		No training given because of the conversion of another building into a Training Center capable of lodging and feeding 14 trainees.				
Oct-Dec	1985	6		1	CEDECOM, Madimba	cassava
26-30 May	1986	5		9	OXFAM	cassava
1-6 Dec	1986	5		7	Collectivity agents	RAU crops
				1	CIZA	
				1	ONATRA	
9-14 Feb	1987	5		7	PAR	cassava
				7	CEDECO	
2-14 Mar	1987	12		4	Agricultural Inspectors-2 from Bandundu	cassava
				2	Collectivity Agents-2 from Bandundu	
				1	Italo-Zairois	
				1	PAR	
				1	CAL from Bandundu	
				1	ONATRA	
				1	CIZA	

(Continued)

Table 14. Training sessions conducted at M'Uuazi in Bas-Zaire (continued).

Date	Year	Number of days	Number of collaborators	Number of Trainees PRONAM	Organisation	Theme
28 Sept-3 Oct	1987	5	1	2	Agricultural Inspector	cassava
			5	3	AGRIDRAL Agents (Mbanza Ngoyo and Kimbanza)	
			2	1	PRODERIM	
			3	2	CEDECO	
			1	1	CDEP	
					Italo-Zairois	
18-23 Apr	1988	5	3	1	AGRIDRAL (Kinkenge, Mfidi Malele, Luala)	cassava
			1	1	OXFAM (PRODAF, Kikela)	
			1	2	APRODEC (C.A.A. Uula, Gombe Matadi)	
			2		PRODERIM (Muala Kinsende and Mbanza Ngungu)	
3-7 Oct	1989	4	5		AGRIDRAL Agents (Benga, Lubisi, Boko [groupment Nkolo], Kasangulu, and Luila)	RAV crops
7-8 Feb	1990	2	2	2	CEDECO (Kiombia, Lombe)	legumes
			1	1	PAA	
			1	1	PAVI	
			1	1	BAEMI	
			1	2	CEDERI	
			2		PASMAM	
Total 1985-1990		50	79	5		

Note: The final day of sessions was not counted if it was devoted to a summary discussion and reception for the participants.

Table 15. Major agricultural field days organized at M'Vuazi, October 1985 to June 1990

Date	Duration	Number of participants	Organization sending the trainees
1986	1 day	39*	SENAFIC
28-29 May 1989	2 half-days (≈12 hrs)	6	PAVI
6-7 June 1989	2 half-days (≈12 hrs)	8	PAVI
31 May-1 June 1990	2 half-days (≈12 hrs)	12	PAVI
Total		65	

* In addition, AGRIDRAL agents working with SENAFIC visited the station on 13 and 17 Sept 1986.

Table 16. Training sessions sponsored by collaborators and conducted off station in Bas-Zaire

Date	Year	Number of days	Number of Trainees	Sponsoring Organisation	Site (Collectivity, Zone)
15-19 Feb	1988	3	130	OXFAM (PRODAF) ^a	Ngidinga (Mfidi Malele, Madimba)
3-6 Oct	1988	3	25	APRODEC (Nsengo a Ntuadi)	Landu (Kimpese, Songololo)
10-14 Oct	1988	3	20	PAA ^b	PAA Training Center, Mbanza Nzundu
24-28 Oct	1988	3	19 ^c	PAVI	PAA Training Center, Mbanza Nzundu
23-25 Oct	1989	3	15	PAVI	PAA Training Center, Mbanza Nzundu
12-14 Oct	1989	2.5	124	CBZO ^d	Kimbaka Center (Benga, Kimvula)
Total		14.5	333		

Themes: production of cassava, intercropping with peanuts, demonstration fields, rapid multiplication.

^a The Projet de Développement Agricole et Familial de Ngidinga (PRODAF) is composed of several groups with different activities. The group at Kikela followed a one-day course from 9h00 to 20h00 on 16 February. The groups of Ngidinga, Kikanga, and Malele followed a similar session from 9h00 to 19h00 at Ngidinga on 18 February. The female extension worker at Ngidinga had attended the PRONAM training session of May 1986 and was very active in getting members of the project to plant multiplication fields after her training. The president of the cooperative of Kikela also attended a training session at M'Uuazi in April 1988.

^b Lemba Mayasi, who had attended a two-week training session at M'Uuazi in 1987, assisted the PRONAM trainers at this session. He and Dikiefu, the volunteer extension worker from Buense, conducted a training session for 19 representatives of newly-formed peasant groups from 14-18 Nov. 1988. Lemba also conducted a training session from 15-18 Oct. 1989 for 31 representatives of 15 Salvation Army churches wishing to set-up community demonstration fields with a cassava peanut intercrop. A similar training was held in Luozi Zone for 6 churches.

^c From 13 associations.

^d One of the women who participated trained 80 members of 2 parishes who came late to the PRONAM training.

Table 17 . Day-long field workshops conducted off station in Bas-Zaire

Date	Number of Trainees	Meters of cuttings received	Number of group members	Group requesting training	Site (Collectivity) all in Mbanza Ngungu Zone
29 Nov 1989	78	3900 ^a	78 - 84	Peasant farmers	Mongo Ndanda (Kwilu Ngongo)
6 Dec 1989	37	3500 ^b	72 families	Paysannat de Mbanza Ngungu	Kipeti (Boko)
6 Dec 1989	51	5000 ^c	3 posts ^d	Salvation Army Division of Mbanza Ngungu	Boko (Boko)
13 Apr 1990	42	800 ^c		AMDRESS ^e	Kipeti (Boko)
Total	208	13200			

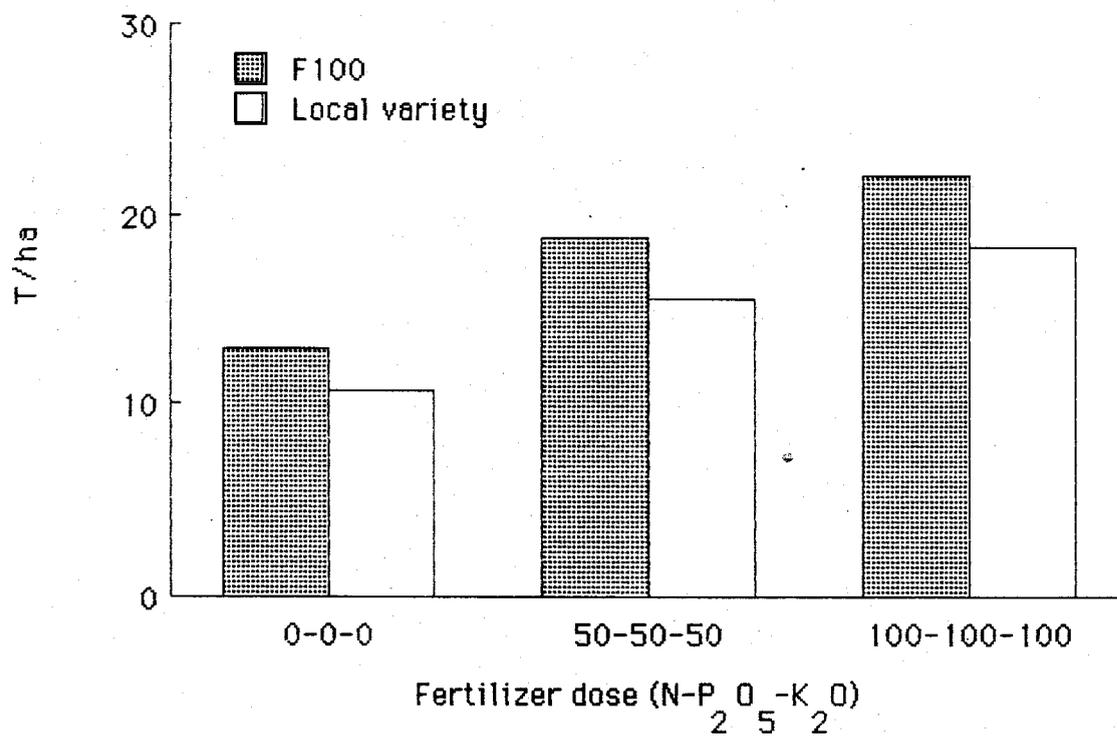
^a 1900 m of F100, 1600 m of Kinuani, and 400 m of 02864

^b F100

^c Half Kinuani

^d A post is a church group; there were 13 from post Kilumbu, 11 from post Kintanu, and 27 from post Mbanza Ngungu. Originally, 5 posts were supposed to take part in this field which is organized by Major Dianzenza and gets technical advice from Lemba of PAA. The division also bought 7500 m of F100 of which 3700 m were sold by peasant farmers in Kilonga, a village near M'Uuazi.

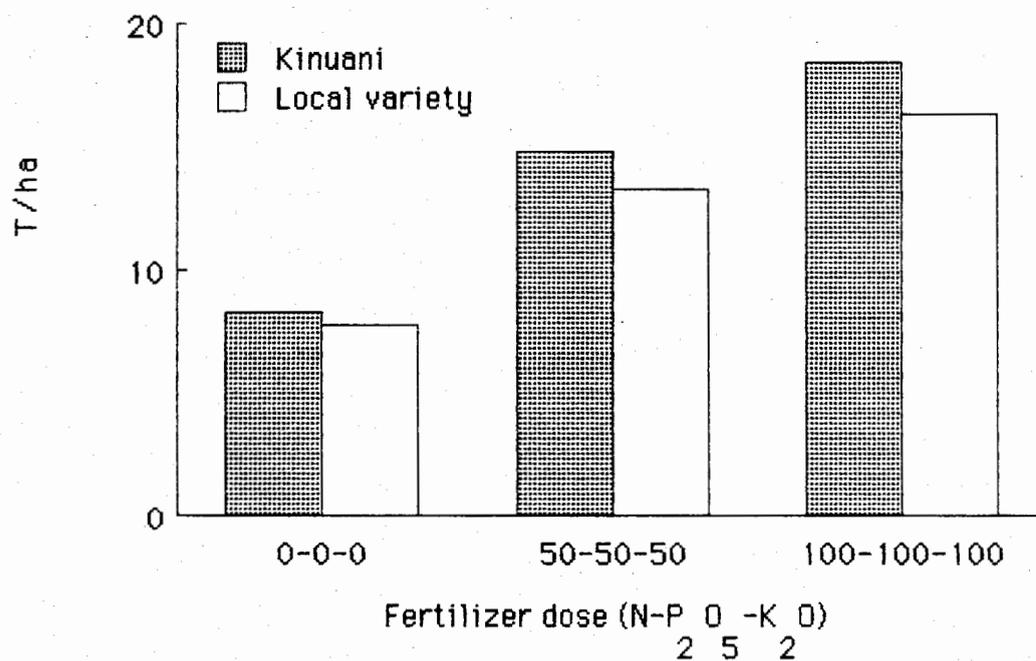
^e L'Association des Mamans de Douze Apôtres pour l'Epanouissement Spirituel et Social de Mbanza Ngungu



Two-way analysis of variance

Source of Variation	Degrees of Freedom	Mean Square	F-Test	P value
Fertilizer dose	2	2455	36.7	0.0001
Variety	1	942	14.1	0.0002
Interaction	2	22	0.3	0.7100
Error	402	67		

Figure 2. Yield of tuberous cassava roots in 68 PRONAM-SENAFIC demonstration fields planted between October 1986 and December 1988.



Two-way analysis of variance

Source of Variation	Degrees of Freedom	Mean Square	F-Test	P value
Fertilizer dose	2	4137	174.7	0.0001
Variety	1	263	11.1	0.0009
Interaction	2	32	1.3	0.2600
Error	552	24		

Figure 3. Yield of tuberous cassava roots in 93 PRONAM-SENAFIC demonstration fields planted between October 1986 and December 1988.