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Solutions for the Smallholders of Uganda

Uganda is a country in eastern Africa that is slightly smaller than Oregon. The total area of Uganda is 241,038 sq Kilometers with 197,100 sq Km of land and 43,938 sq Km of water. 21.57 percent of the land consists of arable land while 8.92 percent is permanent crops. Other uses of the land occupy 69.51 percent of it. Only 90 sq Km of this land is irrigated.

The population of Uganda is 32,369,558 people. The average family has eight people. Families generally provide their own food by growing it. Women typically provide over half of the labor force in the agricultural field. They usually focus on crop production for food rather than using it for income purposes. The life expectancy for the average person is 52.72 years old. Life expectancy is low due to AIDS and high mortality. The urban population of Uganda is thirteen percent of the total population. The labor force is divided up between agriculture at 82 percent, industry at five percent, and thirteen percent in services. Thirty five percent of Uganda lives below the poverty line.

Uganda's average farm size is a little over one hectare. Typical crops grown in Uganda are maize, bananas, cassava, sorghum, millet, beans, coffee, and potatoes. The major barriers that prevent them from improving agricultural productivity are poverty, the lack of education and resources.

A variety of problems from diseases strike the cassava plant. Cassava mosaic disease and cassava brown streak disease are two diseases that have troubled many Uganda families for years now. Cassava is a tuber that grows below the ground. It is very high in carbohydrates in the form of starch and calcium. The root that is harvested is one to seven centimeters wide and fifteen to thirty centimeters long. Before the roots are cooked to be eaten they contain a deadly amount of cyanide, especially during years of drought. Cassava is very important in Uganda because it grows very well in acidic soils and during a drought. Since it grows so easily, farmers below the poverty line often grow it. There is a better chance of getting a crop in poor soil conditions and bad climate conditions. It also does not need to be harvested right away and it can stay in the ground until there is a need for it, but most are harvested eight to twelve months after harvesting. The root can stay in the ground for a time of up to three years. This helps to provide for a family even during drought years when maize has dried up. A family can fend off starvation with cassava root. An advantage of this crop is that it tolerates poor management. A farmer can be too sick from malaria to tend to his crop and his crop still survives.

Cassava is a large staple of the world's diet. Over 70 million people in the world eat more than 500 calories per day while 500 million eat around 100 calories per day. In Africa the importance of cassava is even more compared to the rest of the world. Africans eat on average 80 kilograms/capita a year while other countries consumption is seventeen kilograms/capita. In Uganda cassava provides a majority of calories for a family. Typically it provides 13 percent of daily caloric intake. Certain regions of the country consume from 25 to 70 percent of their calories from cassava. This crop provides important carbohydrates, protein, calcium, starch and vitamins A and C. Malnutrition is a problem in Uganda's population and the mosaic and brown streak diseases are ruining valuable crops that families rely on for basic food supplies, let alone the nutrition that cassava has for the families.

The typical farmer hopes to provide enough food for his family and to make a meager living. Subsistence farmers with poor soil, markets and technology farm with low input cassava farming. This exposes them to pest and disease problems because of the lack of preventative agricultural practices. Resources for

fighting the pests and diseases are not used. Since the farmers are using low input methods they have been hit especially hard in central Africa with the Africa Cassava Mosaic Virus Disease (ACMV) and the Cassava Brown Streak Virus (CBSV). The major pests that also affect cassava plants are mealybugs, hornworms, and whiteflies which transmit the two viruses. With crops being hit so hard with the virus, excess crops are not available to be sold for extra income. Other problems the farmers face are the lack of infrastructure and markets to sell products that would increase household income. The condition of rural roads is poor. During rainy seasons some roads are impassable at times. If investments were made to improve the quality, better market conditions could exist. With the diseases under control, a family would have access to better nutrition and well being and have a better quality crop to sell. This would lead to extra income, and a better quality of life for the family.

Cassava mosaic disease was first found in 1894 in the country of Tanzania. It was later found in the countries surrounding it. The estimated losses of cassava to the mosaic disease are from 15- 24 percent which equals 15 to 28 million tons. Studies have shown there are four different strains of the virus, the African mosaic virus, the east African cassava mosaic virus, Indian cassava mosaic virus, and the South African cassava mosaic virus. There are reports that there is a hybrid between the African mosaic virus and the east African mosaic virus. This strain seems to be more damaging than the others. Some symptoms for cassava mosaic disease are twisted misshapen leaves and yellow areas that are separated between normal green ones, which then causes the plant to be stunted. The yellowish color is usually around the base of the leaflets. Each plant that has cassava mosaic may look different because of temperature, soil quality and host plants health.

Since farmers use low input cassava farming methods, cassava mosaic disease is easily transmitted. Farmers do not use fresh disease free stem cuttings, they just use what they have and later on if their cuttings were not disease free they have a higher risk of getting mosaic disease. This can also lead to putting the virus in new areas that have little to no whiteflies spreading disease. Education is vital to the success in overcoming the problems that the diseases cause. Families need to have access to learn of the programs and how they work in order to overcome this problem. Many organizations are setting up test programs with small groups of farmers and educating them on the importance of proper agricultural practices.

The best way to control mosaic disease is to select cuttings that show no mosaic disease symptoms. However problems arise when drought damages the leaves causing the leaves to look like they are affected while they actually are not. Another problem is when there is too much zinc in the soil and it discolors the leaves, and under educated farmers believe they have the disease when they actually do not.

Through the efforts of many organizations, research facilities and governments, great strides are being made. It will take many years of research and education to resolve this problem. Partnerships among many non governmental organizations and scientists are creating a network of partners. Much work will need to be done just to educate the farmers of effective measures to take to prevent further spread of the diseases. Public information campaigns and one on one work with the farmers will hopefully help to control the disease.

Researchers are hoping that biotechnology is the answer for many of the problems with cassava mosaic disease. Dr. John Wafula, head of biotechnology research at the Kenya Agricultural Research Institute, stated that "The need for biotechnology in Africa is very clear. The use of high yielding, disease-resistant and pest-resistant crops would have a direct bearing on improved food security, poverty alleviation and environmental conservation in Africa." Some of the research done on cassava is geared towards creating varieties that have better starch quality and more beta-carotene and minerals. They also hope to develop the plant to better absorb the micronutrients and trace metals from the soil. Science and technology continue to advance in the fight to lessen world hunger. While research programs work on growing clean

cuttings and new varieties for farmers, much work is needed after that. The local farmers need to be educated about the advantages of the new varieties.

Researchers realize that teams of many different branches of science need to be involved. Since the white fly and other pests spread the disease, entomologists are needed for the benefit of the programs. Pest management is vital for success. To have better results in biological pest management, biotech labs and other areas of science need to work together. The collaboration and commitment of these groups of scientists are leading to unconventional biocontrol methods. The exchange of information among the different fields provides successful research collaboration. Agronomists, genetic researchers and other scientists have created an amazing worldwide team. Many NGO'S, universities and other entities have helped fund these groups. These agencies have a great respect for each other and trade any information with others in hope of finding another break through. Mr. Shakeel Bhatti, Secretary of the International Treaty on Plant Genetic Resources for Food and Agriculture states, "Plant genetic resources are fundamental to combat hunger. In the case of a disease like CMD, or challenges such as climate change, it is genetic diversity that counts, because it provides the means to adapt to change. Therefore it is extremely important to conserve agricultural biodiversity and work together to make genetic resources available to farmers and researchers in all continents."

Major items that need to be addressed in research and partnerships are:

- ★ improved growing, harvesting, processing and conservation practices
- ★ the ability to supply clean, healthy cuttings to farmers
- ★ public awareness of the programs and participation in them
- ★ management of the disease

While much work is done in laboratories and research fields, some farmers are seeing first hand the new varieties. A new three year project in Katine, Uganda had farmers harvesting their first crop of a disease resistant, high yielding variety in 2009. This new variety is longer and bigger than the usual strain they plant - the Nigeria strain. This project was a partnership between the Africa Medical and Research Foundation and Farm-Africa. Farm-Africa provided assistance with the technical aspects of farming. Eighteen groups of farmers were trained in 2008. They each were given stem cuttings and planted a demonstration garden. The new, improved variety must remain in the ground for one year. Some older varieties could be harvested after eight months. The harvest yielded great results. The farmers were surprised with the larger tubers. While the test variety requires more field work, plowed fields with straight rows, it is showing benefits. The old varieties could be planted any way they wished. Farmers were replanting cuttings shortly after harvesting them. Some of the groups wanted to sell some tubers for income but they decided against that. With famine in the area it was decided it was best to keep it for them. Some of the goals were to have availability to food, and to plant more cuttings to share with neighbors next harvest. One of the problems that arise with these programs, is the funding it takes to create it and finding future funding. While it will take years, the new varieties will slowly get to more farmers.

Another success story is the collaboration between the USAID, The International Institute for Tropical Agriculture (IITA) and the National Agricultural Research Organization (NARO). This team developed disease-resistant cassava varieties. They supplied farmers that had lost all of their cassava with new cuttings. The PL 480 Title II Food Aid Program resulted in great production increases. The target area in Uganda saw 700,000 million tons produced currently compared to 1,000 million tons in 1997.

A typical family needs to have improved cuttings to plant to survive. While work is being done, it is not nearly fast enough. Some young children do not attend school, but they stay home to fish, hoping to catch something to eat or sell. Reasons for staying home from school range from lack of food to take for lunch to lack of money to pay for tuition. If crops are healthy enough to sell, extra income is made. Some

markets for cassava have dropped to low levels because of fear of buying infected stock, while other food prices have increased. Malnutrition is on the rise among children. I feel that the situation is slowly improving because of programs at work. In the Great Lakes Region (which includes Uganda) over 500,000 households have received new cuttings to plant just in one program. Farmer Field Schools have trained over 2,000 farmers with the skills and know how to produce plants and identify disease symptoms.

One of the major issues that hamper the fight against the diseases is the fact that there really is no border check or quarantine on the sale or transfer of roots from one country to the next. Many infected roots are brought over the borders and transmit the diseases further. Countries do try to impose quarantine orders but have little success in enforcing them. Many refugees move across the borders and many men move to urban areas in hopes of better employment. Some people feel that climate change has brought more droughts to the area. With a drought a family typically has cassava to rely on, but that has all changed with the onset of the diseases. The lack of markets and infrastructure in rural areas only contribute to the family's inability to earn a living and provide for their family.

There are several recommendations to help the families of rural Uganda. First and foremost research must be continued in biotechnology. High priority should be given to disease resistance, better nutritional value and storage life. The ability to resist pests would also be at the top of the list. With the transfer of disease due to pests, this would greatly reduce the problems encountered. Continued sharing of findings between researchers world wide will only accelerate new findings. Cassava mosaic disease has been found around the world and many teams are working toward the hope of new disease resistant varieties. Regional coordination among agencies working on this is vital. Everyone needs to help others.

The lack of funding for programs is a major problem. Hopefully with participation with others, researchers may be able to gain some ground. Distribution of clean cuttings of new varieties in a timely fashion is critical. Regional extension offices can team up with other agents and farmers to educate them of the disease and the impact that it has on their crop. The farmers need to learn of proper field sanitation to prevent further spread of CMD. The implementation of educational programs is very important to the future of cassava production. The development of training aids and materials is critical to educating farmers of the skills needed to properly grow cassava and identify problems in the field. Explanation needs to be given regarding the research done and the difference on the new varieties and their traits compared to the old ones.

Collaboration among the many organizations and companies is vital. An advantage that this brings is each partner is able to bring their strong points to the table. Building on the strengths of others will only introduce new growth and advances in research to control this problem. If lab researchers have information from the regional staff in the field, it only helps production. When one group is able to handle the technology, one the markets, one the education, then work is more effective. International collaboration will help the spread the knowledge of others, therefore enriching all involved right down to the local farmer. A key issue is the continuation of funding the research that will provide improved crop varieties. Funds must be found internationally, many regional programs depend on this.

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