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Problems and Constraints in the Multiplication of Seed and Planting Material in Uganda: Preliminary Findings

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1.0 Introduction

When packaged effectively together, modern agricultural inputs, capable extension services, markets and marketing opportunities, institutions, and infrastructure, coupled with an enabling environment for private sector involvement and investment, can have a tremendous effect on improving agricultural production, enhancing food security, and reducing poverty. Years of civil strife, economic mismanagement, and disintegrating public infrastructure and services in Uganda during the 1970s and 1980s, however, did much to impede and reduce agricultural productivity and production, and induce greater poverty and food insecurity. In the late 1980s and 1990s, the Government of Uganda began to turn around its economy and agricultural sector through a series of reforms and programs. Despite rapid growth in the agricultural sector during the 1990s, relatively high poverty levels, food insecurity, and low agricultural productivity remain (GoU 2000). In order to improve the welfare of poor subsistence farmers and reorient production towards markets, the Government of Uganda adopted the Plan for the Modernization of Agriculture (PMA) in 2000. Among its numerous strategies, the PMA seeks to support the dissemination and adoption of productivity-enhancing technologies, improve the efficiency of the delivery of services through decentralization, and improve food security and incomes through the reorientation of subsistence agriculture into commercial agriculture (GoU 2000).

Deficiencies in the marketing and markets of agricultural inputs and outputs, coupled with the relatively poor state of transport, communication, and other marketing related infrastructure, impede the intensification and extensification of commercial agriculture in Uganda (Kherallah and Gruhn 2000). On the input side, success in increasing the use of improved seed varieties has been limited. Compared to an estimated requirement of 3000 tons, annual average seed supply has remained stagnant at around 1000 tons during the last ten years (Gwarazimba 1999). Increases in the nation's food demand has primarily been met through an expansion in the area under cultivation, rather than through improved farming practices and increased intensification with higher yielding, nutrient responsive, disease resistant modern varieties of seed and planting material (FAO 1999). Although increasing, use of inorgranic fertilizer remains low. In 1998 and 1999, between 12000 and 15000 tons of fertilizer were imported into Uganda. About 95 percent of the fertilizer imports are used

in cash crop production, the majority of which is purchased and used by the large commercial tea, sugar, and tobacco growers (IFDC 1999). Overall, fertilizer application rates of less than 1 kg of plant nutrients per hectare in Uganda are among the lowest in the world (GOU 2000). Furthermore, there are also a number of studies that suggest that soil nutrient depletion in the country is increasing, which can partly be attributed to poor farming practices including very low use of modern inputs[1]. In addition to the low use of modern agricultural inputs and inattention to effective integrated nutrient management techniques, the provision of extension services is inadequate. Overall, only 5-10 percent of farmers, the majority of whom are located in central and western Uganda, have access to agricultural extension services (GoU, 2000). The lack of access to quality extension services is perhaps the single most important reason why the level of technology adoption has been so low in the country.

The lack of availability and limited adoption of modern varieties by Ugandan farmers, appears to be in part due to deficiencies in the organization and production of certified commercial seeds and planting materials by multiplication farmers. During the 1990s, many changes were made to the seed production system in order to improve and streamline the development and release of modern varieties of breeder seed, strengthen and integrate institutions to ensure quality and proper certification of new modern varieties, and increase the production and quality of foundation, registered, and certified seed and planting material. As contract farmers for the multiplication of commercial seed and planting material, multiplication farmers should have access to some of the most modern varieties, to agricultural inputs, and to extension services. This in turn should result in higher productivity, more effective management of fields and soils, and the wider dissemination of modern varieties and crop management techniques to Uganda's farmers.

In order to examine the apparent constraint in the supply of modern varieties of commercial seed and planting material, the low use of agricultural inputs, and the availability of extension services, the International Food Policy Research Institute (IFPRI), in collaboration with Makerere University, Agricultural Policy Secretariat

[1] Major studies on land degradation include Stoorvogel and Smaling 1990; Wortman and Kaizzi 1998; and a study by FAO in collaboration with the Ministry of Agriculture Animal Industry and Fisheries and the National Research Organization of Uganda.

(APSEC), and National Agricultural Research Organization (NARO) of Uganda, carried out a survey to examine the system for the multiplication of commercial seed and planting material. The survey is one of four surveys led by the Markets and Structural Studies division of IFPRI to analyze the marketing of agricultural inputs and outputs in Uganda. The survey focuses exclusively on multiplication farmers of maize, beans, coffee, and cassava. One of the main objectives of this survey is to provide quantitative evidence on the status of the domestic production and marketing of seeds and planting material, as well as to identify the constraints that hinder efficient functioning of the distribution system of modern varieties. Three other surveys were also carried out as part of this larger project examining Policy Options for Improving Land Use Management in Uganda. The surveys are designed to examine the system of trading agricultural inputs in Uganda, and the trading and processing of agricultural commodities such as coffee, cotton, maize, and cassava. The analyses of these survey data are underway and comprehensive reports will be made available by the end of the year 2001. In this paper, we present some preliminary results from the seed and planting material multiplication survey. While final generalizable conclusions have not been drawn, a number of interesting findings come out of the analyses.

The rest of the paper is organized as follows. Section 2 provides a brief description of the survey methodology. In section 3, we briefly examine some general characteristics of the multiplication farmers and their facilitators, the production and disposal of commercial seed and planting material of the farmers, their usage of agricultural inputs, and the effectiveness of facilitators in providing extension services and information. Finally, section 4 summarizes the major conclusions and identifies areas of additional research that will be carried out as part of the study.

2.0 A brief note on survey methodology

In order to examine commercial multiplication activities in Uganda, a survey of seed and planting material multiplication farmers was carried out. The multiplication of four commodities (maize, beans, coffee, and cassava) was examined as part of the study. The survey was undertaken from November to December 1999, and covers multiplication activities in 17 districts. Overall, 202 farmers were surveyed, of which 60 were involved in the multiplication of maize seed, 38 in bean seed multiplication, 55

in coffee tree propagation, and 49 in cassava multiplication. The maize and bean seed farmers in the sample are all located in Masindi and Kasese, respectively. Masindi and Kasese are the principal areas where the Uganda Seed Project (USP) undertakes it certified maize and bean seed multiplication activities, respectively. The maize and bean seed multiplication farmers interviewed for the survey were randomly selected based on a list of the multiplication farmers used by and obtained from the USP. By contrast, coffee nurseries and cassava multiplication farmers were randomly selected based in part on the estimated total production of coffee and cassava in different districts in Uganda and a list of coffee nurseries and cassava multiplication farmers provided by the Uganda Coffee Development Authority (UCDA) and the Namalonge Agricultural Research Institute (NAARI), respectively. Table 2.1 breaks down the distribution of the various multiplication farmers in the sample by district and commodity.

3.0 Characteristics of the Multiplication farmers

3.1 General characteristics

Before examining the various issues that affect the supply and quality of seed and planting material, we will first briefly examine some general characteristics of the multiplication farmers in the sample. The average multiplication farm household has 9.1 members, of which about 35 percent are less than 15 years of age. Of these household members, about 45 percent spend some of their work related time in crop production and 37 percent work on non-farm activities. In addition, about 20 percent of the household members earn wage income. On average, each household member works about 1.7 months on the farm, of which, about half of this time is spent working on seed multiplication related activities. Less than 30 percent of household members under 15 work on the farm. The typical head of the household for a seed multiplication farm is male (82 percent), 43 years old, married (92 percent), literate (97 percent), speaks 3.2 languages, and earns the majority of their income from farming, fishing and livestock raising activities. Nearly half of the household heads have a second source of income, of which approximately 40 percent earn money from non-agriculture trade related activities, 19 percent from civil service or wage employment, and 10 percent from agriculture related production. Overall, the farmers in the sample have been involved in

the multiplication of commercial seed and planting material for about four years. Maize seed farmers have been involved in maize seed multiplication for the USP the longest (about six years on average).

3.2 Facilitators of multiplication activities

The majority of the seed multiplication farmers interviewed for this study operate under some form of contractual arrangement with the USP, the UCDA, the NARO, or some non-government organizations (NGOs). While these farmers are commonly called *contract farmers*, their modes of operation differ substantially from that of *contract farming* arrangements elsewhere, notably in the Latin American countries, where agro-industrial firms provide farmers with credit, inputs, and information to cultivate and market non-traditional crops [2]. In addition to selecting the best farmers, these facilitating organizations are also responsible for providing technical assistance in terms of input use and other farming practices.

As shown in Table 3.1, the USP has played an important role in identifying and encouraging farmers to become involved in seed multiplication. Friends and family, most likely already involved in the multiplication of seed for the USP, have also played an important role in helping to introduce new farmers to the multiplication of maize and bean seed for the USP. In the case of maize, NGOs and church groups such as AT Uganda and the United Church of Uganda, have also played an important role in undertaking or facilitating the multiplication and distribution of seeds.

Whereas the USP has been an important player in the multiplication of seeds in Uganda, a different set of institutions are involved in the promotion and multiplication of coffee and cassava. In coffee multiplication, the Coffee Research Center (COREC) and the Uganda Coffee Development Authority (UCDA) play an important role. The COREC monitors biological aspects of coffee production, and conducts research to develop better yielding, disease resistant modern coffee varieties. By contrast, the UCDA, in collaboration with other research institutions, helps to prioritize and facilitate coffee research, and to disseminate research results through such activities as

[2] This definition of *contract farming* is due to: Morrissy, 1974; Glover, 1984; Williams and Karen 1985.

farmer training and extension. The UCDA also supports and facilitates the development of privately owned coffee nurseries (UCDA 2000). Over 51 percent of the coffee nursery owners became involved in coffee seedling multiplication through the efforts of the UCDA, and other MAAIF institutions like the COREC and the NARO. Information from friends and family, as well as from own personal observation and evaluation of opportunities, also encouraged a number of the farmers to establish coffee nurseries.

In the multiplication of cassava, the National Agriculture Research Organization (NARO) has played an instrumental role in developing new mosaic disease (CMD) resistant varieties of cassava. In addition to the NARO, NGOs, and the MAAIF have also played an important role in introducing, and encouraging the adoption and wider dissemination of the CMD resistant varieties of cassava (See Table 3.1).

3.3 Production and disposal of seeds and planting material

The multipliers in the sample grow a wide variety of crops. Many of their multiplication crops are intercropped with other crops, making computations of area and yield somewhat problematic. In this section of this report, we will limit the analysis to only the production and method of distribution of seeds and planting material by the different types of multiplication farmers.

As shown in Table 3.2 and 3.3, average yields of the principal seed crop of the USP maize and bean multiplication farmers were about 3.7 and 1.3 tons per hectare, respectively. The method of disposal of the seed varies depending on a number of factors including, whether the farmer produces the seed on their own, whether a contract was established between the farmer and the USP, and the terms of the contract. In the case of beans, nearly all of the seed was sold to the USP as part of the contract arrangement, - less than five percent of the bean seed was retained by the farmers for their own use. Although most of the maize was sold to the USP as part of a contract arrangement, about one third of the maize seed was sold by the maize multipliers to the USP or other farmers on the open market for cash.

The situation in cassava and coffee production is somewhat different. Far less of the multiplication is by means of a contracting arrangement, be it formal or informal.

Where contracts exist, much less of the production is required to be delivered to the contractor than is the case with the USP. The average coffee nursery in the sample produced about 20.5 thousand coffee seedlings during the previous year, which corresponds to the production of about 51 thousand plantlings on each hectare of land. Only about 13 percent of the seedlings produced are sold to the contractor. Rather, nearly three quarters of the coffee plantlings are sold directly to farmers for cash. In the case of cassava, yields are on the order of about 2.1 tons per hectare. A larger portion, nearly 45 percent, of production is given away or sold to the contractor, with the farmer free (though in some cases they may be required by the contractor) to sell or give the remainder of the production to other farmers.

3.4 Input usage

As seen in the previous section, seed and planting material yields among the farmers involved in seed multiplication are reasonable. Although higher yielding modern varieties of maize, beans, coffee, and cassava are being planted; the low use of complementary agricultural inputs may be limiting improvements in productivity and farmer incomes. Although there are some similarities, the usage and source of inputs in seed and planting material multiplication varies considerably among the four commodities. Tables 3.4 and 3.5 illustrate the use, application, and procurement of agricultural inputs in the multiplication activities in the study.

Maize seed multipliers

USP's maize seed multiplication activities are located in the district of Masindi in Western Uganda. Maize is usually intercropped, with another crop such as beans, and often further intercropped with a third crop such as cassava or sweet or irish potatoes. Only about 6.4 percent of the multiplication farmers monocrop maize. When mono-cropped, the maize is usually grown in rotation with beans or another legume. The typical maize seed multiplication farmer sows 93.6 kgs of maize on 5.9 ha of land each season, of which approximately 5.1 ha is for maize cultivation. The average application rate for maize seed is 23.3 kg/ha. Registered maize seed is usually provided either free or on credit as part of the contract (58% of farmers), or purchased from USP (38 % of farmers). Of some concern, is that about four percent of farmers grow commercial seed from their own seed stocks. While farmers can reduce their input costs

by retaining some of the commercial seed from the previous years, the quality of the seed produced declines with each passing generation. If this is common practice among USP contract farmers, the quality of USP seed may not be of the high standard that farmers expect. In order to prevent a decline in the quality of USP produced seed and forestall damage to the reputation of USP seed, USP extension agents need to be vigilant in ensuring that its contract farmers are using high quality registered seed for the multiplication of certified commercial seed.

Few maize multiplication farmers apply organic or inorganic fertilizers to their fields. Intercropping and growing maize in rotation with legumes is used to make up for the low applications of plant nutrients. Overall, only about one-quarter of the maize seed farmers in the sample apply inorganic fertilizers. Of those that apply fertilizers, application rates are on the order of 158 kg/ha, close to the recommend fertilizer application rates in Uganda. The farmers usually obtain all of the fertilizer either by purchasing it in cash or as part of the contract. On average, 39 percent of the fertilizer is procured through cash purchases, and 61 percent is obtained as part of the contract.

Use of pesticides on maize by multiplication farmers is very low. Only about 4.3 percent of the farmers applied pesticides to their maize seed crops. Pesticides are not provided as part of the contract. Overall, all of the farmers that applied pesticides to their maize seed crops paid for the pesticides themselves in cash.

Bean seed multipliers

USP's bean seed multiplication activities are located in Kasese near Uganda's western border near the Rwenzori mountains. As with maize, beans for seed are primarily intercropped. Only 1.1 percent of the bean fields in the sample were monocropped. The beans grown for seed are primarily intercropped with maize. The average field size for USP's bean contract farmers is 1.0 ha, of which the beans themselves cover about 0.8 ha. The average farmer applies about 60.4 kg of certified bean seed, which corresponds to an approximate application rate of 77.6 kg/ha. Overall, about 87.4 percent of the farmers obtained their bean seeds as part of the contract. The other 11.5 percent purchased the seed, primarily on credit.

Application of fertilizer on bean multiplication fields is much lower than on maize multiplication fields. Only about 1.9 percent of the farmers applied fertilizer to their bean crops. Application rates are on the order of 7.4 kg/ha. Of those that applied fertilizer to their bean fields, all of the fertilizer was obtained free of charge, presumably given as a small sample by the contractor or an NGO.

Pesticide use is also very low. Only about 7.7 percent of the multiplication farmers applied pesticides to their bean seed crops. As was the case with maize, pesticides are not provided as part of the contract. All of the farmers that applied pesticides to their bean seed crops paid for the pesticides themselves in cash.

Coffee nurseries

As described previously, UCDA, COREC, the MAAIF, and families and friends have played an important role in encouraging the development of coffee nurseries. In 1989/99, there were 570 robusta coffee nurseries located in 34 districts producing over seven million plantlets from nearly 400,000 mother bushes, and 90 arabica coffee nurseries in nine districts producing over three million plantlets, respectively (UCDA 2000).

Most coffee production is located in Central Uganda, particularly in the districts of Masaka, Mukono, and Mpigi. These three districts produce nearly 42 percent of the coffee grown in the country. Whereas most robusta coffee is grown in Central Uganda, arabica coffee production is primarily located near Mount Elgon in Mbale and Kapchorwa, in the far south-west in Kisoro, and in the far north-west in Arua. In 1998/99, nearly 205.5 thousand metric tons of robusta coffee and 25.7 thousand metric tons of Arabic coffee were procured (UCDA 2000).

Even in nurseries, coffee mother bushes are intercropped, - primarily with banana trees. On average, the coffee nurseries are located on 0.5 ha of land, of which about 80 percent of the land area is allocted to the mother bushes. Overall, about 31 percent of the coffee nurseries apply fertilizers, which is primarily added to the soil surrounding the coffee plantlings. Nearly two-thirds of the nurseries also apply pesticides to their coffee mother bushes and plantlings to combat such things as leaf rust. Although UCDA provides advice and other extension services, it does not provide

fertilizer or pesticides to the coffee nurseries. These agricultural inputs are usually bought by the farmer, and nearly always purchased for cash.

Cassava multipliers

In large part, the current organization system for cassava multiplication in Uganda grew out of an organized response to a destructive disease that led to a major decline in cassava production, an important food and subsistence crop, in affected areas. During the late 1980s and early 1990s, cassava mosaic disease (CMD) was completely devastating cassava production in affected areas. A concerted research effort, led by Dr. Otim Nape of the Ugandan Ministry of Agriculture, identified cassava varieties that were resistant or tolerant to CMD, and devised a strategy and program for the widespread dissemination and adoption of the new technology. The program which ran from 1991/92 to 1995/96 included extension staff training, raising farmer awareness, and establishing a number of systems for the multiplication and distribution of clean, high-yielding, CMD-resistant varieties of cassava (See Gatsby 1997). The technology transferred as part of this effort continues to be used today.

Cassava is typically planted at a rate of about 10,000 cuttings per hectare, with each plant able to produce up to 6 cuttings for replanting. On average, the multiplication farmers plant about 1900 kg of cuttings on about 5.2 ha of land. However, only about 2.3 ha of the land is used by the cassava itself, since the cassava field area is usually intercropped with such crops as maize or beans. Few if any of the farmers in the sample apply fertilizer or pesticides to the cassava growing in their fields. As shown in Table 3.5, cassava cuttings are obtained from a variety of sources. Whether through formal or informal contracts, cuttings for multiplication activities are usually obtained free of charge from the NARO, or from NGOs. Seventeen percent of the farmers in the sample, use cuttings from their own production to continue their multiplication activities. Only about eight percent of the farmers purchased cuttings for their multiplication activities.

NARO and NGOs continue to play an important role in the dissemination and adoption of the improved cassava varieties. In return for receiving free planting material, the contract farmers are required to return a portion of the planting material (cuttings) harvested during the season back to the donor (about 25 percent), a quarter

must be sold to other farmers, with the remainder to be disposed of as the farmer wishes, usually for replanting or to be sold to other farmers. The planting material donor organizations also periodically visit the cassava fields for such things as ensuring proper weed control, proper timing of the taking of cuttings, and to provide technical assistance. Agricultural inputs such as fertilizers and pesticides are not provided. When needed, the farmer usually purchases these in cash.

3.5 Role of facilitators in providing extension services

As described in the previous section, despite the multiplication farmers being some of the best farmers in the area and despite having contractural arrangements giving them access to the newest agricultural technologies, use of complementing inputs in the production of seeds and planting material is low. While rigorous analyses have not yet been carried out, the preliminary results indicate that despite being involved in seed and planting material multiplication for years: 1) the levels of modern input use by multiplication farmers remains low; ii) multiplication facilitators predominantly supply only improved seeds and planting material, not a complete package of modern agricultural inputs; iii) extension training has been limited; and iv) credit for modern inputs is virtually non-existent. In the following section, we will examine the level and limits of the extension services provided to the various multiplication farmers.

One of the key determinants of modern technology adoption by farmers is the effectiveness of information and training provided by the country's agricultural extension services. While our survey does not have adequate information to address the issue of effectiveness, it contains some information to characterize access to various training on improved crop and land management activities by the multiplication farmers. Overall, about 69 percent of the multiplication farmers in the sample received some type of extension training during the previous year. The provision of extension services training to multiplication farmers is relatively constant across the four commodities under study, ranging from 63 percent of bean seed multipliers to 72 percent of maize seed multipliers (though it is curious that maize seed farmers receive more extension training than bean seed farmers, despite both being contractors for the USP). Thus, over 30 percent of the farmers in the sample did not receive any extension

training in the previous year, despite the existence of and their relatively close ties to institutions that have a important interest and supposedly make a strong effort at providing extension services to multiplication farmers who provide the improved varieties of seed and planting material to subsistence and commercial farmers through out the country.

As shown in Table 3.6, extension services related to coffee production seem to cover the greatest breadth of issues and constraints, and are accessed most widely by nursery operators. Extension services important to maize seed farmers are most commonly related to the adoption of new varieties, agricultural input use and application, and marketing. Although encouraging, access to and/or attendance is quite low. Extension services for bean and cassava multipliers appear to be largely inadequate. While general crop husbandry and variety information is provided, little other extension training is available or accessed by these multipliers.

Also as shown in Table 3.6, training on particular aspects of crop and farm management is generally low. Extension training related to crop husbandry is generally the most wide spread, with about 53 percent of farmers receiving some training during the previous year. However, only a quarter of the farmers received training related to new seed and planting material varieties. Training on the use and application of complementary inputs, such as organic and inorganic fertilizers, and pesticides, is provided to less than half of the maize and coffee multiplication farmers, and virtually none of the bean and cassava farmers. Training related to land and soil fertility management is provided to less than 20 and 15 percent of the multiplication farmers respectively. If land use management is to be improved, extension services providers need to make much greater efforts in providing training in this area. If contractors do not have sufficient incentive to provide this type of training to their multiplication farmers, then public sector extension service providers may need to become more actively involved and provide sufficient resources.

The results presented in the Table 3.6 are not particularly informative about whether the trainings that the farmers received were comprehensive and readily applicable. Although our survey does not provide detailed information on the provision of extension services, it does shed some light on the usefulness of the extension

services received by the multiplication farmers. As described in Table 3.7, of the farmers that received extension training, about half acquired new knowledge as a result of the training. The farmers in the sample found the usefulness and effectiveness of the extension services to be particularly high from the training related to crop husbandry, adoption of modern varieties, use and application of fertilizers and pesticides, and land and plant nutrient management. Of the farmers that received new knowledge in the areas of better crop and soil fertility management, over 80 percent applied what they learned on their farm, which in turn contributed to a general increase in crop yields.

It should also be noted that the effectiveness of training in marketing was generally one of the poorest, yet it resulted in the highest level of application of the new knowledge. More effective and useful marketing related training would seem to be needed.

Somewhat worrisomely and despite yield improvements, only about 50 percent of the farmers applied their new knowledge to adopt and use modern varieties and agro-chemicals in their crop production activities. Admittedly higher yields are only a necessary condition and not a sufficient condition to convince farmers to adopt new technologies. Further research is necessary to determine the profitability of the new technology in relation to the traditional technology and to identify the constraints that are limiting the adoption of new technology and farmer profits.

3.6 Main sources of information on input use

Access to relevant information about input use and other farming activities is an important determinant of a farm household's decision to adopt new agricultural technology (Pears, 1980). In particular, information about sources and availability of inputs, knowledge of how each input can be optimally used, and marketing of output can significantly influence farmers' decision to adopt a technology. Effective flow of such information, however, depends on a host of different factors including education, social capital, availability of necessary human capital in the extension department, and infrastructure. A comprehensive analysis of all these factors is not within the scope of this study. However, our survey does contain useful data that can be used to carry out

some simple analyses on the main sources of information that farmers can access with questions regarding applications of various inputs.

As shown in Table 3.8, maize and bean seed farmers obtain the majority of their information on seed and agrochemical inputs, crop, land, and soil management; and marketing information from their contractor, the USP. Farmers generally have better access to information on crop management and seed and agro-chemical inputs, than on marketing, and land and soil fertility management. In addition, while the farmers rely most heavily on the USP for agricultural input and crop management information, the USP provides relatively less information on land and soil management, and marketing. Given the USP's limited resources to provide extension services, it is not surprising that those resources are channeled toward short-term productivity enhancing extension services, rather than toward longer-term, public good oriented goals of improving land and soil management or to more effectively market outputs. Consequently, one would expect that the extension services of the MAAIF should be fulfilling this public need. Luckily, among the maize farmers in Masindi, local farmers associations exist that are able to fulfill the need for such public good oriented extension services.

In the case of coffee nurseries and cassava multipliers located primarily in central and northern Uganda, the MAAIF is the principal provider of information on the management of crop, soil, and land resources. While the MAAIF provides some extension services related to marketing and planting material and agro-chemical usage, the UCDA provides the bulk of this information. Besides the UCDA and MAAIF, a number of coffee nurseries also rely on input traders for information on land and soil management, and agro-chemical application recommendations.

By contrast, the MAAIF - aided by a number of NGOs, provides most of the information on crop, soil, and land management, as well as information on the adoption and use of agricultural inputs to cassava multiplication farmers. As mentioned previously, part of the reason for the heavy involvement of the MAAIF and the NGOs in the provision of extension services for cassava production arose out of the massive effort to overcome the disastrous effects of cassava mosaic disease. Given that the distribution of modern varieties of cassava is not predominantly market driven, and that it is largely a subsistence crop for farmers to ensure food security, it is unlikely that

traders and local farmer associations will have sufficient incentive to provide any type of extension services to cassava multiplication farmers, unless it becomes commercially viable due to some technological innovation and changes in taste.

4.0 Conclusions and areas for additional research

In this paper, we have presented some preliminary findings from our analysis of three different seed and planting material multiplication schemes in Uganda. Based on our analysis, a number of conclusions can be drawn.

First, multiplication farmers are using little fertilizers or pesticides in the management of their crops. Given that these multiplication farmers are likely to have better access to modern varieties, agro-chemicals, credit, and extension services through or with the assistance of the facilitating organizations, what explains the low use of agro-chemicals? It is likely that the low level of modern input use can in part be explained by the thinness of the agricultural markets in the country, and by the ineffectiveness of the facilitators in transferring the technology to the farmers. However, there is also a large body of literature, which shows that even after farmers master all of the intricacies of modern technology, many continue to allocate a portion of their crop production to traditional technologies. Additional research will be undertaken as part of this study to identify the key constraints to the greater adoption of improved technologies.

Second, the roles of the USP, the UCDA, and other facilitators seem to be primarily limited to the provision of improved seed and planting material to the multiplication farmers. The facilitators do not generally provide a whole package of modern technologies to their multiplication farmers. These findings speak against the general contention that farmers who use improved seeds are also likely to use other modern inputs (such as fertilizer and pesticides), leading to technology diffusion and ultimately better land management. Further study will be undertaken to better understand the reasons for the limited provision of technological packages.

Third, a few of the sampled farmers received seeds, planting material, and agro-chemical free of cost. Although the amounts are not substantial, there is a need for an

assessment of the rational behind such distribution as it can hinder private market development.

Fourth, a few of the contract farmers appear to be using certified seed from the previous years harvest rather than registered seed obtained from the USP. If such practices continue, the quality and reputation of USP seed could suffer, which in turn could affect the ability of USP seed to compete with other locally produced and imported seed, and make it more difficult to privatize Uganda Seed.

Fifth, the majority of farmer inputs are purchased in cash. Few inputs are obtained on credit. There can be any number of reasons why a farmer decides not to purchase inputs or sell outputs on credit. For instance, in addition to the lack of a local credit market, the limited use of credit may be a result of low demand for credit among the farmers in the sample, or that transaction costs are simply too high. Additional research will be undertaken as part of this study to examine the ability of farmers to access and obtain credit.

Sixth, nearly one-third of the multiplication farmers did not receive any extension training during the previous year. Further study is needed to examine the availability and participation of farmers in extension training courses, particularly since the farmers involved in the multiplication of seed and planting material should have better access to agricultural inputs and extension training courses than the vast majority of farmers in Uganda.

Finally, although the majority of farmers received some type of extension training during the previous year, the delivery mechanism of such training seems to lack an integrated approach. Only a small fraction of the farmers, generally 15 – 30 percent, reported receiving specific types of training related to the adoption of modern varieties, the application of fertilizers and other agro-chemicals, or land and soil fertility management. While some of the farmers may have received such training previously, it does not appear to have translated into the higher application of modern inputs.

Although preliminary, these results hold important implications for policy and future research, particularly in the context of policy reform / re-structuring initiatives outlined under the *Plan for Modernization of Agriculture* (PMA). While government places heavy emphasis on improving the country's agricultural extension, both actual and planned expenditures for to achieve this objective fall far short of the international standard. According to the PMA document, planned extension expenditures for the years 2000-01 and 2001-2002, a period within which government plans to implement the restructuring of extension services, are 38.82 and 35.15 percents of the agricultural value added respectively, which is significantly lower than the international benchmark of 1 percent of agricultural GDP. Given it is commonly agreed to be a public good, and since current level of extension trainings is so low for the country, there is a clear need for allocating more public resources to successfully restructure and strengthen the country's extension services. Optimal allocation of such resources, however, remains to be an issue for future research.

Bibliography

FAO (Food and Agricultural Organization). (1999). *Uganda Soil Fertility Initiative*. Draft Concept Paper Prepared by a FAO/World Bank Cooperative Program.

Gatsby Charitable Foundation. (1997). *Mastering Mosaic: The Fight for Cassava Production in Uganda*. Gatsby Occasional Paper. London, UK: Gatsby Charitable Foundation. December.

Glover, D. (1984). " Contract Farming and Smallholder Outgrower Schemes in Less Developed Countries." *World Development*, 12(11-12): 1143-57.

Gwarazimba, V. E. (1999). *Uganda Seed Sub-Sector Review*. Draft Report Prepared on behalf of The Seed Working Group. Kamplala, Uganda.

Government of the Republic of Uganda (2000). *Plan for Modernization of Agriculture and Eradicating Poverty in Uganda: Government Strategy and Operational Framework*. Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) and the Ministry of Finance, Planning and Economic Development (MFPED).

IFDC (International Fertilizer Development Center). (1999). *The Fertilizer Market Assessment and a Strategy for Development.* A Report Submitted to Sasakawa-Global 2000 and the USAID, Uganda.

Kherallah, M., and P. Gruhn. (2001). "Report on the Market Feasibility of the Land Use Options". *Assessment of Strategic Land Use Options for Uganda*. A Report Submitted to USAID, Uganda. June.

Morrissy, J.D. (1974). *Agricultural Modernization through Production Contracting.* Praeger, New York.

Pears, A. (1980). *Seeds of Plenty, Seeds of Want: Social and Economic Implications of the Green Revolution.* Oxford: Clarendon Press.

Stoorvogel, J.J., and E.M.A. Smaling (1990). Assessment of Soil Nutrient Depletion in Sub-Saharan Africa: 1983-2000. Report No. 28. Wageningen, The Netherlands: Winand Staring Centre for Integrated Land, Soil, and Water Research.

UCDA (Uganda Coffee Development Authority). (2000). *Uganda Coffee Development Authority: Annual Report, October 1st, 1998 – September 30th, 1999*. Kampala, Uganda: UCDA.

William, S, and R. Karen. (1985). *Agribusiness and the Small-Scale Farmer: A Dynamic Partnership for Development.* Westview Press, Boulder, Colorado.

Wortman, C.S., and C.K. Kaizzi (1998). "Nutrient Balances and Expected Effects of Alternative Farming Systems in Uganda." Agriculture, Ecosystems and Environment 71(1-3):115-130.

Table 2.1: Distribution of multiplication farmers by district and commodity

Region and District	Maize	Beans	Coffee	Cassava
Central				
Luwero			8	9
Masaka			14	
Mpigi			8	
Mukono			17	4
Rakai			6	
Eastern				
Busia				1
Iganga			2	5
Tororo				6
Northern				
Apac				8
Lira				8
Soroti				8
Western				
Kasese		38		
Masindi	60			
Total	60	38	55	49

Table 3.1: Organizations that introduce farmers to multiplication activities

Facilitators	Maize	Beans	Coffee	Cassava
USP	20.0	34.2	0.0	0.0
UCDA	0.0	5.3	38.2	0.0
NGO	18.3	2.6	1.8	32.7
NARO	1.7	2.6	3.6	30.6
MAAIF	0.0	5.3	12.7	18.4
Friends/Family	28.3	42.1	23.6	8.2
Own idea	30.0	5.3	18.2	10.2
Other	1.7	2.6	1.8	0.0
TOTAL	100.0	100.0	100.0	100.0

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.

Table 3.2: Production and approximate yield by multiplication activity

	Maize	Beans	Coffee	Cassava
Average production (Tons*)	18.7	1.1	20.5 *	4.8
Average yield (Tons**/ha)	3.7	1.3	51.2 **	2.1

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.

* Quantity unit for coffee: Thousand seedlings

** Quantity unit for coffee: Thousand seedlings / hectare

Table 3.3: Mode of agricultural output distribution by multiplication activity

Distribution mode	Maize	Beans	Coffee	Cassava
% given away	1.6	1.1	0.8	58.0
% sold in cash	34.1	0.0	72.7	26.3
% sold using credit	0.0	9.0	12.3	1.7
% sold/returned to contractor	62.5	85.2	12.8	12.8
% retained for own production	1.8	4.7	1.3	1.2

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.

Table 3.4: Use and application of agricultural inputs by multiplication activities

Agricultural Input	Maize	Beans	Coffee	Cassava
Seed / planting material				
Average quantity applied (Kg)	93.6	60.4	26820.6 *	1908.4
Average cropped area (Ha)	5.1	0.8	0.4	2.3
Application rate (Kg*/Ha)	23.3	77.6	115021.8	1044.2
Fertilizer				
Percentage applying fertilizer (%)	23.9	1.9	31.2	0.0
Average quantity applied (Kg)	326.9	0.1	3.4	0.0
Application rate (Kg/Ha)	158.0	7.4	36.0	0.0
Pesticides				
Percentage applying Pesticides (%)	4.3	7.7	63.5	3.2
Average quantity applied	0.4	0.1	5.4	0.2
Application rate (Kg eqv./Ha)	2.2	1.6	9.8	33.4

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.
* Quantity unit for coffee: number of seedlings

Table 3.5: Mode of agricultural input procurement by multiplication activities

Agricultural Input	Maize	Beans	Coffee	Cassava
Seeds				
% obtained free	0.0	1.9	3.1	52.5
% purchased in cash	38.0	0.0	0.0	8.1
% purchased using credit	0.0	11.5	0.0	0.0
% contract provided	57.6	86.5	0.0	22.2
% from own production	4.3	0.0	96.9	17.2
Fertilizers				
% obtained free	0.0	100.0	0.0	
% purchased in cash	38.6	0.0	100.0	
% purchased using credit	0.0	0.0	0.0	
% contract provided	61.4	0.0	0.0	
% from own production	0.0	0.0	0.0	
Pesticides				
% obtained free	0.0	0.0	0.0	0.0
% purchased in cash	100.0	100.0	95.1	100.0
% purchased using credit	0.0	0.0	1.6	0.0
% contract provided	0.0	0.0	0.0	0.0
% from own production	0.0	0.0	3.3	0.0

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.

Table 3.6: Extension training on selected agricultural activities

Extension Training received on:	Maize	Beans	Coffee	Cassava	Overall
New seed varieties	28.1	23.7	21.3	34.7	27.2
Seed storage	28.1	5.3	16.3	10.2	16.0
Seed certification	19.3	26.3	31.1	4.1	19.6
Seed conditioning	1.8	7.9	31.1	8.7	12.0
Fertilizer application	50.9	5.3	40.4	10.2	29.1
Pesticide application	29.8	2.6	40.8	4.1	20.7
Crop husbandry	50.0	50.0	50.0	63.3	53.4
Land management	14.0	15.8	26.8	22.4	19.5
Plant nutrient management	10.5	0.0	34.1	14.3	14.9
Plant protection management	10.5	0.0	42.9	20.4	19.2
Water use	0.0	2.6	27.1	2.0	7.8
Marketing	26.3	18.4	26.5	12.2	21.2
Credit	22.8	5.3	6.8	4.1	10.6

Source: Authors' calculation based on IFPRI's seed multiplication farm survey, 1999.

Table 3.7: Effectiveness and perceived benefits of extension training

Type of extension training	Effectiveness indicators: Acquired new knowledge?	Applied new knowledge?	Benefited through yield increase?
	(% of respondents reporting YES)		
New seed varieties	55.7	52.9	72.2
Seed storage	37.1	92.3	--
Seed certification	20.9	88.9	--
Seed conditioning	32.0	75.0	50.0
Fertilizer application	68.3	55.8	87.5
Pesticides application	54.5	70.8	62.5
Crop husbandry	67.9	90.3	93.8
Land management	51.2	81.8	55.6
Plant nutrient management	63.6	85.7	82.4
Plant protection	59.1	88.5	78.3
Water use	40.0	75.0	--
Marketing	37.5	94.4	--

Source: Authors' calculation based on IFPRI's seed multiplication farmers' survey, 1999.

Table 3.8: Source of extension training by type of multiplier and type of training

	Maize seed farmers					Bean seed farmers				
Source of extension training:	Seed inputs	Agro-chem inputs	Crop husbandry	Land / soil management	Marketing	Seed inputs	Agro-chem inputs	Crop husbandry	Land / soil management	Marketing
USP	72.0	65.3	70.0	42.9	52.9	95.9	--	89.5	66.7	85.7
NGO	6.0	10.2	3.3	14.3	11.8	0.0	--	0.0	0.0	0.0
MAAIF	6.0	10.2	6.7	7.1	0.0	4.2	--	10.5	33.3	0.0
Traders	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0	0.0	14.3
UNFA	0.0	2.0	0.0	7.1	0.0	0.0	--	0.0	0.0	0.0
Local Farmer Association	16.0	8.2	10.0	28.6	35.3	0.0	--	0.0	0.0	0.0
Other	0.0	4.1	10.0	0.0	0.0	0.0	--	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	--	100.0	100.0	100.0
# of observations	50	49	30	14	17	24		19	6	7

Source: Authors' calculation based on IFPRI's seed multiplication farmers' survey, 1999.

Table 3.8: Source of extension training by type of multiplier and type of training (continued)

	Coffee nurseries					Cassava multipliers				
Source of extension training:	Seed inputs	Agro-chem inputs	Crop husbandry	Land / soil management	Marketing	Seed inputs	Agro-chem inputs	Crop husbandry	Land / soil management	Marketing
UCDA	73.3	68.3	39.2	30.8	69.2	0.0	0.0	0.0	0.0	0.0
NGO	0.0	0.0	0.0	0.0	0.0	25.0	14.3	22.6	0.0	33.3
MAAIF	22.2	22.0	52.2	57.7	15.4	71.4	85.7	74.2	83.3	66.7
Traders	0.0	7.3	4.4	7.7	0.0	0.0	0.0	0.0	0.0	0.0
UNFA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local FA	0.0	0.0	0.0	0.0	0.0	3.6	0.0	3.3	11.1	0.0
Other	4.4	2.4	4.4	3.9	15.4	0.0	0.0	0.0	5.6	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
# of observations	45	41	23	26	13	28	7	31	18	6

Source: Authors' calculation based on IFPRI's seed multiplication farmers' survey, 1999.