# An Evaluation of USAID/OFDA Efforts against Cassava Mosaic Disease, 1997-2004

**FINAL DRAFT**

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# EXECUTIVE SUMMARY

This report presents the findings and recommendations of an evaluation of the seven-year on-going Cassava Mosaic Disease Program for Eastern Africa (for the purposes of this report referred to as the CMD Program), which is supported by the Office of Foreign Disaster Assistance of the United States Agency for International Development (OFDA/USAID) and implemented by the International Institute for Tropical Agriculture (IITA). The evaluation assessed the overall impact, effectiveness and sustainability of the program, focusing on food-security impacts, and suggests appropriate directions for continued support in the future.

The evaluation was based on a review of extensive project documentation, site visits in Uganda, Tanzania and Kenya and numerous informal interviews with project staff and stakeholders including farmers, members of community-based organizations and staff of the Ministries of Agriculture, national agricultural research centers and non-governmental organizations. Additional interviews were conducted with individuals working on food-security, but not necessarily closely affiliated with the project.

One of the primary objectives of OFDA grants to International Agricultural Research Centers is to support the application and dissemination of research findings and new technologies and practices to a wider audience that includes food-insecure and vulnerable populations. Critical to the success of such an effort is how new information and technologies are diffused. Thus, the evaluation gave special attention to the CMD awareness and multiplication and diffusion components of the CMD Program. In emphasizing food security, the evaluation focused on how the program can further:

1. Reduce the depth, breadth and duration of food insecurity caused by the CMD pandemic.
2. Reduce the response time of the agricultural research and development community to the CMD pandemic

Given the diverse and important role of cassava in East and Central Africa and the incidence, severity and rapid spread of the CMD across the region, OFDA support to CMD management and the CMD Program, in particular, is highly justified and the geographic scope was appropriate. The CMD Program is clearly a worthwhile program in that it supports improvements in food security for a wide range of people living over a large and growing portion of Africa. The CMD Program has been able to make a significant contribution to reducing food insecurity in the region. The set of activities are critical to extending the benefits of agricultural research to a broader audience and, in particular, food insecure and vulnerable populations. As EACMV-Ug inevitably spreads to other regions within currently affected countries and to new countries, there will likely be requests for this type of programming to manage the virus and its impacts. The pandemic has spread westward to Rwanda and parts of Burundi, Gabon and ROC, but the dense forest coverage is expected to slow its progress and ITTA estimates that it will not reach Nigeria for another five to ten years. IITA expects the pandemic to move more quickly through western Tanzania, across Lake Tanganyika to the DRC and south toward Zambia to Malawi.

Subsequent phases of the program should be able to apply lessons from earlier phases, increasing the effectiveness of CMD management. The lessons on the design and implementation of cassava stem multiplication and diffusion and on partnerships and networking are directly relevant and critical to the broader goal of ensuring that agricultural innovations reach poorer and marginalized farmers, and can be extended to other agricultural research and extension programs. Some basic principles to apply in order to improve the food-security impacts of future phases of the CMD Program are: adopt a comprehensive food-security framework for the CMD Program and initiate measures to assure that the poor and food insecure actively participate in the recovery effort, starting at an early stage (e.g., establish a preset selection criteria and regular food-security monitoring), propose specific approaches for effective knowledge transfer and technology diffusion, take steps to get ahead of the CMD pandemic and move CMD-resistant planting material out more quickly, increase CMD awareness among farmers and policy makers, and intensify collaboration and networking efforts, making sure to make effective use of NGO capacities. These principles can serve as criteria for OFDA to use in reviewing future proposals.

IITA considers its work complete in Uganda because ample germplasm is available. This is an opinion generally expressed by development community in Uganda. The Kenya program will focus on fewer districts in both Western and Nyanza Provinces, and the Tanzania program will continue operations, intensifying its work in Mwara Region. The plan to expand the program in Burundi is consistent with the evolution of the CMD pandemic and appropriate. The on-going monitoring and diagnostic surveys can continue to provide a convenient means for setting geographic priority areas However, there is a need to place more emphasis and resources in countries more recently affected and ahead of the CMD pandemic, which will tend to more speculative than strictly monitoring survey based.

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# ACRONYM LIST

| Acronym | Full Title or Phase |
|---|---|
| ACDI/VOCA | Agricultural Cooperative Development International/Volunteers in Overseas Assistance |
| ACMD | African Cassava Mosaic Disease |
| ARI | Agricultural Research Institute, Tanzania |
| AVSI | Associazione Volonari per il Servizio Internazonale |
| CBO | Community-based organization |
| CEDO | Community Enterprise Development Organization, Uganda |
| CMD | Cassava Mosaic Virus Disease |
| COSCA | Collaborative Study of Cassava in Africa |
| CRS | Catholic Relief Services |
| DALO | District Agriculture and Livestock Officer, Uganda |
| DGRST | Délégation Général à la Recherche Scientifique et Technologique (General Delegation of Science and Technology Research), Republic of Congo |
| EACMD | East African Cassava Mosaic Disease |
| EACMV-Ug | Recombinant Cassava Mosaic Disease |
| EARRNET | East African Root Crops Research Network |
| ESARC | East and Southern Africa Regional Center, Kampala |
| FAO | Food and Agriculture Organization of the United Nations |
| FEWSnet | Famine Early Warnings Systems Network |
| FFP | Office of Food for Peace, USAID |
| HA | Hectares |
| IARC | International Agricultural Research Center |
| IDRC | International Development Research Center |
| IFAD | International Fund for Agricultural Development |
| IFCD | Irish Foundation for Cooperative Development |
| IITA | International Institute for Tropical Agriculture |
| IRT | Institut de Recherche Technologique (Institute of Technology Research), Gabon |
| ISABU | Institut des Sciences Agronomiques du Burundi (Agricultural Research Institute of Burundi) |
| ISAR | Agricultural Research Institute of Rwanda |
| KARI | Kenya Agricultural Research Institute |
| KAEMP | Kagera Agricultural and Environmental Management Project, Tanzania |
| KG | Kilograms |
| KM | Kilometers |
| LZARSI | Lake Zone Agricultural Research and Development Institute, Tanzania |
| MARA-FIP | Mara Farmers Initiative Project |
| MT | Metric tons |
| NAARI | National Agriculture and Animal Research Institute, NARO, Uganda |
| NARO | National Agricultural Research Organization, Uganda |
| NARS | National Agricultural Research Centers |
| NGO | Non-governmental organization |
| NPA | Norwegian People's Aid |
| NRI | National Research Institute, United Kingdom |
| OFDA | Office of Foreign Disaster Assistance, USAID |
| PL480 | Public Law 480, food aid program, FFP/USAID |
| PVO | Private Voluntary Organization |
| REFSO | Rural Energy and Food Security Organization, Kenya |
| SARRNET | Southern Africa Root Crops Research Network |
| SCF | Save the Children Fund, US |
| TRTCP | Tanzania Root and Tuber Crops Programme |

| Acronym | Full Title or Phase |
|---|---|
| USAID | United States Agency for International Development |
| VAM | Vulnerability Assessment and Mapping, WFP |
| WB | World Bank |
| WFP | World Food Programme, United Nations |
| WV | World Vision |

## Introduction

The purpose of the evaluation was to assess the food security impacts of the seven-year on-going Cassava Mosaic Disease Program for Eastern Africa, which is supported by the Office of Foreign Disaster Assistance of the United States Agency for International Development (OFDA/USAID) and implemented by the International Institute for Tropical Agriculture (IITA). The evaluation assessed the overall impact, effectiveness and sustainability of the program, focusing on food security, and suggests appropriate directions for continued support in the future. The chief aim of the OFDA grants that support this program is to extend research findings and innovations to poorer, food-insecure populations prevent further deterioration in food security among vulnerable populations in CMD-susceptible areas.

The evaluation more specifically aims to answer the following questions:

- What outputs have resulted from OFDA funding to IITA, from 1997 to the present?
- Approximately how many households have benefited from the project? What were the broad demographic characteristics of the project's beneficiaries? Were any target vulnerable populations in target countries excluded from the project's impacts?
- How has the IITA CMD project impacted productivity and food security for small subsistence farmers? Have the IITA activities resulted in a real and tangible difference in farmers' lives?
- What was the geographic scope of the project? Was this scope appropriate?
- Have other donors provided support to complement OFDA's funding to IITA in combating cassava mosaic disease?
- Are there any ways in which the effectiveness and sustainability of the CMD project could be enhanced?
- Have there been any unanticipated side effects to the IITA CMD project, positive or negative?
- Should OFDA continue to fund the IITA CMD program as currently organized? In what capacity should OFDA be involved? What criteria might OFDA use in determining whether similar projects should be funded in the future?

Because OFDA is one of several donors supporting the efforts of IITA to manage cassava mosaic disease (CMD) in East Africa, it was not possible to attribute outcomes and impacts of the program uniquely to OFDA. However, there are a number of component activities that relied

entirely or to a significant extent on OFDA funding. The evaluation concentrates on these activities, while also assessing OFDA-supported activities in light of the overall effort.

The evaluation was based on a review of extensive project documents, site visits in Uganda, Tanzania and Kenya and numerous informal interviews with project staff and stakeholders including farmers, members of community-based organizations and staff of the Ministries of Agriculture, national agricultural research centers and non-governmental organizations. Additional interviews were conducted with individuals working on food-security, but not necessarily closely affiliated with the project, e.g., staff of World Food Programme (WFP), FEWSnet and several international and local NGOs. A detailed scope of work, a brief description of the methods used to conduct the evaluation and lists of contacts, areas visited and documents reviewed are included in the annexes of the report. A number of summary tables and data are included in the annexes as well.

## Background

### The Role of Cassava in Sub-Saharan Africa:

Cassava (*Manihot esculenta*) is an important food crop for most of Sub-Saharan Africa. More than 200 million people, or about one third of the total population of Sub-Saharan Africa, get more than half of their calories from cassava or cassava products (Manyong, et al, 2000). In the 1990s, over 70 percent of Ugandan farmers grew cassava and over 50 percent claimed that it was their most important staple. In the Lake zone of Tanzania, cassava is the second most important crop after maize, and the failure of bananas due to decreasing soil fertility and increasing pest problems is causing a rise in cassava cultivation in Kagera. The increase in cassava production in Mwanza, Shinyanga and Mara Regions is the result of recurrent droughts and their detrimental effect on maize and other cereals (IITA, 2002). In Kenya, cassava is ranked third in importance following maize and sorghum (see annex 5). Similarly, in Burundi, cassava ranked third behind bananas and sweet potatoes. In the Republic of Congo (ROC), cassava production represents 90 percent of total food output. Local cassava production accounts for 33 percent of the dietary energy supply, with the remainder derived from imports of wheat and rice (FAO, 2002). Nigeria is a major producer and consumer of cassava. In southern Nigeria cassava, followed by yams, is the most important food crop and a significant cash crop (COSCA, 2000). For East and Central Africans, cassava is a significant, and even preferred, food for all income groups. It is consumed fresh and processed - largely in the form of *ugali*, *gari* or *fufu*.

### *Cassava as a Food-Security Crop:*

In East Africa (Uganda, Kenya and Tanzania), cassava is considered a food-security or famine-reserve crop. In addition to its importance as a basic food staple, cassava possesses a number of attributes that make it a strategic crop to grow. Cassava is drought tolerant, resistant to most pests and diseases, able to perform well in marginal or stressed environments, produces satisfactory yields when other crops fail (FEWS, 1998), has fewer and more flexible demands on labor and allows for flexibility in the cropping and farming system. For these reasons, cassava has been promoted as alternative to cooking bananas in areas experiencing decreased soil fertility

and increased pest problems. It is also promoted as a viable crop option for recently settled and semi-settled pastoralist communities.

Cassava roots can be harvested "piece meal," or one by one over time, and the roots of some varieties can remain in situ without spoilage for up to four years, which allows farmers to stretch the harvest over a long period of time. This is a significant advantage over cereals and sweet potatoes. In addition, cassava is available all year, while cereals, bananas and other roots and tubers such as yams and sweet potatoes have distinct seasons. With proper post-harvest handling cassava can be stored longer than most other staples. Finally, cassava is a strategic crop for farmers on the move such as internally displaced people (IDPs) and refugees because it can be managed and harvested sporadically. Although cassava produces higher yields with proper care and sound cultural practices, it withstands considerable neglect.

Once roots have been harvested, dried stems or stalks can be used or sold as fuelwood. Cassava roots are eaten or sold fresh or processed to make dried chips, *gari*, paste, flour, baked goods, starch, glucose, animal feed, alcohol, soap and cosmetics. The leaves of the cassava plant serve as nutritious greens for human consumption or as fodder for livestock. The use of leaves varies widely across the region.

Cassava is a significant cash crop for a wide range of people in a number of countries and sub-regions, ranging from small-scale periodic sales of fresh or processed roots in local markets, to medium- and large-scale long-distance trade, to industrial processing and commercial exports. The commercial potential for cassava within the region is largely untapped and could provide lucrative opportunities for microenterprises as well as larger commercial interests.

**The Cassava Mosaic Disease Pandemic:**

Two cassava mosaic germiniviruses (*Geminiriridae begomovirus*), African Cassava Mosaic Disease (ACMD) and East African Cassava Mosaic Disease (EACMD), are widely distributed across Sub-Saharan Africa and have been present for a long time, reducing yields by as much as 20 percent, but causing little or no concern for farmers because cassava still produced a significant volume of food. In fact, the virus was said to have favorably enhanced the taste of cassava leaves. Until the early 1990s, CMD was considered a minor problem.

In the late 1980s, the first severe cases of CMD were reported in north-central Uganda. A recombinant form of the virus, referred to as the Ugandan strain or EACMV-Ug,[1] was found to be responsible for the severe symptoms in nearly all local varieties and dramatic crop losses. By way of example, a healthy local cassava plant under normal farm conditions could yield on average 4.2 kg of cassava root. If the plant was infected with ACMD, it could yield 2.5 kg. If it was infected with EACMV-Ug, it might yield 1 kg, but it might not yield any roots at all. In addition, the leaves are few and extremely deformed. USDA estimated losses of 15-27 million MT in 1997. IITA estimated annual losses of US$ 60 million for Uganda and comparable figures for Kenya and Tanzania (IITA, 2000).

[1] For the remainder of this report, CMD refers to EACMV-Ug, CMD pandemic refers to the spread of EACMV-Ug and CMD-resistant means resistant to this strain of CMD.

CMD is transmitted by the cassava whitefly (*Besisia tabaci*) or farmers planting infected cuttings, usually from their own fields but also from neighbors, other areas and even from neighboring countries (e.g., cassava stems transported from Uganda to Kenya and from Rwanda to Burundi). Monitoring surveys consistently report that in the vast majority of cases (districts), the incidence of EACMV-Ug is due predominantly to infected cuttings.

Whiteflies prefer the leaves of young plants from four to eight months old. The older the plant is when it is infected, the greater the chance that the plant will produce a good yield because roots will not degenerate due to EACMV-Ug infection. However, cuttings taken from infected plants and replanted will produce plants that present severe symptoms and produce little or no roots. In this way symptoms and food-security impacts of EACMV-Ug worsen over time (a few seasons). Once a farmer plants CMD-resistant material, and to a limited extent CMD-tolerant material, s(he) can begin to successfully manage EACMV-Ug and produce cassava again.[2]

In the 1990s, EACMV-Ug spread through northern, central and eastern Uganda and then into western Kenya and Tanzania (Legg and Owor, 2000). A 1997 survey noted that many Ugandan farmers had abandoned cassava production altogether (IITA, 1999). By 1999, virtually all of Uganda was affected, as were Western and parts of Nyanza Provinces of Kenya. The pandemic had also reached the Kagera Region in Tanzania (see map in Annex 7). Annual damages were estimated at US$ 100 million. One of the monitoring surveys executed in Western Province at this time noted that the incidence was between 80-90 percent with a severity of 3-4 using a scale of 1 to 5 with 5 being the most severe (KARI, 2004). The shaded rows of Table 1 illustrate when and how EACMV-Ug affected cassava production in Busia District of Western Province in Kenya. It also demonstrates how the introduction and diffusion of CMD-resistant varieties turned both the productivity and production decline around starting in 2001. Although local varieties are still planted, this reversal would not be possible without access to CMD-resistant varieties.

In the late 1990s Burundi, Rwanda and the Republic of Congo (ROC) were considered threatened, but over the next few years they became increasingly affected. The advancement through Burundi has been rapid, demonstrating a high incidence of current season whitefly borne EACMV-Ug infection with severe symptoms in areas of the northeast (see map of CMD spread in Burundi in Annex 7). EACMV-Ug is said to have moved rapidly through Rwanda as well. For ROC, the occurrence is noted in the center of the country (see map of ROC in Annex 7). In Gabon, the virus occurs in the extreme southeastern segment of the country (Owor and Legg, 2003). Recently, EACMV-Ug is reported to be spreading into Mwanza, Mara and part of Shinyanga Regions of Tanzania. In Tarime District on the boarder with Nyanza Province of Kenya, the incidence is around 85-90 percent and severe. While EACMV-Ug had spread through Uganda at a rate of 15-20 km/year, it is estimated to be currently traveling 70-80 km/year through the lake zone of Tanzania.

It is expected that EACMV-Ug will eventually spread through all of East and Central Africa and continue on to ultimately cover West and Southern Africa as well. Dense forests of Central Africa are expected to slow the movement of the pandemic in the direct of Cameroon and Nigeria (Owor and Legg, 2004). The spread of CMD into Nigeria is of particular concern

[2] What are generally referred to as "local tolerant varieties," are actually local varieties that express some resistance to EACMV-Ug. They have less severe symptoms and more slowly succumb to the virus.

**Table 1: Cassava Area, Yield and Production**
**Busia District, Western Province**
**Kenya (1990-2004)**

| Year | Achieved (Ha) | Yield T/Ha | Production (MT) |
|---|---|---|---|
| 1990 | 16,430 | 8 | 131,440 |
| 1991 | 63,000 | 8 | 50,400 |
| 1993 | 9,810 | 8 | 78,480 |
| 1994 | 14,858 | 8 | 118,864 |
| 1995 | 12,000 | 8 | 96,000 |
| 1996 | 6,125 | 8 | 49,000 |
| 1997 | 9,574 | 5 | 47,870 |
| 1998 | 6,408 | 4.7 | 25,632 |
| 1999 | 3,791 | 4.7 | 17,818 |
| 2000 | 6,123 | 5 | 30,615 |
| 2001 | 6,784 | 7 | 47,488 |
| 2002 | 11,174 | 10 | 110,174 |
| 2003 | 12,500 | 15 | 187,500 |
| 2004 | 1,067 | 15 | 16,005 |

Source: KARI, 2004

because Nigeria is a major cassava producer and consumer, but IITA estimates that it will take another five to ten years to reach Nigeria. IITA expects the pandemic to move more quickly through western Tanzania, across Lake Tanganyika to the DRC and south toward Zambia to Malawi. These are areas of greater concern.

**Food-Security Impacts of the Cassava Mosaic Disease Pandemic:**

The CMD pandemic is clearly a food-security crisis, affecting a wide range of households, but it affects poorer households dependent on cassava and farmers cultivating on marginal lands to a greater extent. Because cassava is an important food crop for most households, and in some areas it is also a significant cash crop (e.g., Kagera Region of Tanzania), the impact of CMD has been widely felt across different income groups and throughout the region – most of Uganda and the region surrounding Lake Victoria and parts of Burundi, Rwanda, ROC and Gabon. Portions of the Democratic Republic of Congo (DRC) are affected as well.

There has been limited systematic effort to quantify food-security impacts, other than anecdotal evidence and estimates of aggregate production losses. The interest in food security has largely centered on production and food availability. However, interviews with farmers, researchers and

representatives from development organizations working in the region provide an understanding of some of the broader direct and indirect food-security impacts.

Staff of the Cassava Program at the Namulonge Agricultural and Animal Production Research Institute (NAARI) reported that more than 3,000 people died in Eastern Uganda as a result of EACMV-Ug. Children were withdrawn from schools, homes went without repairs, and animals – including oxen - were sold or stolen. The affect on food security was said to be greater in eastern, northwestern and Nile regions where people are highly dependent on cassava. Teso region and Tosoro District were repeatedly cited as an area seriously affected by EACMV-Ug in the early 1990s. Gulu, Kitgum, Pader and Liva Distircts have been plagued by civil conflict and to a lesser extent drought, both conditions that accentuate farmers reliance on cassava production and deepen the food-security impacts associated with the CMD pandemic. Representatives from Associazione Volonari per il Servizio Internazonale (AVSI) and World Vision (WV) noted that even as CMD-resistant stems become available, food insecurity lingers as households constrain their consumption of cassava in order sell it and use the income to replenish their supply of basic necessities and consumables. In Masaka and Rakai Districts, farmers have increasingly been forced to rely on cassava as disease, pests and soil infertility besiege more traditional banana and sweet potato cultivation. The concurrent spread of CMD and HIV/AIDS has seriously hampered their ability to adopt successful alternative livelihoods strategies.

Interviews with farmer groups in the Lake zone of Tanzania revealed many farmers had abandoned cassava and resorted to consuming sorghum, which they normally reserved for alcohol production. There has been so little cassava for sale that regular traders have not bothered to come to interior villages seeking to buy cassava. Farmers reported cassava retail price increases from 500 to 800 percent. People living near market centers in traditionally surplus cassava areas noted that traders are coming from farther away and offering higher prices for what little cassava there is. Prices of substitutes such as maize (up 500 percent) and millet have also risen. Delayed rains this year (i.e., the previous two rainy seasons) have negatively affected banana, sweet potato and maize production and have added further stress. As the situation has deteriorated, farmers have sold fuelwood, their bicycles and small livestock; received assistance from relatives; sent family members to stay with relatives and migrated to secure wage employment. These coping strategies highlight how EACMV-Ug has a strong negative affect on cassava production and on household food and livelihood security.

When the CMD pandemic hit Western Province of Kenya in the early 1990s, it had a pronounced effect on national output because cassava production is concentrated in this area and most producers initially responded to the pandemic by abandoning cassava altogether. Cassava prices rose significantly as did prices for maize and other cereals. A number of women interviewed noted that domestic quarrels increased along with the growing scarcity of cassava. Changing rainfall patterns had caused farmers to intensify their reliance on drought-resistant cassava, which exacerbated household food insecurity and domestic stress. Many farmers planted sweet potato[3] as a strategy to mitigate food shortages, but as CMD-resistant cassava stems become more available, acreage in cassava is expanding at the expense of acreage in sweet potato. Households from one community noted that reducing the number of meals eaten was a common coping strategy.

[3] KARI even distributed sweet potato vines under the CMD Program

Urban consumers have felt the effects of the CMD pandemic as well. Supplies in many urban markets have dwindled and prices have soared. Cassava prices in central Burundi are rising due to demand pressure from northern Burundi where supplies are falling as a consequence of CMD. The scarcity of cassava leaves is also a problem in Burundi because 80 percent of the population consumes leaves, a much higher proportion than in neighboring countries.

EACMV-Ug creates an emergency or food-security crisis situation at the front of the pandemic and, especially, in the immediate shadow. The incidence and severity of the disease are greatest during these phases. Whiteflies infect young cassava plants. Farmers plant new fields with cuttings from these infected plants and subsequent plant growth and harvests become seriously compromised (including losses as high as 100 percent) causing many farmers to completely abandon cassava production. The severity of food-security impacts will depend on farmer access to cassava-resistant planting material and the availability of production alternatives such as sorghum, millet, maize, sweet potatoes and yams. The only way to restore production is to gain access to and plant CMD-resistant cassava.

In this way, the greatest food-security impacts occur one to three years after the initial infection. The depth, breadth and duration of these impacts depend largely on the farmers' awareness of the problem and preferred practices; production alternatives and the capacity of the research, extension and development community to introduce and disseminate resistant materials and knowledge on effective management practices and coping strategies. By way of illustration of the results of effective knowledge dissemination, demand for CMD-resistant planting material exceeded supply throughout the 1990s in Uganda. Consequently, the food-security focus and effectiveness of awareness, training, stem multiplication and diffusion interventions are central to the mitigation of food insecurity and rapid recovery.

## Management of Cassava Mosaic Disease Pandemic:

In 1997 and 1998 a large number of international agricultural research centers, under the auspices of the USAID-funded System-Wide Program for Integrated Pest Management of Whitefly (SP-IPM Whitefly Program), conducted extensive diagnostic surveys of CMD and cassava whiteflies in four West African and five East African countries. These surveys indicated that there was a significant and growing food-security problem associated with CMD (EACMV-Ug) and that it was necessary to begin seriously addressing the disease.

### OFDA Program Activities Addressing CMD:

In 1998 the OFDA-funded Emergency Programme to Combat the Cassava Mosaic Disease Pandemic in East Africa was initiated to address the current and immediate threats of severe CMD, and targeted Rakai and Masaka Districts of Uganda, Western and Nyanza Provinces of Kenya and Kagera and Mara Regions of Tanzania. Several years later the program became the Cassava Mosaic Disease Pandemic Mitigation in East and Central Africa Programme (both programs are referred to collectively as the CMD Program hereafter in this report). The Republic of Congo (ROC) was added to the program in 2000 and Burundi was added in 2001.

The intention of OFDA grants to International Agricultural Research Centers (IARCs) is to extend the reach of other USAID-supported agricultural research programs with IARCs so that poor and vulnerable populations, especially farmers, will benefit from the innovations of such programs as well. Thus, a critical focal point of these grants is diffusion and, in the case of the CMD pandemic, knowledge transfer and the multiplication and diffusion of cassava planting material. This orientation is explicitly stated as the original goal of the CMD Program:

> "To mitigate the effects of current and potential food insecurity crises in areas of Uganda, Kenya and Tanzania recently affected or immediately threatened by the CMD pandemic, and potentially affected zones in Burundi, through the exchange and development of cassava germplasm and the accelerated multiplication of CMD resistant varieties (IITA, 1998)."

The program is coordinated by IITA in Kampala, but it is a collaborative effort involving numerous organizations, agencies and networks including national agricultural research centers (NARCs), national Ministries of Agriculture (MOAs) and subordinate extension agencies, international and local non-governmental organizations (NGOs), community-based organizations (CBOs), philanthropic foundations and donor agencies. In each country, this could include several dozen partners.

The CMD Program is comprised of five complementary components:

1. Monitoring and diagnostics – establish the extent and spread of the CMD pandemic.
2. Multiplication of CMD resistant varieties – accelerate the multiplication and distribution of high-yielding CMD resistant varieties, thereby mitigating the effects of CMD associated production losses.
3. Germplasm diversification and exchange – provide producers with a diversity of varieties combining pest-disease resistance with preferred quality characteristics and to facilitate regional germplasm exchange leading to the establishment of strategic stocks of CMD resistant varieties in East, Central and Southern African countries.
4. Training and technology transfer – enhance researcher, extension agent, NGO and farmer understanding and management practices of CMD amongst cassava producers and strengthen the transfer of technology, including production, post-harvest handling, processing and commercialization.
5. Project management and coordination, program monitoring and impact assessment – strengthen networks at local, national and regional levels for enhanced implementation of CMD Program activities.

For the coming year, the CMD Program proposes to terminate activities in Uganda because it is felt that resistant germplasm is widely available and accessible. Areas in the north and east that continue to experience civil unrest are an exception. The Kenya team proposes to reduce the number of districts covered and focus future work on just ten: Teso, Busia, Butero, Bungoma and Kakamega Districts in Western Province and Siaya, Kuria, Rachuonyo, Homa Bay and Migori Districts in Nyanza Province. These are areas that have recently been affected by the pandemic or continue to require assistance in building up their stocks of resistant material The Tanzania

program will intensify in Mwara Region, which is currently at the front of the pandemic. The Burundi program will likely grow. The Steering Committee will meet in October to discuss and finalize the forthcoming program proposal.

**Other Activities Addressing CMD Within the Region:**

A number of other non-OFDA funded activities have, or continue to, address CMD within the region. The Rockefeller Foundation has supported germplasm development and exchange with significant contributions to Kenya's CMD initiative. Gatsby Foundation funds germplasm diversification and exchange and the commercialization of cassava and cassava products. Along with International Development Research Center (IDRC), Gatsby financed the introduction of the first clones brought to Uganda from IITA in Ibadan. The East African Root Crop Research Network (EARRNET) assisted with the introduction of germplasm (hundreds of clones) and regional coordination of the program. USAID has supported some activities in the DRC.

The Irish Foundation for Cooperative Development (IFCD) supported links with national regional centers and NGOs, which were active in stem multiplication and diffusion. World Food Programme (WFP) has supported Food for Work in cassava stem multiplication, particularly with refugees and Internally Displace Persons (IDP) in Uganda. A number of international and local non-governmental organizations (NGOs) have been implementing on-farm trails, stem multiplication, farmer training and the promotion of CMD-resistant varieties in general in Uganda and Tanzania, a number of them using the Office of Food for Peace (FFP) Title II resources. With Title II funds, IITA implemented a project for the multiplication of mosaic-resistant cassava in six central districts of Uganda (Masindi, Luwero, Mukono, Iganga, Kamuli and Tororo). The International Fund for Agricultural Development (IFAD) also financed stem multiplication activities. The CMD program in ROC is largely financed and, in part, managed by FAO. Using Department for International Development (DFID) funding, the Natural Resource Institute (NRI) is currently developing training manuals on CMD awareness-raising for extension agents and farmers. Although not specifically related to CMD, DFID is also supporting a program to integrate gender in cassava commercialization and marketing.

There is another large group of NGOs and extension agents working with farmers to improve their food security and incomes, which includes the introduction of improved CMD-resistant varieties of cassava as one component of their strategy. They distribute local tolerant varieties or CMD-resistant varieties that were introduced by IITA and multiplied by the NARCs or some other NGO. These efforts reinforce the work of the CMD Program, although they are not a direct output of the program.

## Impacts, Outcomes and Outputs

Given the diverse and important role of cassava in East and Central Africa and the incidence, severity and rapidity of spread of CMD across the region, OFDA support to CMD management, and the CMD Program in particular, is clearly justified. The CMD Program has been able to make a significant contribution to addressing CMD and reducing food insecurity in the region.

The CMD Program has extended over seven years, includes a range of component activities and partners and, in some form (e.g., monitoring, germplasm development), covers eight countries - Uganda, Kenya, Tanzania, Burundi, DRC, ROC, Gabon and Rwanda. Overall, it has been a highly productive program that has often exceeded its output targets (see table of multiplication output in annex 6). The list of accomplishments is too long to present in its entirety in this report. These are detailed in informative quarterly and annual reports that provide descriptions of program activities and quantify outputs. Annex 6 contains several tables and lists that summarize some of the outputs. The broad category of services and outputs include:

- Execution of regular monitoring surveys
- Introduction and exchange of germplasm
- Replication and certification of varieties
- Maintenance of open quarantine sites
- Field trials
- On-farm evaluation plots
- Training of researchers, extension agents, NGO staff and farmers
- Regular technical assistance to extension agents, NGOs working closely with farmers, contract farmers and farmer groups
- Establishment and maintenance primary stem multiplication plots
- Technical assistance for the establishment and maintenance of cassava nurseries and secondary stem multiplication plots
- Provision of resources for transporting stems
- Introduction of hand and powered processing equipment
- Exchange of information and networking
- Guidance to graduate students working on whitefly and CMD related topics
- Impact assessments

Most of the program outputs and accomplishments detailed in the program documents do not reflect direct household food-security impacts per se. This is partly due to the fact that the program monitoring system was not designed to collect this type of information. In some cases, impacts are difficult to track or measure because the CMD Program works through many partners that receive varying levels of resources and technical assistance from the Program. Some partners implement their own programs and distribute planting material that the CMD Program selected, tested and initially multiplied (i.e., primary multiplication), but did not directly provide to the implementing partner. Many NGOs working directly with local communities acquired planting material from regional or district agricultural offices that are engaged in secondary multiplication, some of which have been supported by OFDA funds through the CMD Program. Rather than present data on all of the Program services and outputs in detail, the report focuses on household- and community-level food-security impacts. Because these types of impacts have not been regularly reported in project documents, the information presented below was obtained largely through evaluation interviews with key informants.

**CMD Program Beneficiaries:**

The CMD Program has both direct and indirect effects on farmers. In collaboration with NGOs and district agricultural offices, IITA has worked directly with farmers in Masaka and Rakai

Districts in Uganda. In Kenya, the CMD Program and KARI have direct contact with contract farmers and CBOs. However, because the CMD Program works mostly through partners, there are many more indirect beneficiaries such as farmers who receive knowledge about the virus through participation on an NGO project where the project technical staff was trained by IITA. In fact, the majority of program beneficiaries receive indirect benefits in the form of improved cassava planting material, extension or NGO technical assistance, lower cassava consumer prices, etc. These indirect or derived food-security benefits are considered an outgrowth of program activities, because the availability of new planting material and knowledge is a direct outcome of the CMD Program activities and coordination of CMD management efforts is one of the five Program components.

Unfortunately, it was not possible to quantify program beneficiaries by their socio-economic status or sex. Program targets were not defined according to these characteristics so program reports rarely recorded disaggregated beneficiary information. For example, results tables list the number of farmers attending training sessions, but there is no indication of what type of farmers they are. One exception is Uganda where the primary NGO partner, Community Enterprise Development Organization (CEDO), targets vulnerable households and tracks male and female beneficiaries. Nonetheless, literature, interviews, and site visits indicate that poor and food-insecure households benefit significantly from the CMD Program. Many poor semi-subsistence farmers directly participate in cassava stem multiplication, training sessions, workshops and commercialization activities. An even larger number have access to improved planting material either directly from the CMD Program or indirectly through organizations or their neighbors.

The Ugandan government encourages self-reliance among IDPs and refugees and this facilitates the work of relief agencies supporting agricultural production and income generation activities for their beneficiaries. WFP noted that cassava produced and consumed by IDPs permits WFP to broaden the coverage of its limited food resources. A representative of the Associazione Volonari per il Servizio Internazonale (AVSI) remarked that Congolese refugees in Hoima District in Uganda have intensively cultivated CMD-resistant cassava and marketed roots. With their proceeds they have purchased basic household goods for their own consumption and for resale to other refugees. Burundian returnees are being provided with CMD-resistant stems as part of the resettlement strategy of the CMD Program and relief agencies. World Vision (WV) has also observed that some CMD-resistant stems have been flowing across the Ugandan boarder to farmers in Southern Sudan.

Among the beneficiaries interviewed were women widowed as a consequence of HIV/AIDS. One women's CBO in Western Province described the problems confronting their village – poverty, domestic violence, HIV/AIDS, child prostitution, child headed households, children dropping out school. The group viewed working together through the CBO and cassava processing as a means of confronting and escaping these problems. Several of the CMD Program partner NGOs (e.g., CEDO in Uganda) are working with HIV/AIDS affected populations (orphaned, widowed, the elderly and female-headed families) in the lake regions of the three countries, an area with the highest prevalence of HIV/AIDS in the world, and note that cassava production is a good livelihood strategy for this population. Cassava has fewer and more flexible labor requirements,[4] tolerates neglect, can be left in the ground without spoilage, has a ready

[4] Cooking bananas or *matoke* requires more labor and intensive and inflexible management.

market and is high in energy.[5] WV promotes production of improved cassava varieties in its orphan and vulnerable children program in northern Uganda.

**Productivity and Food Security Benefits:**

The introduction of CMD-resistant planting material has had a pronounced effect on recovery of cassava production and hence food availability (note the area, production and yield data for Busia District in Western Province of Kenya that are presented in table 1). By extension, the dissemination of CMD-resistant material has had significant household food-security impacts as well. Several members of one CBO said that they were able to pay children's school fees, purchase small livestock and hire labor to assist in their own crop production. Members of another group said that they were able to purchase bicycles, install piped water, establish poultry production, augment savings and pay for private school fees. As they substituted cassava flour for wheat flour, they were able to reduce their food expenditures, purchase other basic necessities and increase their savings.

***Benefits of CMD-Resistant Varieties:***

The widespread susceptibility of cassava to EACMV-Ug, its severe symptoms and the dramatic effect on yields accentuate the benefits to farmers that are derived from the use of CMD-resistant varieties. Virtually all of the local varieties have succumb to EACMV-Ug. Some are considered tolerant,[6] but none is resistant. In time, many of these local varieties will become will succumb to the virus, as will some resistant strains.

Two CMD-resistant varieties introduced early in the CMD Program and disseminated broadly throughout most program areas are SS4 and Migyera.[7] These varieties are labeled improved varieties because they have higher yields. Table 1 indicates that average yields for Busia District rose from 8 Mt/Ha to 15 Mt/Ha, or 188 percent, since the introduction of resistant varieties. Aggregate production recently returned to pre-CMD pandemic levels using just 75 percent of the original land area.

CRS/Uganda reported yield advantages of improved CMD-resistant varieties of between 100 and 300 percent over local varieties. The Uganda CMD Program claims that SS4 can yield 40-50 Mt/ha. In contrast, Tanzania reports lower yields of about 30Mt/ha due to poorer soil fertility in the Lake zone.

At this stage, the benefits derived from new varieties are essentially restricted to CMD resistance and improved yields. NARCs have only more recently given attention to selection based on other

[5] The World Health Organization's guidelines on nutritional requirements for people living with AIDS recommend an energy increase of 10-20 percent for PLWHA who are asymptomatic and 20-30 percent for PLWHA who are symptomatic.

[6] What are generally referred to as "local tolerant varieties," are actually local varieties that express some resistance to EACMV-Ug. They initially have less severe symptoms and more slowly succumb to the virus.

[7] While 100s of clones have been exchanged and evaluated, most of the multiplication in Uganda, Kenya and Tanzania has dealt with just a few varieties - SS4 and Migyere in Uganda and Kenya and TMS 4(2) 1425 or Nigeria, SS4, MM96/4684 and MM96/4619 in Tanzania.

characteristics and farmer preferences such as taste; dry-matter content; tuber size, form, and color; habit; early maturing and ability of roots to remain in situ without spoilage.

***Benefits Derived from Participating in Stem Multiplication and Diffusion:***

Primary benefits to those participating in stem multiplication and diffusion are the early access to CMD-resistant material (hence a faster recovery), access to knowledge and training and an opportunity to sell stems to NGOs, the CMD Program and other farmers. Depending on the approach taken in a given country or sub-region, these benefits fan out to more farmers as participating farmers share stems with and train other farmers. Because cassava is slow maturing and the initial stock of stems for multiplication tends to be limited, the time between when the first farmers receive stems for multiplication and several generations of farmers gain access to stems can be quite long – in excess of several years. Bringing the program to scale and reaching poorer, food-insecure farmers is a long-term process and commitment.

Gains derived from selling stems harvested from multiplication plots are windfalls, or short-term opportunities, since it is unlikely that permanent alternative stem markets will evolve. Most farmers traditionally rely on farmer-to-farmer exchange of planting material, not purchases. In Rakai District in Uganda, there are no alternative market outlets to CEDO – the NGO working with local farmers on stem multiplication. However, the windfall does help farmers who participate in stem multiplication recover and make some significant investments – bicycle purchases, roof repairs, etc. This type of windfall tends to accrue to the better-off farmers who are contracted by agencies such as NARCs NGOs or extension. Those participating in stem multiplication must have access to land and sufficient technical capacity, but working through farmer groups can often overcome these constraints to reaching poorer, more food-insecure farmers.

The Tanzania program uses lead or contract farmers and institutions such as prisons and farmer training centers for the initial multiplication of stems. Institutions such as agricultural research stations, training centers and prisons tend to have ample area for multiplication. In Kagera Region, Norwegian People's Aid (NPA) manages nurseries and a nuclear farm and works closely with CBOs for tertiary multiplication. It was found that the incorporation of NPA significantly accelerated farmer up-take of improved knowledge and material. Kenya's approach was to conduct primary multiplication at KARI centers, secondary multiplication in the different districts and tertiary multiplication with farmers (contract farmers) or CBOs supported by an NGO. CBOs were identified through registration lists kept with MOA and were selected according to MOA's criteria, which was not necessarily poverty criteria. In general, the participation of poorer farmers is extremely limited in secondary multiplication, and somewhat limited in tertiary multiplication. As a consequence, they tend to receive knowledge and improved stems after more progressive farmers, training from other farmers rather than CMD Program staff or extensionists and receive few, if any, benefits in the form of short-term or windfall earnings from stem sales.

Resources from the CMD Program have been used to strengthen Kenya's existing national CMD program. It was noted that OFDA's CMD Program and its Kenya coordinator have provided more structure and a systemic approach to the research-multiplication-diffusion efforts. In

addition, the national program was able to expand from Western Province into Nyanza Province. Both of these provinces have poverty rates higher than the national average so these efforts represent greater benefits to poorer Kenyans. However, the three stage approach to multiplication – primary on the NARC's land, secondary on district sites managed by district agricultural offices and tertiary on fields owned by contract farmers of CBOs – implies a considerable wait for the poorest of the poor. Still, the Kenya program estimates that 11,000 ha of cassava have been recovered, i.e., planted with improved CMD-resistant varieties.

Adoption of CMD-resistant varieties is impeded by the slow rate of propagation of cassava, unavailability of improved stems, and other typical factors such as farmer preferences and limited capacity of the stem distribution system. The ability to respond quickly has improved through the sharing of lessons learned. CMD Program management has observed that the response rate for Kenya was faster than for Uganda, and Tanzania was faster than Kenya.[8]

While it is generally felt that there is sufficient improved germplasm in Uganda, many NGOs in Uganda are still working on multiplication and diffusion in northern and eastern regions where there is civil unrest (e.g., AVSI activities with IDPs in Kitgum and Pader Districts) because an environment characterized by conflict and uprooted populations, necessitates continuous restocking and distribution. NAARI in Kigum and several contract farmers are providing stems. These activities are being carried out without OFDA support.

***Benefits Derived from Improved Knowledge:***

The CMD Program recommends a number of improved agronomic practices. For example, planting stems horizontally exposes more nodes to the soil, which produces more roots and overall higher yields. While it is more strenuous to harvest this type of heavy branching root structure, it is also more difficult to steal the roots. Many women, IDPs and refugees have adopted the practice because of this advantage. Another practice introduced through the program is how to keep cut cassava stems alive once the roots have been harvested so that stem supplies do not need to be replenished each season.

CMD Program awareness training is generally provided to researchers, agricultural officers, extension agents and NGO technical staff through workshops. The expectation is that the knowledge gained through participation in these workshops will be transferred to farmers and that these farmers will include the poor and food insecure. However, effective transfer of knowledge is dependent on the capacity of, and resources available to, local extension agencies and NGOs. Key informants and direct field observation revealed that farmers' knowledge uptake is quite variable. Farmers' understanding of the how the virus is transmitted and how it affects the cassava plant is not widespread. It has been particularly difficult to successfully orient farmers who are situated ahead of the pandemic's front, because they can not see the evidence of the virus or its impact In fact, in some cases extension agents' understanding of the virus, agronomic practices, varietial characteristics and commercialization was limited or incorrect.

[8] Uganda is were the pandemic is said to have originated.

***Benefits Derived from Cassava Processing Technology:***

In general, the new CMD-resistant varieties produce significantly higher yields than traditional varieties. CMD Program staff saw the increased productivity as an opportunity to bolster farm incomes through commercialization of surplus production. Hand- and fuel-powered cassava chippers and flourmills were introduced to the CMD Program as a way to process and sell surplus, improve farm incomes (or access to food) and, therefore, enhance the food-security impacts of the CMD Program. A small number of cassava processors have been distributed to community-based organizations comprised of cassava farmers involved in stem multiplication. The Program refers to these groups or processing sites as Technology Transfer Centers (TTC)[9]. It can be argued that this component is more related to development and less related to food-security emergency or recovery, e.g., Bungoma District of Western Province in Kenya.

Community-based cassava processing groups can reduce labor time in processing, shorten the time required for drying chips[10] and improve the quality of chips and flour produced, allowing group members to command higher prices and produce a wider array of better quality value-added products. Members of cassava processing groups and others who avail themselves of the milling services can substitute either cassava or sweet potato flour for wheat flour and save money on wheat purchases. Orange-flesh sweet potatoes have the added advantage of fortifying flour because of the higher Vitamin-A content.

Processing groups can also sell milling services within their local community. Some processing groups even arrange for transport of their mill to other communities within their district in order to provide milling services to a larger population.

Group members, especially women, noted a strong sense of self-achievement, independence and empowerment. A number of women felt that in response to their enhanced economic standing, their husbands made contributions to the women's growing businesses and spent more on their families. A well-managed CBO can provide milling services, identify buyers of chips and flour, quickly develop new added-value products and steadily expand the group's business and profits while allowing individual members to make investments in their homes, fields and children's educations. Kenyan CBOs were particularly adept at cultivating their business opportunities.

***Unexpected Impacts of the CMD Program:***

There are several unexpected impacts of the CMD Program. In Uganda, women are responsible for cassava production and processing. They also market cassava on a small scale. Men have traditionally focused on more lucrative cash crops. Since CMD-resistant varieties have higher yields and the CMD Program has been promoting greater commercialization of cassava, cassava has become more lucrative and has captured men's attention. Because men control cash income, the benefits from cassava commercialization accrue more to men than women, even when women are the active participants. As men's interest in cassava as a lucrative cash crop grows,

[9] The Technology Transfer Centers (TTCs ) were nuclei of program activities, including farmer training, farmer evaluation of germplasm, stem multiplication and cassava processing.

[10] Members said that machine processed chips dry within 24 hours whereas hand processed can require one to two weeks to dry, which can result in discoloration and fermentation.

women stand to lose control of the production and hence a valuable source of food for their families.

The initial improved CMD-resistant varieties introduced by the CMD Program had high levels of cyanogenic gluocides, which has negative health effects if not properly processed before consuming. Households accustomed to consuming sweet unprocessed cassava were unfamiliar with appropriate processing methods. The dissemination of the resistant varieties and subsequent purported instances of poisoning created a political stir in Uganda. However, the disturbance was not lasting, and the CMD Program and other projects promoting these varieties introduced complementary training on appropriate cassava processing.

The response time, scale of the operations (e.g., coverage) and the overall food-security impacts were probably compromised somewhat due to the lack of an explicit and systematic multiplication and diffusion approach. Food-security impacts may have been compromised to some degree as well. A number of NGOs distributed stems to farmers for direct planting. A greater number of farmers could have been reached if they had established multiplication plots with clear processes for distributing stems once plants could be ratooned[11] provided adequate training to insure a successful harvest of stems and a succession of stem harvests, used an agreed upon criteria for selection of farmers to receive multiplied stems and monitored the process, including assessing impacts and collecting feedback.

Policy makers and agricultural institutions in the region have turned to cassava as an alternative to historically preferred crops such as maize or bananas, which are now failing due to growing soil infertility and pest and disease problems. In some instances, this reorientation has included supporting the commercialization of cassava. This apparently rational solution to an immediate problem could, however, be less advisable from a longer-term food security and vulnerability perspective. The reduction in cropping diversity compounded with deteriorating environmental conditions and natural varietal breakdown could ultimately create new and perhaps more serious food-security risks and consequences. Because only a few varieties were initially multiplied and promoted, the genetic diversity of cassava material currently in circulation is limited, which puts farmers at greater risk if other unforeseen pest or diseases problems arise.

The lack of varietal diversity was probably one reason why farmers continued to plant local varieties and refused to remove infected plants. A number of NGOs complained that the CMD Program did not solicit farmer opinions and preferences until late in the technology development-diffusion cycle. Under pressure to rapidly release and multiple CMD-resistant planting material, researchers focused on a limited number of varieties, expecting to focus on diversification at a later time. Researchers initially selected for CMD resistance and yield. Given the near complete devastation of cassava caused by EACMV-Ug, farmers were desperate for planting material and willingly planted new varieties. For a period of time when the demand for stems greatly exceeded the supply, farmers were willing to pay for stems – not a customary practice in Uganda or Tanzania. Still, farmers preserved their local varieties because they liked the fact that they were sweet, quick maturing, stayed in situ without spoilage for several years, dried quickly, had high dry matter content, produced good quality flour or *ugali* or yielded large

[11] Cut back for harvesting stems.

well-shaped tubers that commanded a good price in the market. The current limited number of CMD resistant varieties does not subsume all of these preferred characteristics.

## Increasing Food-Security Impacts and Sustainability

The focus of this section of the report is to draw out lessons learned and make recommendations on how to increase the food-security impacts of the CMD Program. The lessons are drawn largely from the Program itself and from the broader CMD management effort within the region.

OFDA grants support the diffusion of agricultural innovations to poorer, food-insecure and vulnerable populations. Food security and coverage are two key elements underlying this perspective. With the goal of OFDA grants in mind, this section presents observations and recommendations with the aim to strengthen the capacity of the CMD Program to:

1. Reduce the depth, breadth and duration of food insecurity caused by the CMD pandemic.
2. Reduce the response time of the agricultural research and development community to the CMD pandemic

The depth, breadth and duration of these impacts and the response time depend largely on: 1) the farmers' awareness of the CMD pandemic and preferred practices, 2) production alternatives available to farmers and 3) the capacity of the research, extension and development community to rapidly introduce and disseminate acceptable resistant materials and information on effective CMD management and appropriate coping strategies. Technologies and practices have to be effective at managing the virus, but equally important, they have to be acceptable to farmers. Germplasm diversification and exchange and preliminary trials are constrained by science and the biology of the cassava plant, which has a prolonged growth cycle. But, the food-security focus and effectiveness of program components covering awareness, training, stem multiplication and diffusion can play a significant role to mitigate food insecurity and enhance the rate of recovery. In this way, the OFDA grants supporting IITA and its partners are critical to the overall CMD management effort.

### Principles to Enhance Food Security Impacts

In the three main countries - Uganda, Tanzania and Kenya – the CMD Program was comprised of the same basic components, but the situation on the ground differed over time and across space. The variation in the geographic progression of the CMD pandemic, local agro-ecological conditions, economic opportunities, research efforts and institutional capacities have all fostered geographic temporal and variations in country-specific program designs, implementation and results. Therefore, it was extremely difficult to compare programs across countries or identify one overwhelmingly successful and universal approach. Nonetheless, it is possible to draw lessons, outline some basic design and implementation principles and make recommendations for future phases of the CMD Program. Extracting these lessons is extremely valuable given the near certainty of future CMD crises in other African countries.

The following lessons and principles provide ideas for how the CMD Program could strengthen its food-security impacts and promote greater sustainability. The principles should not be viewed as one complete package of suggestions to be adopted in its entirety, but rather as a series of observations and ideas for strengthening the Program. Some are easy to adopt, others may be more difficult or only possible in a specific country context. Implementation of a number of these suggestions could require shifting the allocation of program resources between components and, in some cases, could necessitate additional resources. Alternatively, a CMD Program partner might be willing to take responsibility for supporting and instituting one or more of the suggestions presented below, e.g., coordination and networking.

***Adopt a Comprehensive Food-Security Framework for the CMD Program:***

Currently the CMD Program framework focuses on food availability and centers on recovery of aggregate cassava acreage and production. A more comprehensive food-security framework would orient the Program to place more attention on which farmers are recovering their production and how rapidly, and if cultivation of cassava is not possible, what are the other crop options. A broader food-security perspective requires placing greater emphasis on the food economy, the livelihood and coping strategies of small-scale farmers and the distribution of outputs and services among affected farmers. Employing this type of framework necessitates the involvement of multiple partners such as NARCs, NGOs, CBOs, farmers and individuals with a variety of skills and experiences. More involvement of socio-economists and field practitioners is recommended.

A critical step toward improving the food-security focus of the CMD Program is to make the inclusion of food-insecure and vulnerable populations an explicit objective of the CMD Program, and then tailor the design of the various program components to consistently and systematically reflect this objective.This requires broadening the focus from acreage and output to place more attention on when and how different socio-economic groups benefit from Program services and outputs. Farmers with land and economic capacity are logical and valuable allies in the race to rapidly expand the supply of stems and cassava roots produced. Taking advantage of their capacity is a good strategy. But a simultaneous effort should be made to bring poorer farmers into the recovery process. The Program would thus be able to achieve greater coverage in terms of the numbers of farmers served and the geographic scope of program services and outcomes.

***Systematically Monitor Household-Level Food-Security Impacts:***

Program monitoring should be adjusted to include appropriate mechanisms for assessing progress toward reaching food-insecure populations and improving household-level food security. One method could be to monitor where improved stems go and whether they continue to be multiplied and diffused. Another option is to include food-security impact performance indicators in regular program monitoring and reporting. A detailed breakdown on a quarterly basis would probably be prohibitively expensive, but some disaggregation of results is needed. Alternatively or additionally, the Program could conduct regular food-security impact assessments that provide more information about the characteristics of program beneficiaries and on the distribution of program outputs, services and impacts. Finally, execution of short socio-economic surveys within geographic areas where monitoring and diagnosis surveys are currently

being carried out could provide useful and regular information on potential and actual food-security impacts of CMD and farmers perceptions.

***Specify Food-Security Selection Criteria for CMD Program Participation:***

To insure that the CMD Program is reaching poorer food-insecure farmers, the program design could explicitly specify or recommend selection criteria for participation in the CMD awareness, training, stem multiplication and diffusion and cassava processing activities. The criteria should be developed in collaboration with NGO and CBO partners to ensure that the desired population is targeted, and that these targeting criteria are easily understood and applied and generally accepted by the local population.

The program design should suggest methods for applying the selection criteria. For example, Appropriate Technology of Uganda (AT) conducted participatory poverty assessments to ensure that women and poor households would be included among their beneficiaries. This process clarified for the community what AT was trying to achieve, generated buy-in among community members and opened the door to initiate community CMD awareness training. They were able to achieve a participation rate for women of 50 percent and promote a more continuous chain of farmer-to-farmer stem transfers. NPA works with their communities to identify the sequence of farmers who will receive stems from farmer-based stem multiplication. Because they know who will receive stems, they are able to follow up with their farmers, who are also viewed by NPA as potential future-generations of stem multipliers. Many NGOs are familiar with participatory methods, and those with experience can train NGOs that are less experienced or unfamiliar with these techniques. Program funds could support a workshop for this type of training. The CMD Program could advocate among their partners for greater application of these methods.

***Propose CMD Program Design and Implementation Models:***

A lot of time can be saved if different country programs learn from the experiences of other country programs. One way to encourage the sharing of experiences is to develop a set of recommended approaches for awareness raising and stem multiplication and diffusion, which a national program or network could use as a model to develop its own implementation approach. For example, large-scale stem multiplications at prisons exploit the idle land and labor available at prisons in Tanzania. In addition, establishment of a strategic alliance with an NGO that has a strong and successful relationship with CBOs in a region and can effectively organize tertiary stem multiplication schemes.[12] A well managed program with NGO monitoring and follow up, can have a positive effect on the continued sequencing stem multiplication and exchange among farmers, which will lead to dissemination of more cuttings.

The set of approaches to be employed across the network would thus reflect a range of opportunities found on the ground such as access to strong extension or NGO partners or challenges such as the absence of government support, MOA priorities that conflict or inadvertently comprise CMD program goals or civil instability. Included among the shared practices would be suggested means to gauge whether a country program should charge farmers for stems, impose a nominal fee or establish a system of in-kind payments in the form of give-away stems transferred to neighbors and other farmers. Many good models exist and are

[12] Farmer-based, farmer-managed multiplication

currently being implemented, only not in a systematic way or on a large scale. These approaches should be packaged together and comprise part of the training provided to program partners.

### *Forge Strategic Relationships with NGOs to Facilitate Knowledge and Technology Transfer*

Many NGOs have an explicit mandate to help the poor and food insecure and they tend to provide more intensive service and follow up than national extension agents do. Consequently, NGOs more rapidly and effectively scale up CMD awareness, tertiary multiplication and diffusion. Some excellent examples were the Norwegian People's Aid (NPA) in Kagera Region in Tanzania, Africanow in area of Kisumo in Kenya, Appropriate Technology Ltd (AT) in northeastern Uganda and CEDO in Rakai and Masaka Districts in Uganda. However, NGOs can inadvertently create problems if, under pressure to quickly respond to farmer needs, they distribute material that is not clean or likely to become infected because the material was not properly evaluated. NGOs can also restrict their potential impact if they give out stems without taking advantage of opportunities to set up multiplication and diffusion schemes. But, as a group, NGOs can help CMD Program staff identify effective practices to use as model approaches and those with greater capacity can train the staff of other less-experienced NGOs as well as extension agents.

### *Get Ahead of the CMD Pandemic*

To get ahead of the CMD pandemic, the CMD Program should have a strategy in place well before the CMD pandemic front arrives in a given location. One of the initial steps in the strategy should be to form a group that would begin immediately to develop a larger and more active network. The strategy should be holistic and identify potential policies and regulations that could hinder implementation of the future response, propose alternative livelihood strategies for farmers and define a stem multiplication and diffusion plan. Strategic partners with different technical and managerial capacities working in different parts of the country have to be identified and brought into the network. Information and awareness training on EACDV-Ug, the probable progression of the pandemic and its consequences needs to be stressed more. Raising the awareness of farmers, in particular, has to begin earlier.

The CMD Program could also consider making greater use of tolerant local varieties as a first line of defense and facilitate the multiplication and distribution stems. Tanzania brought tolerant material from Zanzibar into the Lake zone. By using local varieties, the program will: 1) start the response with more material for multiplication, 2) multiply more quickly, 3) work with what farmers already know, and 4) work with materials that are already adapted to local conditions. Another tactic would be early introduction of CMD-resistant varieties, including the establishment of on-farm trials and commencement of preliminary multiplication, recognizing that thus far pre-positioning efforts have progressed slowly because the local population had not yet felt the impact of the pandemic. Currently, the CMD Program is attempting to identify good locations to establish export sites where varieties from plant quarantine stations in Kenya can be made available to Zambia and Malawi

***Increase CMD Awareness among Farmers:***

Interviews with secondary and tertiary stem multipliers indicated that their knowledge of the virus and improved practices was sometimes quite weak. Many farmers mistakenly thought that the application of a topical spray would rid cassava plants of CMD. In one case, members of a stem multiplication CBO thought that the symptoms of CMD were caused by pollution. Many farmers could not distinguish between CMD and cassava green mite symptoms. Because the CMD Program generally uses these multipliers to train other farmers and raise awareness within their communities, their ideas are passed on to others, which could seriously compromise knowledge transfer, hinder the adoption of improved practices and actually contribute to the spread of CMD. Interviews with different farmer groups suggest that those groups being assisted by NGOs are better informed. In general, NGOs provide more follow up than the local extension agencies do and, therefore, they tend to be more effective partners. NGOs and extension agents could work in tandem to reinforce consistent knowledge transfer and to strengthen local extension and promote more sustainable outcomes.

The awareness component should include and even stress teaching farmers about the expected losses associated with the more severe strain of CMD, and make recommendations on alternative cropping and livelihood strategies (e.g., planting sweet potatoes) that farmers could adopt for the short and medium term. For example, in Burundi the CMD Program is recommending that farmers plant sweet potato in place of cassava as a stopgap measure until adequate CMD-resistant material can be multiplied and disseminated, which is likely to occur only in the medium to long term.

***Increase CMD Awareness among Policy Makers***

Raising awareness can extend beyond reaching farmers. Although key informants in Uganda noted that there were incidents where district representatives seized cassava stems from multiplication sites for rapid distribution within their own districts for political reasons or concern of their constituents. Ugandan politicians were said to been influential advocates of CMD awareness raising. Tanzania has used the radio and press to heighten awareness.

An important component of awareness raising is to educate policy makers about how they can support extension and awareness campaigns and facilitate germplasm exchange so that the process can function in an efficient but rational manner. Although well intended, Tanzanian cross-district border quarantine policies have constrained the process of identifying and testing promising germplasm and the pre-positioning of planting material of tolerant varieties in anticipation of future acute demands. The CMD network could enter into dialogue with policy makers and advocate for solutions to overcome these kinds of constraints.

***Move CMD-Resistant Material Out to Farmers More Quickly***

The CMD Program should seek to identify methods that can help move material out to farmers more quickly. Planting mini-stems and pre-germination results in more rapid development of cassava plants and can accelerate stem multiplication. The Agricultural Research Institute at Ukiriguru in Tanzania produced over 90,000 mini-cuttings of TMS 4(2) 1425. The Burundi

Program is experimenting with both methods as well. The CMD Program's Burundi coordinator estimates that one hectare of traditional multiplication returns enough stems to support the planting of 100 ha, whereas one hectare using these rapid methods could support 6,000 ha. Because these methods require more technical skill and a controlled environment, they are suitable for primary multiplication sites. Irrigating and fertilizing multiplication plots and the establishment of cassava nurseries and nuclear sites are variations of production intensification and acceleration schemes suitable for primary and some well-managed secondary multiplication sites.

Soliciting farmer preferences and including farmers at an earlier stage – even the design stage - of the technology development process can increase technology up-take or adoption and accelerate diffusion. "Mother-baby trails"[13] used in both the Tanzanian and Kenyan country programs are an example of one method that can bring farmers into the selection process at an earlier stage. Findings ways to support the release of more varieties with a wider array of desirable characteristics would encourage adoption and result in greater diversity within the germplasm pool.

***Emphasize Coordination and Networking***

Program partners unanimously praised the quality of technical assistance received from the CMD Program. However, several NGO partners expressed a need for more technical assistance and follow up from the Program. They perceived the need for more formalized and active networking in order to more rapidly transfer knowledge and facilitate the collaboration among research centers, NGOs, CBOs and farmers. It was felt that the recovery in Uganda could have progressed more quickly and reached a wider range of farmers if there had been more communication and sharing of experiences.

To facilitate knowledge transfer and collaboration, the CMD Program could make more effective use of networking methods. Creation and maintenance of a listserv to take advantage of the knowledge and experience base of the wider community working on CMD management within, and even outside, the region could result in more informal and frequent technical assistance. It could also facilitate capacity building of extension agents and serve as a conduit for farmer and NGO feedback.

NGOs, CBOs and even individual farmers should be encouraged to participate in national and regional networks and meetings, and to present their findings and experiences along with those presented by CMD Program scientists. This would encourage more bi-directional learning. A newsletter and/or series of technical notes and implementation briefs could be developed to facilitate faster and wider information exchange, especially in the interim between formal workshops and meetings.

Because management and facilitation are demanding tasks, it will probably be necessary to identify staff from among the Program's partners that can share in the responsibility.

[13] Mother-baby trails are used in Tanzania. Three replications of a large number of clones are conducted on the mother plot. Baby plots are managed by individual farmers and each has at least three clones.

Alternatively, additional staff could be hired with the specific role of managing the entire Program or one or more the components. Because networking requires a significant time commitment, it is advisable to designate a near full-time individual to the task.

***Turn the Commercialization Component Over to Microenterprise Specialists***

While there are some thriving CBOs with processing equipment, this component of the CMD Program has had only mixed success. Some groups have rapidly prospered and others have quickly disbanded. There are several fuel-powered mills laying idol in Uganda and of the six TTC centers established in Kenya in 2000, two are defunct due to lack of leadership. The success of this component is highly dependent on employment of good selection criteria for group participation as well as considerable and consistent NGO follow up, facilitation and training. Whereas developing and fostering microenterprises requires significant time and input, the CMD Program provides little more than the technology around which microenterprises are expected to form and flourish. If the processing and commercialization component is to continue, the CMD Steering Committee will need to bring more economists, microenterprise specialists and NGOs into the design stage. There should be a clear process for engaging NGOs with appropriate expertise in microenterprise development or for hiring appropriate staff and reigning in more funds to develop this component within the CMD Program.

## Future Program

The CMD Program is clearly a worthwhile program in that it supports improvements in food security for a wide range of people living over a large and growing portion of Africa. The set of activities are critical to extending the benefits of agricultural research to a broader audience and, in particular, food insecure and vulnerable populations. As EACMV-Ug inevitably spreads to other regions within currently affected countries and to new countries, there will likely be new requests for this type of programming to manage the virus and its impacts.

Subsequent phases of the program should be able to apply lessons learned from earlier phases, increasing the effectiveness of CMD management. The lessons on the design and implementation of multiplication and diffusion and on partnerships and networking are directly relevant to the broader goal of ensuring that agricultural innovations reach poorer and more marginalized farmers, and can be extended to other agricultural research and extension programs. Criteria for OFDA to use in determining whether to fund future phases of the CMD program stem directly from the basic principles listed in the preceding section:

1. Has the CMD Program adopted a comprehensive food-security framework and identified appropriate measures to insure that the poor and food insecure actively participate in and gain from the recovery effort, starting at an early stage (e.g., establish a preset selection criteria for program participants and regular food-security monitoring)?

2. Does the proposal indicate that the program includes steps for getting ahead of the CMD pandemic and moving CMD-resistant material out more quickly?

3. Does the proposal clearly indicate what approaches to stem multiplication and diffusion it will promote and which lessons from past phases have been incorporated, especially those related to reaching the poor and food insecure?

4. Has adequate attention been given to CMD awareness among farmers and policy makers, and to intensifying collaboration and networking efforts?

5. How strong is the coordination and networking component, including clearly defined mechanisms for sharing information and experiences among partners (particularly NGOs) and for collecting feedback from beneficiaries?

The CMD Program management's expressed plan to withdraw from Uganda because ample germplasm is available is an opinion generally expressed by other development agencies working in Uganda. The plan to focus on fewer districts in Kenya, continue operations in Tanzania and expand the program in Burundi is consistent with the evolution of the CMD pandemic and appropriate. The on-going monitoring and diagnostic surveys can continue to provide a convenient means for setting geographic priority areas, however, some of the initial pre-positioning activities will most likely precede the initiation of regular monitoring surveys.

While the commercialization component is a logical extension to the multiplication and diffusion component, it is not critical to the CMD recovery effort. Given the extremely limited resources available to OFDA for this type of programming and the greater importance of both promoting CMD awareness and satisfying the vast need for CMD-resistant stems, future program resources would be more wisely spent strengthening these later two components of the program. A clear case can be made for USAID support for cassava commercialization under other funding mechanisms and, in particular, the new agricultural strategy of the Economic Growth and Agricultural Trade pillar bureau and the Initiative to End Hunger in Africa, especially if the commercialization program emphasized the strengthening and expansion of local markets and economies (e.g., open-air markets) as opposed to providing essentially raw material (e.g., cassava chips) to large-scale industrial and export-oriented markets. Both OFDA and FFP should follow up with the appropriate pillar bureaus and divisions.

# ANNEX 1

# SCOPE OF WORK

**Evaluation of USAID/OFDA Efforts Against Cassava Mosaic Disease**
**1997 – 2003**

## Purpose

The U.S. Agency for International Development's Office of U.S. Foreign Disaster Assistance (USAID/OFDA) seeks to evaluate its efforts to combat Cassava Mosaic Disease (CMD) from 1997 to the present. This evaluation will focus on the effectiveness, sustainability, and overall impact of OFDA's support to the International Institute for Tropical Agriculture (IITA) for CMD-related activities. OFDA seeks one experienced professional to conduct research in the field and Washington over an estimated period of 40 days.

## Background

Since 1997, OFDA has been funding work to combat the Cassava Mosaic Disease in eastern, central, and western Africa. CMD is devastating to cassava, which is a valuable food security crop to subsistence farmers throughout most of the continent. Over the past six years, OFDA has provided approximately $1.7 million to the International Institute for Tropical Agriculture to monitor the spread of the disease and to multiply and disseminate cassava plant varieties that are resistant to CMD.

## Evaluation Questions

The evaluation will address the following series of questions.

- What outputs have resulted from OFDA funding to IITA, from 1997 to the present?
- Approximately how many households have benefited from the project? What were the broad demographic characteristics of the project's beneficiaries? Were any vulnerable populations in target countries excluded from the project's impacts?
- How has the IITA CMD project impacted productivity and food security for small subsistence farmers? Have the IITA activities resulted in a real and tangible difference in farmers' lives?

- What was the geographic scope of the project? Was this scope appropriate?

- Have other donors provided support to complement OFDA's funding to IITA in combating cassava mosaic disease?

- Are there any ways in which the effectiveness and sustainability of the CMD project could be enhanced?

- Have there been any unanticipated side effects to the IITA CMD project, positive or negative?

- Should OFDA continue to fund the IITA CMD program as currently organized? In what capacity should OFDA be involved? What criteria might OFDA use in determining whether similar projects should be funded in the future?

**Methodology and Estimated Timeline**

The notional start date for the evaluation is early April 2004. The evaluator will conduct the evaluation and complete the report by end of September 2004.

The evaluator will review documents and available data, conduct interviews and organize field interviews with the assistance of IITA prior to embarking on field visits (10 days). S/he may review strategic assessments, grant files, and other relevant documents. The OFDA Evaluation Coordinator will assist with facilitation of meetings and procurement of documents as necessary.

The evaluator will then conduct field visits and data collection in Uganda and Tanzania in July or August 2004 (20 days)[14]. IITA will assist in identifying appropriate key informants, establishing contacts and organizing field visits. The IITA research will accompany the evaluator for at least some of the field visits.

The evaluator will write a report of his/her findings (7 days). The evaluator will draft the report over 5 days, and will provide a draft copy to the OFDA Evaluation Coordinator.

The evaluator will debrief OFDA staff (1 day). Approximately one week after delivery of the draft report to OFDA for review, the evaluator will brief OFDA managers and staff in Washington on findings, and will obtain feedback.

Incorporation of feedback & delivery of final report (2 days). The evaluator will present a final copy of the report to OFDA, which may incorporate feedback received in the debriefings.

[14] Kenya is also being considered. The exact locations will determined with assistance from IITA.

**Deliverables**

The evaluator will produce the following deliverables:

*Work Plan:* Prior to departure to the field, the evaluator will provide to OFDA a 1 page written strategy detailing how the evaluation will be completed, for OFDA review and approval. The work plan will include a list of potential interviewees, a draft list of interview questions, and a description of any other data collection instruments (e.g., surveys) to be used.

*Field Debrief:* Upon completion of research in July and August 2004, the evaluator will provide a courtesy debrief of preliminary findings to IITA staff, and will request preliminary feedback which may be incorporated into the final report.

*Written Report:* The evaluator shall write and present for review a first draft of the evaluation report at least one week prior to the final oral briefings (below). The report will include an executive summary, overview of IITA's OFDA-funded CMD activities, description of methodology, and a detailed description of the evaluation's findings and recommendations. Additional information including itinerary, interviewee lists, questionnaires, surveys, and bibliography should be included in annexes. The report should be no more than 25 pages, excluding annexes. Following the final oral briefings and taking into account any new information obtained, the evaluator will prepare and print a final version of the evaluation report, with the number of copies to be determined.

# ANNEX 2

# METHODS

The evaluation is based on: 1) a review of relevant project documents and literature on cassava, CMD and food security in Uganda, Kenya and Tanzania and 2) informal interviews with key informants in Uganda, Kenya, Tanzania and Washington, DC. Key informants include staff or representatives from IITA and its direct program collaborators within the region, national agricultural research centers (NARs), Ministries of Agriculture (MOAs) field staff and extension agents in the Lake Victoria region of the three countries, Title II private voluntary organizations (PVOs) and local non-governmental organizations (NGOs) and community-based organizations (CBOs) working on cassava in the region, World Food Programme (WFP), the Famine Early Warning Systems Network (FEWSnet) and farmers.

Data on program outputs, the performance of IITA cultivars and the geographic coverage of the program will be provided by IITA. This information will be extracted largely from IITA reports and data, but also through interviews with field staff. Title II PVOs, MOA extension agents and farmers will provide information on performance of cultivars in their areas of operations, suitability for their client farmers, food security impacts – both positive and negative, accessibility of improved varieties and knowledge of cultural practice and collaboration with and support from IITA and other local partners. They will also provide a perspective from partners with varying degrees of involvement with program activities, e.g., some have participated in training sessions, while others have not. WFP, Title II PVOs and others will provide insights on the distribution and characteristics of food insecurity within the region, the role of cassava in household food-security strategies and the food-security impacts of CMD. They will also be able to assist in identifying food-insecure populations not supported through this OFDA program. Fieldwork will concentrate in the Lake Victoria Region where the CMD pandemic originated and is concentrated. Focusing on this region will also facilitate access to all three countries.

## Questions to Be Addressed Through Interviews

The questions presented here should be viewed more as themes rather than verbatim interview questions. They serve to frame the interview and guide the interviewer. Interviews will not be limited to these questions. It is expected that questions will evolve as the document review and fieldwork progresses.

### *IITA and Immediate Collaborators*

*(Questions will attempt to elicit IITA's perception of its role and relationship to partners, partners' roles and capacities, food-security issues surrounding CMD, farmer priorities, sustainability of results and next steps)*

- How were the program objectives and research agenda defined?

- Who participated in the planning and who participates in reviews (IITA, NARO, MOA, PVOs, farmers, etc)?

- What are the food-security impacts of CMD and how are farmers coping with these impacts? What impact has this program had on the situation?

- Besides CMD resistance, are their other key traits or characteristics of the cassava plant that form part of the research agenda (e.g., leaf quality, quick maturation, in situ storage life, taste, etc)? How were these traits or characteristics selected?

- How do you measure success? What are your indicators and how do you collect this information? Is food security one measure of success and, if so, how do you measure this?

- Which components of the program (monitoring, development of resistant varieties, training, multiplication, etc) have been or less successful and why?

- What are the necessary complementary activities or services (e.g., multiplication and distribution, extension, etc) required to support this program, eradicate or control CMD within the region and ensure sustainability of program results? Do these activities and services exist and are they effective? What are the next steps for this program and the overall effort to address CMD in these three countries?

- Why is the work in Uganda considered "complete" or the program closing down? What do you feel is needed as a follow-on to this program in Uganda?

***Title II PVOs and WFP***
*(Questions attempt to elicit perceptions of food-security issues over the entire country and region and whether the program is addressing a priority)*

- Where are the most food insecure areas in the country, who are the most food insecure and what are the basic factors underlying that food insecurity? What are the food security priorities for this country and the specific areas of food insecurity?

- Which food insecure or vulnerable populations are served by this program and how?

- Which food insecure or vulnerable populations are not served or negatively effected by this program and why? How could the program serve these populations better?

***Title II PVOs, WFP, MOA extension agents and farmers***
*(Questions attempt to elicit the perceptions of farmers and agents who have direct contact with farmers and identify whether the program is addressing a priority food-security concern and how effectively)*

- What are the food-security impacts of CMD and how are farmers coping with these impacts?

- Do the IITA cultivars meet farmers' and households' preferences and needs? How or why not?

- How important is cassava to farmers and households compared to other crops and livelihood strategies, as an overall strategy and as a coping mechanism or survival strategy? How does CMD and new varieties affect or alter this role (i.e., what has been the impact of CMD and the introduction of new varieties)?

- What are farmers' and households' primary constraints in the effective adoption of CMD resistant varieties (e.g., availability or access to material, inputs, knowledge, cultural practices, etc)? Does the program address these primary constraints? What could be done to strengthen desired program outcomes (e.g., greater adoption, limited resurgence of CMD, etc)?

- What are the necessary complementary activities or services (e.g., multiplication and distribution, extension, etc) required to support this program, eradicate or control CMD within the region and ensure sustainability of program results? Do these activities and services exist and are they effective? What should be the next steps for this program and the overall effort to address CMD in these three countries?

**Field Work Time Frame**

July 31 through August 19, 2004. See attached schedule for details.

# ANNEX 3

# LIST OF KEY INFORMANTS

| Name | Position | Organization, Location |
|---|---|---|
| | District Agriculture and Livestock Officer | MOA-Biharamulo, Tanzania |
| | Farmer Training Center | Busia, Kenya |
| Adolph, Barbara | Social Development Specialist | NRI, UK |
| Amevet, Justine | Cassava Program Technician | NAARI, Uganda |
| Amour, Rahila | Agricultural Field Officer | ARI-Ukiriguru, Tanzania |
| Auhulo, George | Farm manager | FTC, Busia, Kenya |
| Awunga, Florence U | Training Officer | FTC, Busia, Kenya |
| Bahemm, George | District Extension Officer | Ngara, Tanzania |
| Bajora, Mr | Stem multiplication nucleus nursery | NPA, Nyakahura, Tanzania |
| Bajore, Marco | Project Officer | NPA, Ngara, Tanzania |
| Barungu, Hashimu | District Extension Officer | MOA-Tarime, Tanzania |
| Bell, Allan | Humanitarian Program Coordinator | Oxfam, Uganda |
| Bigiriamana, Simon | CMD Program Coordinator | ISABU, Burundi |
| Bua, Anton | Head of Cassava Program | NAARI, Uganda |
| Chirimi, Baker | District Agriculture and Livestock Officer | MOA-Llemela, Tanznia |
| Christian, Julieta | Project Coordinator | NPA, Ngara, Tanzania |
| Contract farmer | Stem multiplication | Nsunga, Tanzania |
| Contract Farmer | Multiplication | Nsunga, Tanzania |
| Danley, Cheryl | Resident Representative | Africare, Tanzania |
| Director, Igabiro Agriculture Training Center | Stem multiplication | Ngara, Tanzania |
| Farmer | Production | Kuria, Kenya |
| Farmer Group | Kocholya Food Production Group | Amagoru, Teso, Kenya |
| Farmer Group | Siwongo Irrigation Scheme Self-Help Group | Busia, Matayos, Kenya |
| Farmer group | Stem multiplication | Muleba, Ngenge Ward, Tanzania |
| Farmer group | Stem multiplication | NPA, Kwavia, Tanzania |
| Farmer group | Stem multiplication and on-farm trial | Murumono, Tanzania |
| Farmer group | Stem multiplication | Songambele, Tanzania |
| Farmer group | Mother Baby trial | Matayos, Western, Kenya |
| Farmer group | Stem multiplication | Rachuonyo, Nyanza, Kenya |
| Farmer Group | Stem multiplication | FTC, Busia, Kenya |
| Farmer Group | Stem multiplication | Gamalenga, Kenya |
| Farmers | Stem multiplication | Masaka, Uganda |
| Farmers | Stem multiplication | Misenyi, Uganda |
| Farmers | Production | Igombe, Tanzania |
| Farmers | Production | Nyanza, Kenya |
| Farmers | Stem multiplication | Teso, Kenya |
| Farmers cooperative | Stem multiplication and cassava root processing | Rakai, Uganda |
| Feibig, William | Agriculture Advisor, Food Security Unit | SCF-US, Washington, DC |
| Fermont, Anneke | Agronomist | IITA-ESARC |

| Name | Position | Organization, Location |
|---|---|---|
| Geita Crops Officer and extension staff | Stem multiplication | Butundwe Prison, Tanzania |
| Gwang, Tabitha | District Crops Officer | MOA-Nyanza, Kenya |
| Jaribu Women's Group | Stem multiplication and cassava processing | Kajulu, Kenya |
| Jeremiah, Mr | District Crops Officer | MOA, Musoma, Tanzania |
| Jitahidi Women's Group | Stem multiplication and cassava processing | Kisumo, Western Province, Kenya |
| Kaba, Mahawa | VAM Officer | WFP, Burundi |
| Kanyangesu, Hezekiah | District Extension Officer | MOA-Musuma, Tanzania |
| Karayeija, Fred | Program Manager | AVSI, Uganda |
| Katabalwa, Charles Kenneth | Monitoring and Evaluation Specialist | CEDO, Rakai, Uganda |
| Keny, Salome | Jitahidi Women's Group | Vihiga, Kenya |
| Kibari, Tayphon | Head of Crops Program | ARI-Ukiriguru, Tanzania |
| Kileo, Robert | Zonal Research Coordinator | ARI-Ukiriguru, Tanzania |
| Kimambo, Heidi Mafikia | Zonal Coordinator, HIV/AIDS | WV, Lake Zone-Makura, Tanzania |
| Kintu, James | | Action Aid, Uganda |
| Kocholya Food Production Women's Group | Stem multiplication and cassava processing | Amagera, Teso, Kenya |
| Laker-Ojok, Rita | Executive Director | AT/Uganda |
| Legg, James | OFDA CMD Program Coordinator | IITA-ESARC |
| Luyimbazi, C David | Agriculturist | Rakai, Uganda |
| Luyimbazi, C. David | Agriculturist | MOA-Rakai, Uganda |
| Marando, EF | Breeder | ARI-Maruku, Tanzania |
| Maryanne, Apok | Cassava Program Socio-Economist | NAARI, Uganda |
| Mayiga, Rosemary | Program Coordinator | CEDO, Rakai, Uganda |
| Mazta, Johnson | District Extension Officer | MOA-Serengeti, Tanzania |
| Meket, Phillip | District Crops Officer | MOA, Western, Kenya |
| Mitengo, Vincent | Project Coordinator | WV, Lake Zone, Tanzania |
| Muklua, Valeria Mutenyo | Sinoko Noibeekelema Self-Help Group | Bonguma, Kenya |
| Murphy, Emmet | Grants & Development Manager | ACDI/VOCA, Uganda |
| Mutanga, Ernest | National VAM Officer | WFP, Uganda |
| Mutengu, Andrew Keith | Representative | FEWSnet/Uganda |
| Muyesu, CC | District Agriculture Officer | Bungoma, Western, Kenya |
| Mwebesa, Beda | | CARE, Uganda |
| Nagawagala, Mr | Stem multiplication nucleus nursery | NPA, Nyakahura, Tanzania |
| Namyange, Marie Claire | Head of Cassava Program | ISAR, Rwanda |
| Nankam, Claude | Agriculture Officer | WV, Washington, DC |
| Ndolo, Phillip | Tuber crops | NARI-Kakamega, Kenya |
| Ndyetabura, I | District Agriculture and Livestock Officer | Ngara, Tanzania |
| Ngawagalla, Bruno | Ward Agricultural Extension Officer | MOA, Nyakahura, Biharamulo, Tanzania |
| Ngendello, Theresia | Post Harvest | ARI-Ukiriguru, Tanzania |
| Nicodem, Mr | Stem diffusion | MOA-Muleba, Ngenge Ward, Tanzania |
| Ntawuruhung, Pheneas | Coordinator | EARRNET, IITA, Kampala |
| Obiero, Hannington M | Researcher | NARI-Kakamega, Kenya |
| Obora, Calebobute | District Crops Officer | MOA-Western, Kenya |
| Odongo, Omari Mumani | Centre Director | KARI-Kakamega, Kenya |
| Omondi, Hellen | District Crops Officer | Migori, Kenya |

| Name | Position | Organization, Location |
|---|---|---|
| Omoni, Hellen | Crops Officer | Migori, Kenya |
| Ongwae, Susan | District Home Economics Officer | MOA-Nyanza, Kenya |
| Opio, AFN | Director of Research | NAARI, Uganda |
| Oroma, Lawrence | Monitoring and Evaluation Specialist | WV, Kampala |
| Orwa, Atieno | Contract farmer | Migori, Kenya |
| Owar, Betty | Researcher | IITA-ESARC, Kampala |
| Oyena, Diana | Cassava Program | NAARI, Uganda |
| Pakkala, Timo | National VAM Officer | WFP, Kenya |
| Pallangyo, Anael | National TSACCOS Coordinator | TSACCOS, Tanzania |
| Prison Warden | Multiplication | Kitengule Prison, Tanzania |
| Prison Warden | Stem multiplication | MOA-Biharamulo, Tanzania |
| Powers, Laura | Agriculture Specialist | OFDA/USAID, Washington, DC |
| REDESO staff | Stem valuation and multiplication nursery | Kabaheshi, Tanzania |
| Remington, Tom | Regional Agriculture Advisor | CRS/EARO, Nairobi |
| Rwegasira, Mr | District Crops Officer | MOA, Tarime, Tanzania |
| Rwekiza, Jojiana | Agricultural Extension Officer | MOA-Muleba, Ngenge Ward, Tanzania |
| Rweyemamu, Mr | Stem multiplication | REDESO, Kabaheshi, Tanzania |
| Rwiza, Elizabeth | Agricultural Field Officer | ARI-Ukiriguru, Tanzania |
| Sassi, SOY | Regional Agricultural Advisor | Mwara, Tanzania |
| Sonoko, Julius | District Crop Officer | MOA-Tarime, Tanzania |
| Sperling, Louise | Researcher | ICRASAT/Rome |
| Stanslaus, Desbert | District Agriculture and Livestock Officer | Ngara District Council, Ngara, Tanzania |
| Tewolde, Michael | Northern Province Coordinator | CRS, Uganda |
| Theophil, Mr | Stem multiplication and experimental field farmer | Muleba, Ngenge Ward, Tanzania |
| Timony, Kaare S | Agricultural Field Officer | ARI-Ukiriguru, Tanzania |
| Toroka, Suleman R | Project Leader, Land Rights Project | NPA, Dodoma, Tanzania |
| Wabwile, Electine | District Crops Officer | MOA, Bungoma, Kenya |
| Wambuwa, MW | Cassava Program | KARI-Alupe, Kenya |
| Warmara, Marco | Program Coordinator | Africare, Tanzania |
| Werc, Alice | Cassava Program | KARI-Alupe, Kenya |
| Wille, Loren | Head of Programming | CRS, Uganda |
| Women's Group | Cassava processing | Nyanza, Kenya |

# ANNEX 4

## SITES VISITED*

| Uganda | Tanzania | Kenya |
|---|---|---|
| Rakai District | Kegara Region | Nyanza Province |
| Masaka District | Mwanza Region | Western Province |
| | Shinyanga Region | |
| | Mara Region | |

* More detail is provider on the list of key informants.

# ANNEX 5

## Most Important Energy Food Crops by Crop and District, KENYA

| *CROPS* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***DISTRICT*** | **Cassava** | **Maize** | **Sorghum** | **Finger Millet** | **Sweet Potato** | **Rice** | **Arrow Roots** | **Bananas** | **Irish Potatoes** |
| Bondo | 4 | 1 | 2 | 3 | 5 | - | - | 6 | - |
| Bungoma | 4 | 1 | 6 | 5 | 3 | 8 | 7 | 2 | - |
| Busia | 2 | 1 | 3 | 6 | 4 | 8 | 7 | 5 | - |
| Butere | 3 | 1 | 4 | 7 | 5 | - | - | 8 | - |
| Homa Bay | 4 | 1 | 2 | 8 | 3 | 5 | 7 | 6 | - |
| Kakamega | 5 | 1 | 7 | 6 | 4 | - | 8 | 3 | - |
| Kisumo | 5 | 1 | 2 | 3 | 4 | 7 | 8 | 6 | 9 |
| Kuria | 1 | 4 | 3 | 2 | 5 | - | 7 | 6 | 10 |
| Lugari | - | - | - | - | - | - | - | - | - |
| Migori | 3 | 1 | 2 | 5 | 4 | 7 | 10 | 6 | 8 |
| Mt. Elgon | 6 | 1 | 8 | 7 | 5 | - | 9 | 3 | 4 |
| Nyando | 5 | 1 | 2 | 8 | 4 | 3 | 6 | 7 | 9 |
| Rachuonyo | 4 | 1 | 2 | 6 | 3 | 7 | 8 | 5 | - |
| Siaya | 3 | 1 | 2 | 6 | 4 | 5 | 9 | 7 | - |
| Suba | 3 | 1 | 2 | 5 | 4 | - | 7 | 6 | - |
| Teso | 4 | 2 | 3 | 1 | 5 | 6 | 7 | 9 | 8 |
| Vihiga | 5 | 1 | 3 | 6 | 4 | - | 8 | 2 | 7 |
| **Total** | **61** | **20** | **53** | **84** | **66** | **56** | **99** | **83** | **55** |
| **Mean** | **3.81** | **1.25** | **3.31** | **5.25** | **4.12** | **6.22** | **7.07** | **5.19** | **7.86** |
| **Rank** | **3** | **1** | **2** | **6** | **4** | **7** | **8** | **5** | **9** |

Source: IITA (1999). "First Quarterly Technical Report: Phase 1." Kampala, IITA.

## ANNEX 6

## SUMMARY OF CMD PROGRAM SERVICES AND OUTPUTS

### Multiplication of CMD-Resistant Varieties (stems)*

| Country | 1999/2000 | 2000/01 | 2001/02 | 2002/03 |
|---|---|---|---|---|
| **Kenya** | 150,000 | 5,900,000 | 6,000,000 | 13,080,000 |
| **Tanzania** | 50,000 | 1,200,000 | 4,400,000 | 2,405,400 |
| **Uganda** | 150,000 | 2,500,000 | 2,370,000 | 3,200,000 |
| **Burundi** | | | | 125,000 |
| **ROC** | | | | 70,000 |

*Targets were generally exceeded. Agroclimatic conditions were main intervening factors. The Kenya 2001/02 target was not achieved because hailstorms destroyed 17 ha of land planted for cassava multiplication. Also in 2001/02, Tanzanian stem production was affected by soil infertility and moisture stress. There was a shortfall in Tanzania In 2002/03.due to drought.

### CMD PROGAM – Kenya Achievements Since 1997:

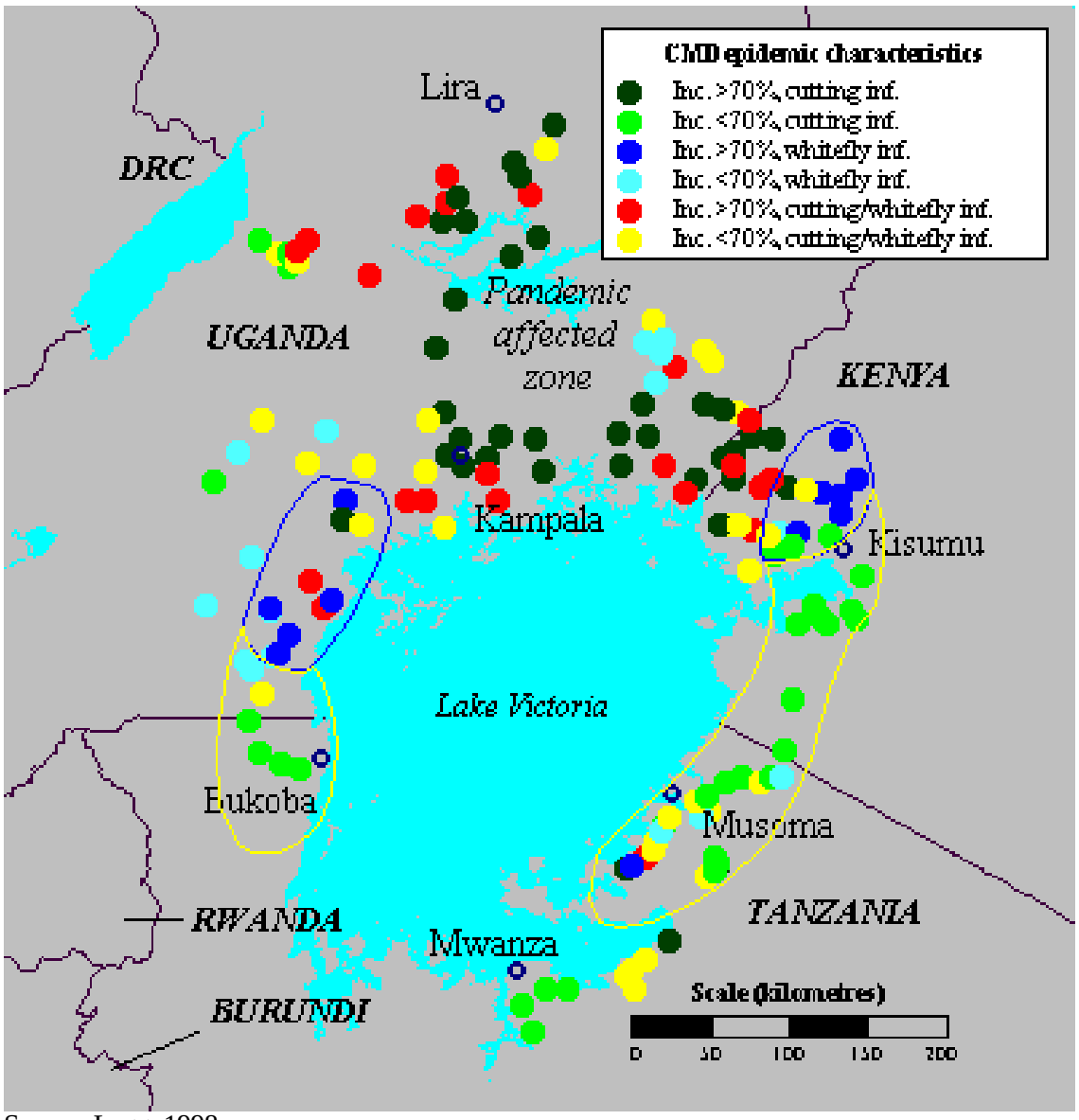
- 14,000 clones introduced, 15 chosen for release, multiplication and distribution.
- 35 million mini stems supplied to farming communities in Western Kenya from primary multiplication – enough to establish 3,500ha (since 1998).
- 4 secondary multiplication sites of 99ha established in 17 districts in Western Kenya
- An Estimated 18,000 ha under improved cassava
- More than 300,000 HH in Western Kenya are growing improved cassava varieties
- 4 women's groups in 4 villages have processing units
- Over 70 percent of farmers at the back (in the shadow of) and 10 percent in the front of the pandemic have adopted improved varieties
- 10,000 stakeholders engaged in the program
- 1,000 stakeholders have been trained in processing and utilization
- 22,172 ha of tertiary stem multiplication in Western Province (from 2001 – 2004). A little over 50 percent of the area is in improved varieties.
- 6,242 ha of tertiary stem multiplication in Nyanza Province.
- The area, yield and production of cassava have increased for Katamega, Bungoma and Busia Districts of Western Province from 1990 to 2000.

Source: KARI, 2004

## ANNEX 7

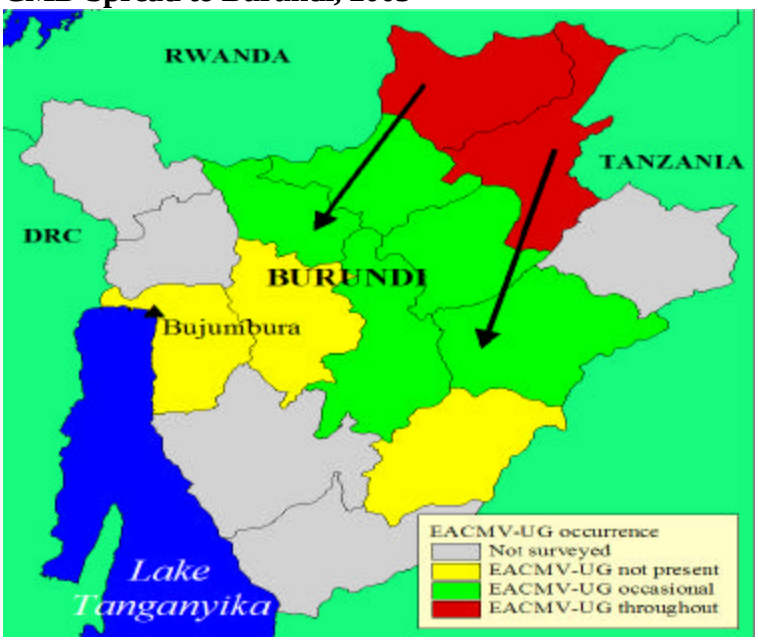
## MAPS OF CMD SPREAD

### CMD Spread Through Uganda, Kenya and Tanzania, 1998



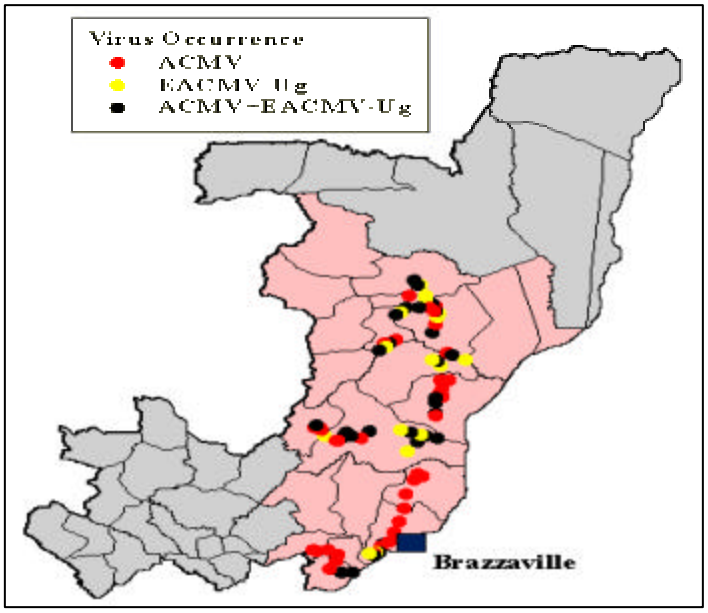

Source: Legg, 1998

**CMD Spread to Burundi, 2003**




Source: Owor and Legg, 2004

**Occurrence of CMD (by strain) in ROC, 2002**




Source: Owor and Legg, 2003

# ANNEX 8

# REFERENCES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