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NATIONAL PLAN TO PRODUCE AND TRANSFER POSTHARVEST TECHNOLOGIES UNDER THE POSTHARVEST HANDLING AND STORAGE PROJECT (KARI) IN UGANDA

Prepared for

Postharvest Handling and Storage Project (KARI)
Mississippi State University

by

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November 1998

University of Idaho
College of Agriculture

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Acknowledgements

Dr Tom Trail is grateful to all of the persons listed in Appendix C who took time to meet with him and share their insights, knowledge, concerns, and suggestions

Dr Trail especially wishes to thank Dr Silim Nahdy, Director of Kawanda Agricultural Research Institute (KARI), and his staff for their suggestions and recommendations which contributed towards the development of the Plan Direct contact and interviews with the Postharvest and Storage Project/Agricultural Non-Traditional Export Promotion Program (PHHS/ANEPP), primary beneficiaries of the Project, enabled Dr Trail to directly observe the positive impact of the Program (note Case Study No 1) in increasing incomes and adding value to farmers' crops

Special thanks goes to Victor Ogwang and Margaret Angom, District Postharvest Subject Matter Specialists Their grassroots level work with farm organizations and farmers in transferring postharvest technology is impressive

Dr Trail also would like to thank Dr Ulysses Acasio, Project Leader PHHS unit, who provided transportation and logistical support for the consultancy His project leadership has greatly contributed to the success of the Project

Dr Tom Trail
Consultant, Postharvest Institute for Perishables

Contents

Acronyms

AAO	Assistant Agricultural Officer
ACDI	Agricultural Cooperative Development International
ADC	Agricultural Development Center of the IDEA Project
ADO	Agriculture Development Officer
AEATRI	Agricultural Engineering and Appropriate Technology Research
AEP	African Project Development Project (WB)
ANEPP	Agricultural Non-Traditional Export Promotion Program
APACTI	APAC Technical Institute
APDF	African Project Development Facility
ATU	Appropriate Technology Uganda
CAAS	Cooperative Agriculture Association Systems
CAO	Chief Agricultural Officer
CEI	Commodity Exports International
CIAT	Centro Internacional de Agricultura Tropical
COMESA	Common Market for Eastern and Southern Africa
DAO	District Agricultural Officer
DANIDA	Danish International Development Agency
DFI	District Farmers Institute
DPO	District Production Officer
EPED	Environmental Protection and Economic Development
EEC	European Economic Community
EEU	European Economic Union
EU	European Union
FAO	Food and Agricultural Organization
FFGI	Food and Feed Grains Institute
FOSEM	Food Security and Marketing Project of ACDI
FOSRI	Food Science Research Institute
GAHI	Greater African Horn Initiative
GOU	Government of Uganda
IDEA	Investment in Developing Export Agriculture
IGADD	Inter Government Authority for Drought and Development
KARI	Kawanda Agricultural Research Institute
KSU	Kansas State University
LOP	Life of Project
MAAIF	Ministry of Agriculture, Animal Industry, and Fisheries

MDA	Maruzi Development Association
MIT	Ministry of Industry and Trade
MNS	Marketing News Service
MSSGA	Masindi Seed and Grain Growers Association
MSU	Mississippi State University
MTEA	Multi-Purpose Training and Employment Association
NARI	Namulange Agricultural Research Institute
NARO	National Agricultural Research Organization
NTAE	Non-Traditional Agricultural Exports
NGO	Non-Governmental Organization
PCV	Peace Corps Volunteer
PH	Postharvest
PHP	Postharvest Program
PHHS	Postharvest and Storage Project
PHSMS	Postharvest Subject Matter Specialist
PHTT	Postharvest Technology Transfer
PIP	Postharvest Institute for Perishables
PRESTO	Private Enterprise Support Training & Organizational Development Project
s	Uganda shillings (1300s to US$1 00)
TA	Technical Assistance
TOT	Training of Trainers
UCA	Uganda Cooperative Alliance
UAES	Uganda Agricultural Extension Service
UCCU	Uganda Central Cooperative Union
UCFA	Uganda Commerical Farmers Association
UMA	Uganda Manufacturing Association
UNDP	United Nations Development Program
UNFA	Uganda National Farmers Association
UOSPA	Uganda Oil Seed Processors Association
UPFA	Uganda Progressive Farmers Association
USP	Uganda Seed Project
WB	World Bank
WFP	World Food Program
VB	Village Bank
VOCA	Volunteers in Overseas Cooperative Assistance
USAID	U S Agency for International Development

Executive Summary

Introduction

Dr Tom Trail, University of Idaho Postharvest Institute Program Consultant, was requested to develop a sustained plan to deliver the developed technologies to the end-users in Uganda The requested plan is built on the critical mass that has been generated by government programs and enhanced by donor funds on postharvest loss prevention and income generation activities, which is developed in conformity with the decentralized extension service in Uganda

The specific objectives of the consultancy were

1 Identify production, consumption, and marketing statistics on cereal grains and oil seeds in Uganda

2 Identify major causes of postharvest losses in cereal grains and oil seeds in Uganda and how they are being addressed by stakeholders

3 Assess technology transfer capabilities of major players in the cereal grains and oil seed industries such as those in the private sector, research institutes and Non-Governmental Organizations (NGOs)

4 Inventory relevant technical skills and farm equipment manufacturers in Uganda

5 Identify available credit programs in support of improved production and postproduction technologies in Uganda

6 Write a decentralized, attainable, and sustainable plan to produce and deliver the required postharvest technologies to the end-users

Dr Trail reviewed relevant project documents He visited four of the target districts and met with the major stakeholders including district officers of the recently decentralized extension service In addition, Dr Trail met with KARI researchers, NGO, and private sector representatives

Major Postharvest Constraints and Losses in Cereal Grains and Oil Seeds in Uganda

Postharvest losses range as high as 30% for maize, and losses for beans, soybeans, and sunflowers vary from 10-20% These represent major losses, not only for the farmers, but Uganda as well In addition, some of the postharvest losses can be counted in the poor quality products that are sold to traders and millers The MTEA Project in the Iganga District in maize production teaches farmers to reduce postharvest losses through improved drying techniques utilizing the dryers developed by the PHHS KARI unit The improved quality maize results in an added 15s /kilo price to the farmer Several farmers interviewed in the Iganga District reported making

100,000s (Uganda shillings=1300s to US$1 00) profit by adopting the new multi-purpose dryer postharvest technology

A number of improved postharvest technologies and techniques for low value added crops has been introduced by the PHH KARI Unit The most impressive technology at this time is the dryer Over 100 dryers have been built Strong technical assistance support is provided by extension at the district level with the Postharvest Subject Matter Specialists (PHSMSs) Field workers from Uganda Cooperative Alliance (UCA), ATU, Uganda National Farmers Association (UNFA), Uganda Oil Seed Processors Association (UOSPA), and several NGOs work closely with the District Specialists and the researchers at KARI

Relevant Technical Skills of Farm Equipment Manufacturers in Uganda

The KARI/PHH Unit has obtained promising maize and bean postharvest technologies from IARCs, foreign universities, and private companies These technologies have been tested and modified under approved technology protocols The development of the multi-purpose convection dryer is a promising innovation Over 100 dryers have been built More than 2,000 maize hand shellers have been purchased by farmers Dryers, cleaners, and agroprocessing equipment have also been introduced into the private sector

The KARI/PHH has successfully worked with private sector millers in installation of dryers and cleaners These technologies have been adopted Four farm equipment manufacturing companies have built prototype postharvest technologies The PHHS unit has also trained local artisans to build multi-purpose dryers

Technology Transfer Capabilities of the Major Stakeholders

Building up the postharvest capacity of Uganda's human resources of agricultural professionals, field workers, and farmers is critical if the target to reduce postharvest losses, improve food quality, and improve farm family income is to be achieved Early in the Project, it was recognized that essential to success of organizations required commitment and support

The Government of Uganda (GOU) currently budgets about 0 25% of its budget for agricultural research At the start of the Project, ten key specialists at the KARI/PHHS were engaged in some phase of postharvest (PH) work Of these, five were considered key project personnel Many of the specialists originally working with the Project have been assigned to other duties or promoted since the start of the Project To compound the human resources shortage, the GOU has mandated PH researchers to transfer the generated postharvest technology to field workers and farmers A major constraint has been inadequate GOU counterpart funding The in-cash fund earmarked for the PHHS came to a halt early in the Project The PHHS has been operating completely using its own funds and resources to keep station and field activities operating

An important aspect toward project objectives is building the capacity of the District PHSMSs, the private sector and the NGOs The UGO has greatly reduced support for Uganda Agricultural Extension Service (UAES) Agricultural personnel are now assigned directly to the district

governmental unit The five target district PHSMSs have been key contacts at the district level for the PH program To date, five SMSs have received training from KARI/PHH specialists, and they in turn are training subcounty agricultural agents, NGO field workers, and farmers in postharvest technologies This has been an important first step in building capacity at the district level

Development of the private sector capacity is the best opportunity for long term sustainability of new postharvest technologies President Museveni congratulated the Uganda National Farmers Association and the Uganda Cooperative Alliance for their roles in providing farmers with agricultural advisory services, and noted that by offering services on a demand-driven and cost recovery basis, that these organizations are empowering farmers to ensure agricultural sustainability

The UNFA and the UCA represent about 25% of the farmers in the country The KARI PH project has trained a number of field officers of both organizations The UNFA leadership has proposed assigning five of their district field officers to work a substantial part of the time transferring postharvest technologies This offer needs to be explored It tentatively demonstrates the commitment of a leading farmers' organization in the private sector

The NGOs especially ATU, Environmental Protection and Economic Development (EPED), and Food Security and Marketing Project (FOSEM) are actively promoting postharvest technologies The KARI/PHH researchers have provided training for these NGO field workers NGO organizations continue to conduct effective PH programs, however, a major constraint is uncertainty of NGO funding which depends upon external donors and private citizens

Available Credit Programs in Support of Improved Production and Postharvest Technologies

Farmers in the rural sector encounter severe difficulties in trying to obtain credit for agroprocessing and postharvest technologies Womens' access to credit is difficult because of educational limitations, social, and low economic status

Historically, according to studies conducted by the Bank of Uganda, almost all credit schemes have performed poorly Major problems have been poor repayment records, development of attitudes that money loaned is in fact a grant, diversion of loan use, and loan delinquencies

Credit for farmers is available through some of the UNFA groups The Danish International Development Agency (DANIDA) is providing some financing in a pilot loan project Utilizing group pressure, UNFA leadership reports almost 100% repayment of loans DANIDA plans on expanding support for the program in 1999

UCA represents more farmers than any other organization in the rural sector Members can obtain loans in about 600 of the primary societies Loans are made for agroprocessing and postharvest technologies

Forty Village Banks, Postal Credit Union, and Uganda Savings and Credit Union are other credit organizations There are a number of foreign based NGOs which have program subcomponents

to support micro-enterprise development The Private Enterprise Support, Training, and Organizational Development Project (PRESTO), which is USAID supported, strengthens the institutions that provide savings and credit services for micro enterprises PRESTO assists programs such as World Vision, Oxfam, Plan International, and many others A complete inventory of all credit sources, available within each district, would be a valuable resource for District PHSMSs and other field workers with postharvest technology responsibilities

Development of a Decentralized, Capacity Building and Sustainable Postharvest Technology Transfer Plan

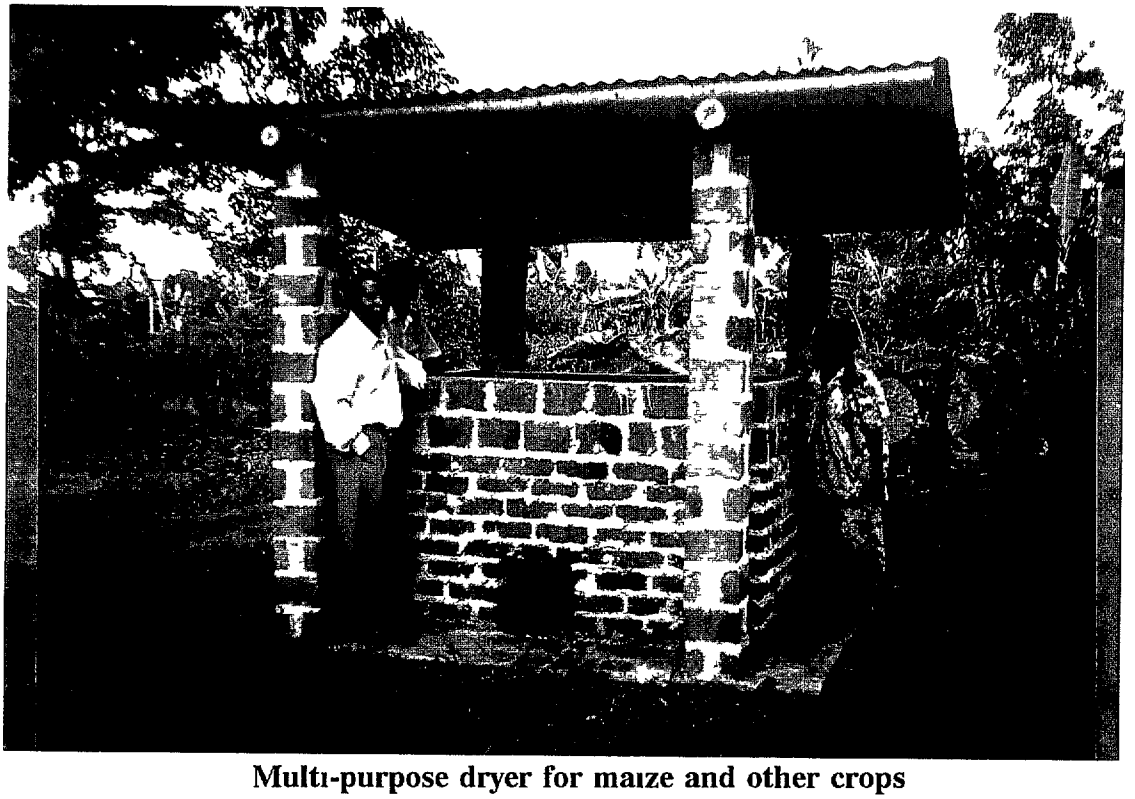
The current PHHS Project has made good progress in development of postharvest technologies at KARI Funding for the project terminates at the end of December 1998, however, a proposal for a no-cost extension to the end of December 1999 is currently being developed by Mississippi State University The extension would enable long term technical assistance (TA) to continue with general project support However, limited technology transfer activities, due to manpower limitations and lack of GOU financial support, will continue to constraint the Project from fully realizing its objectives

This consultant developed a plan with six components These included project design and strategy building, leadership and implementation, financial sustainability, monitoring and evaluation, beneficiary participation, and structured flexibility Implementation steps are involved in all six components A specific list of steps, stakeholders, and responsibilities are outlined A budget to support the plan is noted in Section VII, along with a list of proposed short term consultants

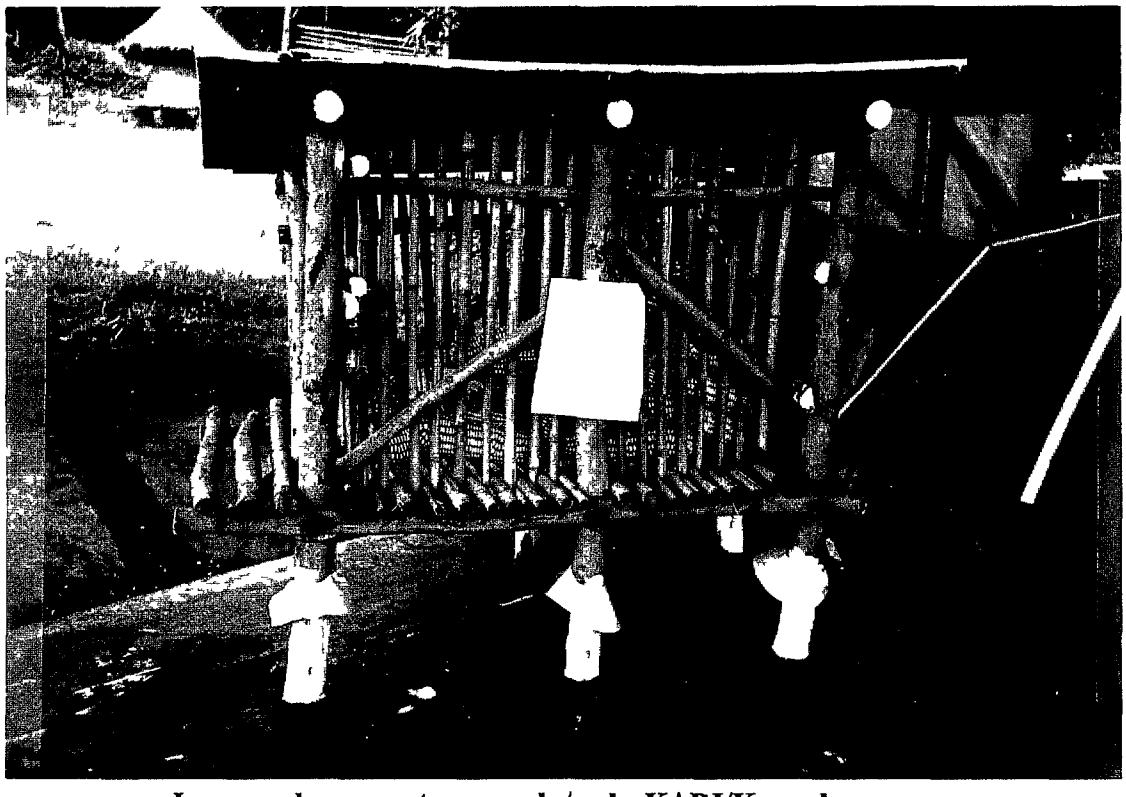
Specific financial commitments to ensure project sustainability were outlined Specific sources of funding that might be considered were also noted Again, the plan is specifically developed to enable the KARI/PH Unit and major stakeholders to effectively build increased program capacity and sustainability Conditions that facilitate sustainable development and support participation of beneficiaries is an important part of the Plan The process needs to start in the design phase where the stakeholders can identify and articulate their objectives to improved sustainable development

The PHHS Project has demonstrated a positive impact in the improvement of economic conditions and quality of life for farmers This is well illustrated with several case studies in Appendix D

Dr Tom Trail, Postharvest Institute, and Margaret Angom, Extension Specialist (Lira District), examine a charcoal burner for multi-purpose dryers



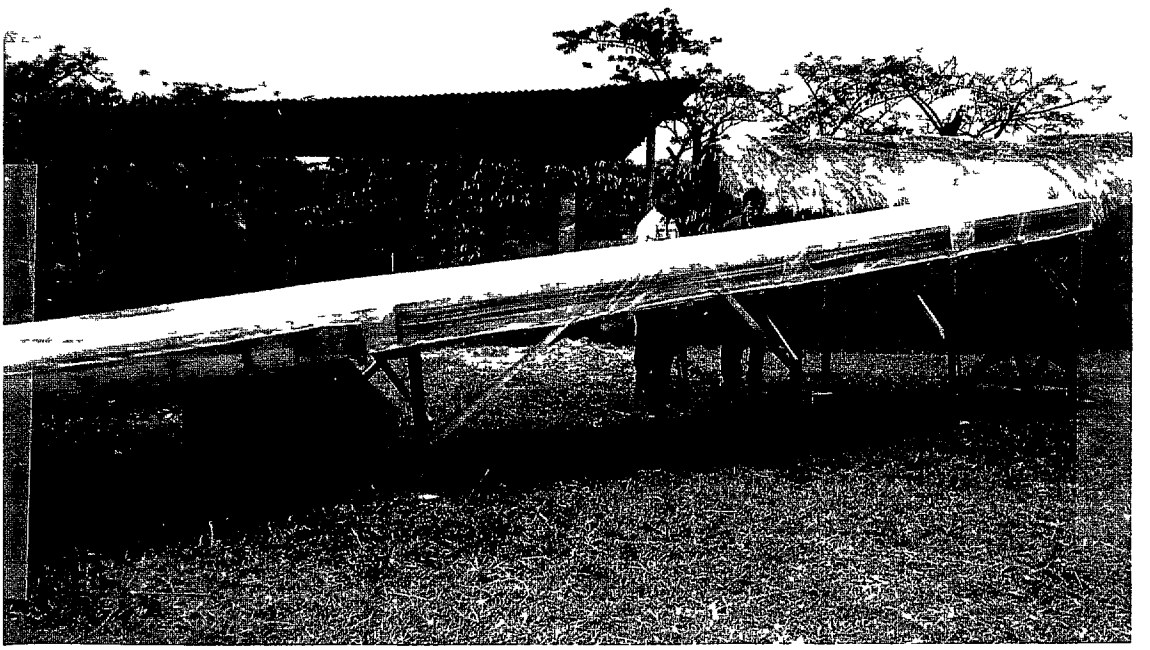
Multi-purpose dryer for maize and other crops



Improved maize storage silo/crib KARI/Kwanda

Dr Ulysses Acasio and colleagues demonstrate a portable cleaner

Ox-drawn plow developed at a research institute in Uganda



Solar dryer used for drying pineapple and other crops

Section I Introduction

Overview

Agriculture accounts for over 90% of Uganda's export earnings and well over 50% of Gross Domestic Product (GDP) About 90% of Uganda's population earn their livelihood from farming Until drastic changes, beginning in the 1972-1973 period, cotton and coffee constituted most of the agricultural exports Agriculture remains the primary basis for much of the industry in the country

The industrial sector in the past has been relatively small In 1963, the industrial sector contributed 7 8% to the GDP, rising to 8 2% by 1971 The economic war waged by the Idi Amin Government against the private business sector resulted in a decline in industry's share of GDP by the year 1977 to 6%, and a further decline by the end of the second Obote administration to 4% Since 1988 the economy has experienced a very healthy 6 5%-9 0% growth and the industrial sector contribution has grown to about 8% of GDP The reduction of the roles of parastatals and the liberalization of the economy to the private sector have contributed significantly to the development of a growing economy

As a matter of fact, Uganda has achieved the highest level of manufacturing growth of all the least developed countries in the world according to a report released in October 1998 by United Nations Conference on Trade and Development The UNCTAD reports that despite the many problems that still exist in Uganda, it is one of the few poor developing countries which has proven successful in its attempts to diversify from an almost total reliance on primary commodities

UNCTAD's figures show that average manufacturing growth in Uganda has risen from 15 1% in 1994 to 17 3% in 1995 and a staggering 19 7% in 1996 The manufacturing growth figures are also one of the reasons that Uganda has one of the highest levels of investment growth among the least developed countries at 9 6%, 38 5% and 14 7% from 1994 to 1996 Diversification remains vital if Uganda is to continue its economic revival

Coffee has been Uganda's most important export crop over the past four decades Coffee overtook cotton in value of exports in the mid-1950's By 1965, coffee contributed 65% of export value compared to 35% for cotton In 1993 over 2 2 million bags of coffee were exported, valued at about US$145,000,000 In 1997 coffee accounted for about 56% of total domestic exports with a value of almost US$400,000,000

The value of cotton peaked in 1973, with 450,000 bales of lint exported Cotton seed at that time contributed about 80% of the vegetable oil requirements of the country During this time Uganda was self sufficient in vegetable oil for domestic purposes The Amin and Obote regimes destroyed the cotton infrastructure, and in 1993 fewer than 50,000 bales of lint were exported The World Bank and the GOU signed an agreement in 1993 to rehabilitate the cotton infrastructure The Bank, through UN/International Fund for Agricultural Development (IFAD), has invested more than US$30,000,000 in the rehabilitation process Still, in 1997, the country only exported about 100,000 bales of lint This represented only about 2 15% of exports Cotton

will continue to develop as an increasingly important crop, however, it is difficult to see it regaining its importance of the early 1970's Some cotton seed will be utilized for vegetable oil, and cotton seed meal will be utilized for the expanding livestock industry Cotton will remain an important actor in the vegetable oil market

In 1994, Uganda imported 90% of it requirements for domestic vegetable oil The Uganda Oil Seed Processing Program reported that since the early 1990's, USAID, through financial support of the PL 480 funds, has assisted the GOU in promoting production and processing of sunflower and soybeans Today, UOSPP estimates that 70% of domestic vegetable oil needs are imported Of the 30% raised domestically, cotton seed contributes about 50%, sunflower 40%, and soybeans 10% of the domestic production Studies indicate that sunflower and soybean postharvest losses range between 10-15%

Uganda has yet to capture the wealth that lies in its agriculture sector Recent studies have demonstrated that, with fertile soils, plentiful water resources, a variety of climatic conditions, several growing seasons a year, and inexpensive labor, Uganda has the ability to grow a number of high value crops at costs that compare favorably in the overseas markets The regional market for exports of low-value, bulk commodities such as maize and beans has barely been tapped For example, most of the surrounding countries import maize and beans In 1996-97, a total of 87,000 MT of maize, valued at about US$18,000,000 and 40,000 MT of beans valued at about US$15,000,000, were exported to surrounding countries This made up about 5% of total exports Kenya imports over 500,000 MT of maize/year, but considers Uganda maize as second class, lacking quality and uniformity needed to meet first class import standards

In 1995, the USAID funded IDEA Project (Investment in Developing Export Agriculture) started a cooperative maize and bean research program with the National Agricultural Research Organization (NARO) IDEA funded research has concentrated on target screening, on-farm testing, multiplying and disseminating improved maize and bean seed varieties, identifying pest and disease control measures, and techniques for reducing postharvest losses Technology transfer to end-users is now a mandated charge for NARO

The Postharvest Handling Storage/ANEP Project

The PHHS Project subcomponent of Agricultural Non-Traditional Export Promotion Program aims at helping Ugandan farmers increase their incomes through reduced postharvest losses This is achieved by assisting producers to increase the total amount of their produce available for market This is done through reduction of postharvest losses attributed to improper handling and storage of the commodities The goal and objectives of the program are to be achieved through four major activities (a) technical assistance, (b) generation and transfer of appropriate postharvest technologies, (c) training of target groups, and (d) capacity building

These activities are being carried out by two sub-components of PHHS (a) postharvest handling and storage of grains (maize and beans), and (b) postharvest handling of high value crops (fruits, spices, vegetables, etc)

The PHHS has developed many appropriate postharvest technologies applicable to cereal grains and oilseeds which are now being disseminated in five districts for target groups The postharvest technologies include (a) threshers and shellers, (b) mechanical grain cleaners and sorters, (c) small and medium scale bio-mass dryers, (d) commercial grain dryer, (e) hand tractor with trailer for rural transportation and traction, (f) hybrid solar drying technologies, (g) small scale bulk storage structures, and (h) environmentally safe pest management techniques

The project is located at the Kwanda Agricultural Research Institute outside of Kampala It is part of the Agricultural Engineering and Appropriate Technology Research Institute (AEATRI), established through the National Agricultural Research Organization (NARO) The aim of the institute is to improve the quality of rural life through development, adaptation, and outreach dissemination, as well as training This training is in appropriate technologies in the fields of Farm Power Sources and Implements, Agricultural Processing and Storage, Household Energy Environment and Water Supply, and Soil Conversation, Irrigation and Drainage

The institute is among the eight research stations established under NARO of Uganda The NARO statute authorized its creation together with the Institute for Food Science and Technology Research The two institutes address engineering and food science technology constraints in production, processing and utilization of crop, livestock, fisheries as well as some forest products

Besides its involvement in research, AEATRI is involved in (a) consultancy, training, and advisory services to extension agents, farmers, small scale industrialists on various agricultural engineering technologies as well as many others appropriate technologies developed within and outside its mandate, (b) publications, and (c) farmer participatory, research, technology development and transfer through on-farm research, field days, and direct contact with extension staff Since 1995, the GOU has been downsizing the extension service, and it has greatly decentralized its activities to the district level In 1997, the GOU mandated KARI/NARO to generate and transfer technologies with their mandates to agencies/organizations directly working with farmers

The Life of the Project is three years in duration (End of Project-December 1998) with approximate funding of three million dollars Implementation of the Project required external technical assistance in the form of one long term technical advisor (Dr Ulysses Acasio) to be stationed at KARI, and with other governmental, private sector, and NGOs dealing with postharvest products The PHHS Project is contemplated to enhance the capabilities of KARI and other governmental and NGO organizations to continue PH activities in Uganda beyond the Life of the Project Currently, discussions between Mississippi State University, USAID, and KARI are being conducted to develop a one year, no-cost project extension

Consultancy Mandate

Dr Tom Trail, University of Idaho, Postharvest Institute Program Consultant, was requested to develop a sustained plan to deliver the developed technologies to the end-users The requested plan is built on the critical mass that has been generated by government programs and enhanced

by donor funding for postharvest loss prevention and income generation activities, and it is developed in conformity with the decentralized extension service in Uganda

The specific objectives of the consultancy were

1 Identify production, consumption, and marketing statistics for cereal grains and oil seeds in Uganda

2 Identify major causes of postharvest losses in cereal grains and oil seeds in Uganda and how they are being addressed by stakeholders

3 Assess technology transfer capabilities of major players in the cereal grains and oil seed industries such as those in the private sector, research institutions and NGOs

4 Inventory relevant technical skills and farm equipment manufacturers in Uganda

5 Identify available credit programs in support of improved production and post production technologies in Uganda

6 Write a decentralized, attainable, and sustainable plan to produce and deliver required postharvest technologies to the end-users This includes a detailed budget of implementation for possible funding by GOU and international donors

Research Methodology

Dr Trail reviewed relevant project documents, visited four of the target districts, and talked with major stakeholders including district officers of the recently decentralized extension service In addition, Dr Trail met with KARI researchers, NGO/PVO, and private sector representatives Individuals interviewed are listed in Appendix C

Section II Production, Consumption, and Marketing for Cereal Grains and Oil Seeds in Uganda

Overview

It is a challenge to find reliable and valid data concerning production, consumption, and marketing for cereal grains and oil seeds in Uganda Mark Wood, of the USAID funded Agribusiness Development Centre (IDEA Project), stated that statistics relating to production and consumption of cereal grains and oil seeds in Uganda are very unreliable He noted that in many cases, the national estimates reported by the Ministry of Industry and Finance in the National Budget Plan are basically "guesstimates" No crop estimates made with tested statistical treatment and farmer sampling techniques are utilized by the GOU Mr Wood estimated that statistical error in reporting data could vary by up to 100% one way or the other

As an example, Table 1 lists the historical production of maize, beans, soybeans, and sunflower from 1994 to 1996

Table 1 Analysis of Historical Production

Reported Volume (MT)					Estimated Discount	Actual 3 yr
Commodity	1994	1995	1996	Average		
Maize	850 0	912 0	939 0	900 3	60%	360 0
Beans	378 0	387 0	434 0	399 7	50%	199 8
Soybeans	78 0	78 0	80 0	77 7	85%	11 7
Sunflower	11 8	11 8	55 0	32 7	30%	22 9

*Source Ministry of Trade and Finance, National Budget Plan '97-98, GOU, from various official government documents and interviews Figures reported in metric tons and includes exports

The GOU attempted to arrive at accurate data through an estimated actual figure, which discounted reported volume for the various crops by as much as 85% There are also problems caused by cross-border trade, especially between Uganda, Kenya, and Rwanda Reported trade volume again must be viewed with caution Maize tends to be exported to Kenya and more beans to Rwanda Kenya imports over 500,000 MT of maize/year, however, it considers Uganda maize as second grade because of mixed and poor quality which does not meet first class international standards

The Ministry of Trade and Finance also estimated domestic exports for cereal grain and oilseed crops for 1996 and 1997 These export figures are listed in Table 2

Table 2 Domestic Exports Quantity and Value 96-97

	Quantity		Value (US$)	
Commodity	1996	1997	1996	1997
Maize	87,600	42,234	17,800,000	19,407,000
Beans	39,900	27,094	15,950,000	10,502,000
Soybeans	9,216	396	2,913,000	240,000
Sunflower*				

Figures are reported in metric tons (MT) and include exports
*No figures were listed for sunflower exports Production is assumed to be utilized for domestic consumption

Weather conditions obviously have a dramatic impact on production The great variation in price also either serves as an incentive or as a disincentive to the producer For example, in 1994 the price per ton of maize was about US$40 MT In 1997, the price was as high as US$400 MT Conflicts and refugee problems in the general area, have contributed much to the demand for maize and beans The World Food Program (WFP) has been a major purchaser of both maize and beans for relief programs Again, this overview provides the reader with recent national production and export figures of the crops under discussion, however, caution must be utilized in the accuracy and validity of the figures

Maize

Mark Wood, of Agricultural Development Center (ADC), notes that while the figure of 900,000 MT/year is often mentioned as the yearly maize production statistic that 500,000 MT may be more reasonably accurate The GOU has targeted the figure of US$20 million for maize exports Cross-border trade studies indicate that the figure may be double Kenya has traditionally been an export market for Uganda maize, however, Kenya considers Uganda maize to generally be of poor and mixed quality During the past 10 years, Kenya has had to import from between 500,000 - 900,000 MT/year to meet domestic demand, however, most of the imports came through Mombasa from suppliers outside the immediate geographic area Using maize as an example, Uganda has a comparative advantage in East African, Inter Government Authority for Drought and Development (IGADD) and the Common Market for Eastern and Southern Africa (COMESA) regional markets for Non-Traditional Agricultural Exports (NTAE) This is because of its favorable climate and soils, as compared to its neighbors Further, the instability in some regions, including Rwanda, Burundi, and the Sudan, is a clear indicator for the demand for food aid

Uganda's total exports of maize from 1990-95 averaged 109,177 MT of which 53 0 was formal and 47 0 informal (note Table 3) Major importers of Uganda in maize are Kenya, Rwanda, and Zaire, as noted in Table 4

Table 3 Uganda's Total Exports of Maize (MT) (Formal, Informal) 1990-1995

Years	Total Maize Exports (MT)	Formal	%	Informal	%
1990	53,820	26,142	48 6	27,678	51 4
1991	67,374	35,733	53 0	31,641	47 0
1992	56,529	29,570	52 3	26,959	47 7
1993	210,294	108,791	51 7	101,503	48 3
1994	168,686	87,285	51 7	81,401	48 3
1995	98,360	59,444	60 4	38,916	39 6
Average	109,177	57,828	53 0	51,350	47 0

*Source URA, Customs Records, interviews

Table 4 Exports of Maize by Destination 1990-1995

Years	Total Maize Exports (MT)	Kenya	Tanzania	Rwanda	Zaire	Others
1990	53,820	15,423	4,922	8,785	26,164	581
1991	67,374	14,660	11,802	20,626	19,705	561
1992	56,529	13,131	5,030	8,970	28,836	562
1993	210,294	50,663	11,134	33,815	112,645	2,087
1994	168,686	40,587	14,250	50,949	61,242	1,658
1995	98,360	11,153	12,177	31,584	42,315	1,131
Average	109,177	24,269	9,886	27,788	48,151	1,083

*Source Background to the Budget 1995/1996, WFP

Peter Wathum, Monitoring and Evaluation Specialist for ADC, reported on a three year study of estimating maize production for the Iganga, Masindi, Kasese, and Kapchorwa Districts Fifty farmers in each subcounty were interviewed regarding maize production data Researchers cross checked data following the crop disposal flow used by millers The estimated production figures over the three seasons on the average were Iganga-60,000 MT, Kapchorwa--50,000 MT, Masindi--8,000 MT, and Kasese--12,000 MT These are probably the most accurate figures available in the country, but it would be impossible to try and extrapolate data for the entire country based on this activity ADC did pinpoint some maize consumption figures that were of interest Approximately 40% of maize produced is consumed on the farmstead and 60% sold in markets

ADC is helping farmers improve quality of their maize through the Multi-Purpose Training and Employment Association of Iganga ADC trains the MTEA director, who in turn, trains farmers in postharvest technologies, including drying, to improve the quality of maize MTEA enters into an agreement with a buyer or buyers in Kampala who are willing to pay a premium price for product delivered to their stores that meet agreed on specifications The end-buyers pay this premium price because they do not have to clean or dry the maize further Part of this savings is passed along to the MTEA in the form of a higher price MTEA returns some of this price premium to the farmer by establishing a higher purchase prices This often means an extra 15s /kilo to a farmer (Note Case Study in Appendix D)

There are currently 25 MTEAs in the Iganga District serving approximately 8,000 farmers The European Economic Union (EEU) has recently approved a US$2 5 million grant proposal to establish an additional 175 MTEAs in other districts Mark Wood indicated there is excellent support for the MTEAs in postharvest technologies from KARI and the District PHSMSs

Beans

Bean production, according to the Ministry of Trade and Industry, averaged about 199,000 MT from 1994 to 1996 ADC's three year study of four districts also surveyed farmers regarding bean production The estimated figures for the four districts are Iganga--8,000 MT, Kasese-10,000 MT, Masindi--5,000 MT, and Kapchorwa--12,000 MT Beans sell for a relatively high price, however, it is estimated that about 80% of beans are utilized for home consumption

A 1996 ADC study provides an idea of Uganda's total exports of beans from 1990-1995 According to figures, there has been a fluctuation in the export trend of beans The largest amount of beans was exported in 1994, while the least was in 1995 The general trend, however, depicts a slight decline in total bean exports over the study period These figures are depicted in Table 5

Table 5 Uganda's Total Exports of Beans (MT)
(Formal, Informal) 1990-1995

Years	Total Bean Exports	Formal	%	Informal	%
1990	21,259	9,271	43 6	11,988	56 4
1991	40,644	14,208	35 0	26,436	65 0
1992	49,708	9,326	18 8	40,328	81 8
1993	21,560	8,500	39 4	13,060	60 6
1994	53,302	26,955	47 4	26,347	52 6
1995	18,674	8,857	47 4	9,817	52 6
Average	34,191	12,853	37 6	21,338	62 4

*Source URA, Customs Records, interviews

It can be seen that the largest formal exports (26,955 MT) occurred in 1994 The largest informal exports of beans occurred in 1992 (40,382 MT) The least amount of beans were exported in 1993 (8,500 MT) and 1995 (9,817 MT) through formal and informal channels The main reasons for these differences, particularly the high level in 1992 and 1994 and the very low levels in 1993 and 1995 exports, are as follows

1 Poor bean harvest due to drought in Uganda in 1989/90 season

2 Bumper maize harvests during 1992 and 1994

3 Increase in demand for relief aid, particularly in Rwanda and Tanzania from 1993 to 1994, and its decline in 1995

4 Poor trading relations between Uganda and Kenya, particularly during 1995

Projected exports of beans for relief exports in 1998 for Uganda is estimated at 7,652 MT (Tanzania-1,469, Rwanda 5,615, Congo 94, and others-474) The ADC study indicates that the destination for regularly exported beans in order of importance are Kenya (46%), Congo (31%), Rwanda (11%), Burundi (5%), and Tanzania (3%) The historical pattern of bean exports by destination is outlined in Table 6

Table 6 Exports of Beans by Destination 1990-1995

Years	Total Bean Exports (MT)	Kenya	Tanzania	Rwanda	Zaire	Others
1990	21,259	8,725		1,195	8,742	2,957
1991	40,644	14,660	413	1,833	13,398	3,978
1992	49,708	13,131	422	1,417	8,794	2,397
1993	21,560	50,663	688	6,289	4,324	1,380
1994	53,302	40,587	1,855	9,149	21,747	6,457
1995	18,674	11,153	1,3597	3,404	6,656	1,914
Average	109,177	34,191	947	3,881	10,610	3,135

*Source URA/Customs Records

Oilseed Production

Uganda was self-sufficient in vegetable oil production into the early 1970's Cotton seed was the prime raw material for processing Due to political turmoil that resulted in a subsequent decline, Uganda's vegetable oil production was severely curtailed A key constraint to greater self-reliance in edible oil is having ample raw material for oil seed processing

In 1994, Uganda imported about 90% of its vegetable oil needs A 1997 study, funded by the Uganda National Farmers Association (UNFA), showed that current return to labor for oil seed crop production is low The study also indicated that most oil seed crops rank medium to low in research and development, and marketing of oil seed is not well coordinated High tariff charges on electricity and petroleum products, along with taxes, coupled with loopholes in tax codes, and smuggling, is rendering domestically produced edible oil less competitive compared to imported products

The study further revealed that, despite Uganda's excellent climate, fertile soils to produce oil seed, ample human resources, and current installed processing capacity estimated at 700 MT per day, that the country is today importing about 70% of its domestic edible oil and related product requirements In 1994, the country imported 55,999,793 kgs of oilseed worth 36 billion Uganda shillings in 1995, and in 1996, 64,806,347 kgs worth 48 billion shillings By interesting contrast in 1994 alone, Kenya imported 259,000 MT of edible oil products costing 6 billion Kenya shillings (one Kenyan shilling is equivalent to 120 Ugandan shillings), however, studies show that Kenya is the leading supplier of raw material and edible oil products to Uganda

Uganda has made some progress in reducing imports of its vegetable oil needs from 90% in 1994 to 70% currently Peter Otimodoch, Executive Director of the Uganda Oil Seed Processors

Association, reports that of the vegetable oil processed in Uganda, cotton seed represents 50%, soybeans 40%, and sunflower 10%

A key constraint to greater reliance in edible oil is having ample raw material for oil seed processing Since the early 1990s, through monetized proceeds of Title II, assistance has been and is being provided to expand raw material tonnage in alternative seed crops such as sunflower and soybeans Rehabilitation of mills, provision of spare parts, and training in maintenance of operations are areas that have been addressed to make the industry functional and operational

USAID, through the Cooperative Agriculture Association Systems (CAAS) in the early 1990s, identified access to a financial institution that can assist with credit needs of production, marketing and capital requirements of the agriculture sector as a vital component in achieving food security in Uganda Funds generated through the monetization of vegetable oil provided much needed capital for the only agricultural bank, the Cooperative Bank Ltd , to support restructuring and recapitalization requirements

This support and assistance, provided through the Title II Program, is stimulating agricultural production, promoting the rehabilitation and expansion of agri-business, and assisting women's business groups The Title II Program provides credit access to farmers in several districts

A major stakeholder in producing more vegetable oil is the Uganda Oil Seed Processors Association There are now 62 edible oil millers who are members of the UOSPA The organization takes a leading role in the development of the vegetable oil industry by disseminating up-to-date information about the industry The UOSPA's seed multiplication program dates back to 1994 It provides farmers with high quality oil seed for planting, facilitates members to obtain credit, and provides farmers technical advice on matters relating to production, marketing, and processing of vegetable oil UOSPA, through its members, has area representatives who provide technical assistance and purchase their production Sunflowers and soybeans are both considered cash crops

Many farmers or farmer groups have sunflower oil presses Appropriate Technology Uganda (ATU) has provided many farmers access to small oil presses The value-added product has contributed to increasing farmer income Vegetable oil from sunflowers is consumed by farmers and sold locally Soybeans have to be shipped to Kampala to extract oil District PHSSMSs note that very little soybeans are utilized in local diets Relief programs purchase soybeans to mix with millet, sorghum, and other grains to enhance diets Soybean oil cake and sunflower cake are utilized in the Ugandan livestock industry Current sunflower production figures are 37,000 MT in 1996, and soybeans at about 77,000 MT with approximately 10,000 MT for export

Section III Major Causes of Postharvest Losses for Cereal Grains and Oil Seeds in Uganda

Overview

A significant amount of farmers' produce suffer heavy losses due to spoilage by micro organisms, insect pests, and rodents KARI estimates that losses are 20%-25% in cereal and grain legumes, about 30% in semi-perishable crops and are much higher in highly perishable products The Executive Director from the Uganda Oil Seed Processing Association estimated postharvest losses in sunflower and soybeans to range from 10%-20% Interviews with farmers and field workers indicated losses in cereal grains to be about 30%

The losses are a great drain to households and national food security Figures for estimated crop losses in Uganda for the period 1992-1995 are cited in Table 7

Table 7 Estimated Mean Average Postharvest Losses in Uganda for the Period 1992-1995

Crop Category Losses	Estimated Annual Means		
	Production	PH Losses	Financial
Cereals	1,879,000	369,000	96,628,000
Pulses	515,000	102,000	38,176,000
Oil Seeds	325,000	69,000	40,758,000

*Source NARO Production and PH losses reported in metric tons (MT) Financial losses reported in Uganda shillings

Besides these losses, lots of waste products are often generated through processing Most of these wastes could further be processed and safely recycled as useful products Postharvest losses in cereal grains and oil crops in Uganda represent a major negative financial impact on the economy Included in this section (Tables 5 and 6) are some of the major problems, causes, and solutions in maize and bean postharvest losses

Maize Postharvest Losses

Maize is an important cereal crop grown in Uganda Maize is grown by small holder farmers, semi-commercial farmers, and commercial farmers For example, maize production has been increasing in Masindi District since 1994 and has replaced finger millet as the main staple food crop Farmers report maize as having increasing importance as a cash crop which requires less labor The production of maize in the districts of Lira and Apac, for example, is limited because of market factors and weather

The postharvest system for maize is generally broken down into field drying, harvesting, transporting, storage, shelling and marketing High losses of maize often occurs in the storage stage This frequently occurs among semi-commercial and small holder farmers who have to pay attention to other crops There are also substantial losses in maize, especially the first crop, when the rains occur This is because harvesting occurs during the rainy season

1 Field Drying

Farmers generally practice field drying when there is persistent rain at the time of harvesting, and when the ground on which maize can be dried is moist This problem is common primarily with farmers who normally have a larger harvest Field drying is also practiced when there is a shortage of labor during the time of harvest Field drying and lack of storage space for small holder and commercial farmers may delay harvesting ATUI has identified labor shortages as a major issue in field drying

Extended field drying exposes the crops to field pests This increases storage damage of maize Slow drying in the field and subsequent possibility of more rain on the crop also increases molding with risks of decay and aflatoxin accumulation Animals and birds feed on maize, when they are in the field, which causes additional labor demands There is also the problem of field theft during field drying

There have been limited intervention in the field drying system Noticeably, for example in the Masindi District, some partners like the Masindi Seeds scheme, Uganda Farmers Association (UNFA), and the Environment Development Project (EPED/ACDI), extension, and the Uganda Cooperative Alliance (UCA) have supported several interventions KARI/PHH has provided technical assistance in these interventions

Maize dryers are a postharvest technology which appears to offer promise in reducing losses In the target districts of the KARI/PHH project, over 100 dryers have been built for semi-commercial farmers These dryers are built with local materials on a cost-share basis with local farmers KARI has trained local artisans to build dryers The estimated cost per dryer ranges from 225,000 - 250,000s This consultant interviewed two women farmers in the Iganga district who had dryers (note the Case Study in Appendix D) Both farmers were drying about 500 kilos of maize per day, and neighboring farmers were utilizing the dryer free of charge One farmer estimated that she had already made an added profit of 100,000s utilizing the dryer She received an added 15s /kilo for her maize because of the improved quality She had been trained by the District PHSMS and the Director of the MTEA (Multi-Purpose Training and Employment Association) The program is funded through the IDEA Project During the consultant's visit an added 25 farmers requested new dryers

Maize cribs are another technology introduced to Uganda farmers Training has been provided for both agricultural personnel and farmers in its use The PH program at KARI has developed several examples of maize cribs which can be utilized by farmers

In the Masindi District, all seed producers were required, by the conditions of their contracts, to build maize cribs About 200 cribs were built Many of these structures were not well built or effectively utilized There have been problems including destruction of maize by insects and pests

This often occurs if maize is stored too long Losses by termites and rodents is also prelevant Some research conducted by KARI and other organizations utilizes the development of organic compounds of neem and acasia leaves The leaves are dried and then ground into powder Two kilos of the compound sprinkled throughout 100 kilos of maize provides some protection against insect damage

Additional interventions exist to reduce losses This includes the provision of locks on crib doors and located near the homestead Additional training and technical assistance to farmers using dryers can ensure a higher degree of skill in the utilization of the drying technology

2 Harvesting

Harvesting by small holders and semi-commercial farmers is based on traditional hand picking Larger producers often supplement family labor with hired labor Women generally do the majority of harvesting

Postharvest system management training, concerning field harvest, should be implemented in a more comprehensive manner with farmer input Demonstrations and field trials should be part of the training program Since losses are high during harvest, research efforts to develop improved harvesting techniques should be given a high priority

3 Transportation from the Field

After harvesting, maize on cobs are transferred to cribs or other storage areas Most of the transport is done by women and by hand Maize often falls out of baskets During rainy weather, cobs that fall in the field become wet and muddy

Many of the problems relating to losses, incurred during transportation, are related to human factors Creating farmer awareness of the problem through training is one approach being carried out by ATU

4 Shelling and Threshing

Traditionally threshing maize is commonly done by putting the maize cobs in bags and then beating them with sticks by women Small holders and some semi-commercial farmers still use their hands for picking the grains from the cobs, which is tedious and hard on hands This is normally taken as an off-work time in the evening after the meal Most of the threshing takes place in, or near, the homestead In the small-holder farms and some semi-commercial farms, hand-shelling may be slow and strenuous Grain breakage frequently occurs Hand-shelling is very labor intensive

The KARI/PHHP has introduced over 1,500 hand shellers to Ugandan farmers These are currently being manufactured in-country Shellers sell for about 1,500s and are very affordable Portable hand shellers have been developed at KARI and several of these have been introduced in the districts UCA, through their primary societies, approve loans for their members or small groups to purchase shellers and also hammer mills The UNFA also provides some limited loans

to their members to purchase small shellers The KARI/PHH also introduced some larger shellers to small scale millers and operators

Table 8 Major Problems, Causes, and Solutions to Postharvest Losses in Maize

Problem Areas	Major Causes	Realistic Solutions
• Inappropriate drying practices	• Lack of price incentive for quality • Lack of knowledge on grades • Lack of knowledge of drying methods • Limited finances	• Improve drying methods • Train farmers/agents on drying methods • Sensitize traders on need for grade incentives • Mobilize financial resources • Disseminate dryers
• Discolored maize • Microbial attack	• Poor drying • Rewetting in storage • Drying on wet ground	• Improve drying methods • Improve storage methods • Timely harvest and better drying methods
• Poor shelling methods	• Lack of technology	• Improved shellers
• Poor cleaning facilities	• Limited financial resources	• Improved cleaners and sorters
• Poor storage facilities	• Lack of appropriate storage technology	• Test, evaluate, and disseminate technologies
• Poor on-farm transport	• Adequate knowledge on appropriate technology	• Develop appropriate technologies
• Postharvest labor constraints	• Limited technology and resources	• R&D on labor saving devices

Source NPHP/NARO, Constraints and Activities for Low Value Crops, 1996

Bean Postharvest Losses

Beans have emerged as an important domestic and export crop for Uganda Mr Wanzala, Deputy Chairman of the UNFA, estimates that farmers consume between 60%-70% of their production Beans are grown in all of the target districts with Masindi, Iganga, and Apac taking the lead Beans appear to have increased in importance and production during the past three years According to ATU personnel in Lira, it was reported as a leading food crop Beans grow rapidly and cook well when fresh, however, they are susceptible to pests and insects

The Uganda Seed Project has made excellent progress in developing and multiplying improved bean seed for farmers Distributors are located in must subcounties The Masindi Seed Project has done an effective job in the bean multiplication program Problems relating to seed viability, while using NARO developed dryers, have followed technology protocols Farmers drying beans, using multiple-use dryers, do not have problems with seed viability if field protocols are followed

The postharvest systems for beans include harvesting, drying, shelling, and bagging and storage Within the system, losses are reportedly a results of neglect, poor handling, and in certain cases, specific problems of the variety Losses for the first crop are generally due to rain

1 Harvesting/Drying

Harvesting is normally done by women and involves up-rooting the whole bean root Harvesting causes losses, especially when pods are dry Farmers practicing earlier harvesting can reduce losses, caused by pods shattering, while still in the field

There are generally three stages of bean drying These include (a) field drying, which has been problematic, especially for the first crop as there is normally too much rain, causing rotting of pods Field drying can affect both the quality and quantity of the bean seeds, (b) the drying of vines follow and because of the bulkiness of the crop, makes drying laborious which often leads to losses, and (c) further losses are incurred when drying, threshed beans are placed in the sun to dry Some multi-purpose dryers have been placed by the KARI/PHH for various crops, such as bean pods, which can be dried if technology is used carefully

Normally harvested beans are spread on a veranda If rainfall persists then seeds may start to germinate The dryers introduced can utilize 10 kgs of beans every six hours One of the problems is that not all farmers know how to use them properly Care has to be taken to protect the subsequent viability of the seeds The dryers are generally affordable for semi-commercial farmers

The UNFA, with technical support from ADC, has provided farmers in Kasese and Kibale with improved varieties of seed, marketing, and training in improved postharvest drying techniques

Farmers have been trained by the PHSMSs at the district level in determining optimum harvest timing However, follow-up work concerning introduced dryers will need to be conducted Capacity may have to be increased to adequately support production levels The Lira PHSMS reported that farmers may be able to obtain loans through the Lira Development Association Extension and ATU field workers will need to continue to train farmers on how to actively adjust

heating systems so that seeds produced are not destroyed by heat Raised tables, constructed on the compound, can provide adequate drying stands UCA and UNFA field workers are assisting their members in utilizing this type of technology

2 Threshing and Winnowing

It is common practice for the stems, containing the pods, to be put in a heap and beaten with sticks This is the common method of threshing beans The major problem with this technology is that it destroys part of the grain Cracked grain is highly susceptible to secondary infestation which results in loss and lower quality An excessive amount of trash is also generated which is mixed with other beans and results in winnowing problems All of these traditional procedures are labor intensive

The KARI/PHH program has introduced a threshing platform The device is designed to thresh partially dried bean pods, while still attached to the stalks, by beating them with a wooden stick Bean pods shatter during the beating process thus releasing individual beans down into a wire meshed tray, located below the slatted platform This helps separate dust, dirt, and small stones from the threshed beans The device has been shown to participants at a PH workshop in Masindi Beans are then dried in the charcoal heated dryer developed by the KARI/PHH program More threshing and winnowing technologies should be introduced through research, training, and extension Technologies identified should be reproducible by local artisans and farmers

3 Storage

Beans are normally stored in threshed form Small holder and some semi-commercial farmers store their beans either in silos built in the home or compound Some store beans in bags depending on the production level Some farmers use ashes or chilies and sometimes leaves of minda which serve as a strong aroma to reduce weevil infestations

The most serious storage problems are bean weevils These are found to be a serious problem for beans grown throughout Uganda The bruchids infestation often begins in the field and is then carried into storage Damage can be substantial if followed by a late harvest Theft is also a serious problem

There are already a number of storage methods, including chemicals, in use Field workers for UCA, extension, and NUFA provide some training for farmers in the use of chemical applications to beans in storage Success in the use includes involving farmers in formulation of low organic applications or low cost insecticides Further costs with organic applications need to be tried Some farmers already use ground chilies to mix with beans in storage Research, using ground leaves from neem and acasia trees, looks promising ATU has shown some work in this regard NARO should continue research to develop resistant varieties for bruchids

Table 9 Problems, Causes, and Solutions in the Postharvest Losses of Beans

Problem Areas	Major Causes	Realistic Solutions
• Inappropriate drying practices • Inadequate drying facilities	• Lack of price quality price incentive • Lack of awareness/knowledge of drying technology • Limited financial resources	• Urge GOU policy policies/grades and pricing • Improved drying methods • Increased credit resources
• Microbial attack • Discolored beans • Dirty beans	• Rewetting in storage • Poor drying • Drying on bare ground • Inadequate drying	• Proper sorting • Stress need for sorting • Timely harvest • Improved drying
• Poor threshing methods	• Lack of appropriate threshing technology	• R&D and new threshers
• Inappropriate cleaning facilities	• Limited financial resources	• Improved cleaners
• Inadequate storage facilities	• Lack of appropriate storage technology	• Develop appropriate technologies
• Insect pest damage in storage	• No incentive on grades and quality standards	• Develop standards and incentives
• Postharvest labor constraints	• Limited technology and resources	• Introduce labor saving devices

Source National Postharvest Program/NARO, Constraints and Activities for Low Value Crops

Soybean Postharvest Losses

Soybeans is an oil crop that does well in all of the larger districts It is grown for both domestic and commercial production, however, household consumption appears to be limited and soybeans are usually considered as a cash crop Soybeans now contribute about 40 percent of the source for domestically made vegetable oil The postharvest systems include harvesting, transportation, drying, storage, shelling and marketing Adequate technologies are still lacking

1 Harvesting

Harvesting consists of picking pods by hand with the use of family labor The first crop is harvested in June while the second crop is harvested in December with the onset of the dry season The main problems during harvesting are caused by root rats and other rodents The effect of weather and shortage of labor are the major constraints

The development of several small threshers by the KARI/PHH program should be field tested District field workers, for the UOSPA, have provided postharvest management training for farmers to reduce losses due to human factors during this stage

2 Drying

Harvesting is generally done by women, and the pods are brought into the compounds in basket-like containers or heaping them in a clean and well-swept area in the field before being taken to a drying site Transportation can be done with the soybeans sacked

A major problem frequently involves leaving pods in the sun for a long period of time Drying is often affected by unstable weather In recent years, field drying has been abandoned because of theft Losses due to birds is also frequent

One of the postharvest technologies that has been introduced are raised tables for drying The Kawanda PHHS unit has also introduced dryers but in a limited way The multi-purpose dryers need to be carefully operated, and field workers need to be trained properly in order to teach farmers the correct drying techniques The construction of properly designed cribs can provide safe storage and security

3 Shelling

Shelling can be done when the pods are dry Shelling is the stage that precedes marketing This step is generally done by women and children The process often involves putting the pods in a gunny sack and beating them with a stick This is very intensive and some damage may be done to the beans Further work in the development of small, but appropriate, shelling machines for semi-commercial farmers is needed

4 Storage

Generally, since soybeans tend to be a cash crop, farmers sell to representatives of oil processing mills Storage in a dry place is required for longer holding periods Field workers for UCA, NUFA, and UOSPA provide technical assistance to farmers raising soybeans

Sunflower Postharvest Losses

Sunflowers have become an increasingly important source of domestically produced vegetable oil According to UOSPA, sunflowers account for about 10 percent of the domestic vegetable oil supply A major stakeholder in encouraging farmers to grow sunflowers is the Uganda Oil Seed Processors Association UOSPA has 62 edible oil millers who are members of the Association The organization has a seed multiplication program and provides farmers with technical information relating to production, processing, and marketing Appropriate Technology Uganda (ATU) has collaborated with UOSPA in encouraging farmers to grow sunflowers and has also assisted many farmers buy small oil presses

Sunflower is usually planted by farmers as an intercrop during the first year of newly opened land or planted during the second or third year UOSPA and ATU field workers report observing no severe soil fertility problems in sunflower fields, however, these field workers do point out that research concerning soil fertility and intercropping systems with sunflower and other crops need to be carried out by NARO

Peter Otimodock, Executive Director of UOSPA, estimates sunflower seed postharvest losses at from between 10 - 20 percent One of the major problems during harvest is the failure of farmers to properly identify mature sunflowers heads Many farmers do not allow the sunflower head to fully mature As a result, many sunflower heads are not completely filled out and the maturity of the seeds greatly varies This results in a lower quality product This problem can be addressed through training

A common process during harvesting is to take heads and stems to the homestead In areas where there is a shortage of firewood, farmers use dried sunflower stalks as cooking fuel The recommended technique to ensure proper drying of sunflowers is to leave heads in the field to dry on the stalk, and then cut and bring the heads to the homestead in a basket or sack

Allowing the sunflower heads to mature in the field provides additional opportunity for the seeds to properly mature Seed heads that still require drying can be dryed on a slightly elevated drying pad The use of the KARI Project dryers, to dry sunflowers, is a possibility, but additional research and field testing will be needed Poorly dried sunflower seeds results in poor quality and lower prices for farmers One of the greatest problems faced by millers are bags of mixed quality seed Again, field workers for UCA, UNFA, Extension, and ATU are addressing some of the training needs to improve seed quality and reduce postharvest losses through training

ATU has been especially interested in increasing the bargaining power and ensuring access to markets through farmers' organizations ATU has assisted farmers in increasing their bargaining power through raising improved sunflower seeds, formation of farmer's groups, improved postharvest technologies to reduce losses, and promoting the sale of small oil presses Oil press sales have risen dramatically as a result of changes in pricing and sales policies with womens' groups More than 300 presses are now owned by farmers in target districts IA has received additional support from the Uganda Cooperative Alliance to farmers' group and cooperatives who contributed to improve production practices and reduce postharvest losses Improved drying technologies have enabled farmers to maintain a higher quality product Improved storage technologies have enabled farmers to store sunflower seed to sell later at a higher price, reducing postharvest losses

Summary

Section III has covered some of the major postharvest constraints for maize, beans, soybeans and sunflower Postharvest losses range as high as 30 percent for maize, and losses for beans, soybeans, and sunflowers vary from 10-20 percent These represent major losses, not only for the farmer, but to Uganda as well In addition, some of the postharvest losses can be counted in the poor quality products that are sold to traders and millers The MTEA Project in the Iganga District, in maize production, teaches farmers to reduce postharvest losses through improved

drying techniques, utilizing the dryers developed by the KARI/PHH Project at Kwanda The improved quality maize results in an added 15s /kilo price to the farmer

A number of improved postharvest technologies and techniques for low value added crops has been introduced by the PHH/KARI unit The most impressive technology at this time is dryers Over 100 dryers have been built It will be interesting to note how much these dryers are used at the end of the current cropping season Strong technical assistance support is provided by extension at the district level with the PHSMSs Field workers from UCA, ATU, UNFA, UOSPA, and several NGOs work closely with the District Specialists and the researchers at KARI

Section IV Relevant Technical Skills of Governmental and Private Farm Equipment Manufacturers in Uganda

Overview

This consultant visited KARI, private farm equipment manufacturers, and a UOG technical institute during the consultancy Interviews were also conducted with several local artisans and managers of seed and oil processing companies

Governmental

The PH Program at KARI has a national mandate to develop solutions to the problems in the postharvest handling of maize and beans Postharvest Programs (PHP) work closely with researchers at AEATRI There is also an important mandate of developing some agroprocessing technologies Five pilot districts are directly benefiting from the postharvest technology work of the PHHS/KARI These are Iganga, Masindi, Apach, Lira, and Mbarara The PHHS/KARI works on high value added crops such as fruits, chilies, and ginger in four districts

Major activities and technical skills focused on by KARI to date include

a) Timely harvesting, grain handling and management, proper shelling/threshing practices and development of appropriate equipment for farmers and millers

b) Grain drying methods such as two-stage drying, use of stable drying surfaces, fiber-reinforced PVC sheets, use of bio-mass fuel for artificial drying, and natural drying techniques such as solar use in narrow cribs

c) Development of appropriate grain cleaning equipment for semi-commercial farmers, farmers' groups, and millers

d) Development of grain storage structures and storage practices at the farm level This has included the development of naturally (organic) grain protectants and approved chemicals for pest control

e) Organization of integrated pest management programs at farmer, trader, and exporter levels to maintain grain quality and loss prevention

f) Improving traditional agricultural processing techniques

The PHHS/KARI has obtained promising maize and bean postharvest technologies from IARCs, foreign universities, and private companies These technologies have been tested and modified under approved technology protocols Many of the new technologies have been moved out through various technology transfer organizations to the end-users It should be pointed out that

the PHHS/KARI also has a further GOU mandate to transfer technology to agricultural organizations and end-users

One of the problems is that, although many appropriate technologies have been identified that will reduce postharvest losses in maize and beans, there has not been sufficient time to obtain technology dissemination on a scale sufficient to achieve wide spread impact However, this consultant observed progress being made with several technologies

The development of the multi-purpose convection dryer is a promising innovation Over 100 of these dryers have been constructed Several farmers (note Appendix D) are already utilizing the dryers for maize A woman farmer in the Iganga District estimates that she realized a profit of about 100,000s drying maize The cost of the dryer ranges from 200,000 - 250,000s (1300s = US$1) The farmer also reported that 15 of her neighbors utilize her dryer, and that she is also utilizing it to dry cassava Since most of the dryers have just been built or are in the process of being completed, the key test will be to see how much the dryers are used at the end of harvest season A key will be the follow-up training of farmers by technical transfer field workers in the proper utilization of dryers KARI/PHHS researchers have trained many field workers in proper drying techniques

Another simplified technology transferred to small holder and semi-commercial farmers has been the simple hand-operated maize sheller The cost of a sheller is about 1,500s , and a local manufacturer in Soroti is now manufacturing them Over 2,000 shellers have been purchased by Uganda farmers Some shellers are being exported to Tanzania and Angola

A hand-cranked maize sheller, developed by IITA in Nigeria, was modified at KARI The sheller was then fabricated at a local workshop This was done, with the collaboration of a World Bank consultant in small farm equipment, attached to the AEATRI The IDEA Project ordered 10 units for field testing and demonstration Two hundred units have been ordered by the Sukura Produce Agencies and General Merchandise Ltd , Mbale The cost of each sheller is about 20,000s

Some technical development work has also been carried out with millers and exporters Construction of an 18 MT capacity, deep bed grain dryer was built for the Commodity Exports International (CEI) It is equipped with a diesel fuel burner and old Kongskilde centrifugal blowers belonging to CEI In 1997, PHHS built a 2-MT capacity brick type flatbed grain dryer at the Kisindi Farmers Cooperative Society The PHHS unit also designed and built a 2 5 MT capacity Bio-Solar, Multi-Crop dryer Several commercial size farm operators, as well as grain traders, have expressed interest in the dryer

The PHHS/KARI initiated the fabrication by the KARI foundry workshop of two prototype hand-cranked maize shellers made of cast aluminum The PHHS/KARI ordered 10 units for demonstration purposes A prototype sheller sells for about 55,000s The foundry has received an initial order for 20 shellers Additionally, technical assistance was provided to the Uganda Seed Project in Masindi by identifying bottlenecks in their seed drying operation The Uganda Seed Project (USP) 10-ton vertical, re-circulating grain dryer was activated, and enabled USP to enhance its overall seed processing efficiency A dryer and cleaner is also being utilized by Akony Kori, Ltd sunflower seed factory in Lira

Technical assistance has assisted SAIMCO farm equipment manufacturers in Soroti to make blowers and seeders This has been financed through United Nations Development Program (UNDP) In addition, technical assistance has been provided to J B Engineering works, Tonnet, Ltd , and Afro Engineering in Kampala Tonnet has made 20 food processing machines which are a combination grater/slicer/and chipper The machine with attachments costs about 75,000s and can process up to 150 kilos of product/hr

Again, for the short time of the project, there have been a number of postharvest technologies developed The above examples illustrate the skills carried out in project activities and passed on to owners and workers of private enterprise farm machinery workshops, rural artisans, commercial/semi-commercial/small holder farmers, and millers

This consultant visited the Apach District Technical Training Institute The Institute offers three year courses in (1) tailoring, (2) carpentry, and (3) building construction There is a 100 ha farm on the Institute grounds PHHS/KARI and district PHSMSs provided technical assistance to the Institute to build a multi-purpose dryer Rural students were taught to build dryers The dryers will be utilized to dry Institute maize and other crops The Assistant Director indicated that the Institute would be interested in training students in the operation of dryers Students might be interested in helping their parents construct and operate dryers

Private Sector

This consultant only had a limited time to talk with owners and workers in several farm equipment companies It is apparent that these workshops, with fairly rudimentary equipment, have the capacity to manufacture tested equipment developed at Kawanda The SAIMCO farm manufacturer in Soroti is currently manufacturing food processors and other farm equipment

In Kampala, Afro Enterprises, Tonnett, and J B Engineering Works are all small farm machinery manufacturers They also do a variety of other manufacturing work Technical assistance from the PHHS/KARI at Kawanda has been successful in transferring some postharvest technologies to their enterprises These manufacturers have the necessary mechanical skills to make both prototype and finished farm machinery The owners and workers often have suggestions for innovative improvements in the manufacturing of equipment Promotion, diffusion, and further widespread adoption of these new technologies will allow the private sector to sell farmers equipment at a lower price as demand increases

In the country-side, a number of local artisans have been trained by PHHS/KARI unit to make multi-purpose dryers This has built up local capacity which can assist in the promotion and building of multi-purpose dryers as postharvest technology is more widely accepted The PHHS/KARI has successfully worked with private sector millers in installation of dryers and cleaners These have been selective interventions because of time constraints Technologies have been accepted and mill personnel trained in the operations and maintenance of equipment A project extension would enable the Project to further expand postharvest technology efforts with the private sector

Summary

NARO must extend the transfer of farm machinery technologies to farmers as part of GOU's mandate Adoption of these new technologies is demand driven Researchers must work closely with farmers to demonstrate, test, and revise prototypes to help assure farmer acceptance Farmer input in the R & D process is crucial as is the involvement of local farm machinery manufacturers NARO PHHS scientists should train local artisans and farm machinery staff in workshops and prototype development to ensure that new technologies will be disseminated effectively The involvement of the Uganda Manufacturing Association and the Uganda Small Scale Industry Association can strengthen the building capacity of local distributors and farm equipment manufacturers

Section V Technological Transfer Capabilities of Major Stakeholders

Overview

Progress toward attainment of the Postharvest and Storage (PHHS) Project objectives and activities are moving ahead satisfactorily although, they are slightly behind schedule This has been due to delay in start up time, moving activities to various districts, security problems, low level of counterpart support due to other demands on KARI, and delay of local currency necessary to take care of projected contributions by the GOU to the project Overall, the development of postharvest technology has progressed on schedule, but certain constraints in transferring technology to the end-users have been encountered

Traditional technology transfer mechanisms, such as the Uganda Agricultural Extension Service, may not be viable, due to reduced support of the extension service by the government and the international donors Many donors are now relying heavily on NGOs and PVOs for transferring postharvest technology The problem encountered is that although NGOs abound in Uganda--they may not be sustainable because of their reliance on uncertain funding by donors and private citizens The consultant reviewed the technical transfer capabilities of government organizations, the private sector, and PVOs and NGOs

Governmental Organizations

The governmental organizations reviewed included NARO, UAES, Makaere University, and technical institutes

1 KARI Postharvest Program

The GOU recently reaffirmed that researchers have a mandate to transfer research findings to end-users The traditional extension service has been decentralized, and field workers remaining have been reassigned to district governments PHSMSs receive their salaries and support from the GOU

It was anticipated that the KARI/PHP would increase its technology transfer capacity through designing and conducting adaptive research, designing and developing training programs, designing of training materials, and providing technical assistance to farm and commercial sectors The PHHS Component has accomplished a great deal in spite of very limited manpower Much of what has been accomplished has been through the efforts of the long term technical advisor

The KARI/PPH component has established and carried out the following activities related to technology transfer (a) selecting target districts, (b) developing specific training programs and materials for extension and technology transfer to NGOs and end-users, (c) conducting field trials, demonstrations, and related training for small holders, (d) conducting demonstrations for field workers, farmer associations, and the commercial sector, and (e) conducting demonstrations

and specific training for local traders, processors, and exporters Some specific examples of the KARI/PHH's technological transfer capability is outlined in Section IV

KARI's PHHS project conducted a one week long workshop and several one-two day workshops for extension and NGO field workers The basic approach has been the Training of Trainers (TOT) concept Basic training focused on training techniques, postharvest technologies, developing training plans/training activities, and how to build and operate different types of postharvest technologies A major effort has involved the training of field workers in building and operation of PHHs charcoal heated, convection multi-purpose dryer

Workshops for local artisans on how to build multipurpose crop dryers has helped to develop capacity at the farm level Technical assistance for commercial farmers, millers, and exporters has also been outlined in Section IV

KARI researchers have developed excellent planning, teaching (TOT), and organizational skills They have trained the five district PHSMSs and other key field workers in these skills The major constraint is the limited human resources available in the KARI/PHH Unit Several researchers have been reassigned duties or have been promoted A number of positions have not been filled It is essential to fill these positions needed at the national level

2 Uganda Agricultural Extension Service

The primary contacts at the district level are the District Postharvest Subject Matter Specialists (PHSMS) The specialists are now assigned to the district governmental administration Their salaries are still paid by the GOU Each PHSMS works directly with approximately 20-30 agricultural agents located at the subcounty level Specialists generally have a motor bike for transportation and field agents a bicycle Each agent works with more than 1,000 farmers

Agents, working at the subcounty level, are generalists, and they have to cover the entire agricultural spectrum PHSMS Margaret Angom, from the Lira District, reports that eight of 30 agricultural agents in her district spend a significant part of their time on postharvest work with farmers

The five District PHSMSs are the key PH facilitators at the district level They organize and coordinate training of extension agents All of the SMSs have other duties besides PH work Margaret Angom, for example, spends several days a week working on agroprocessing activities funded under the UNDP Without a doubt, the key postharvest technology transfer facilitators are District Specialists

3 Technical Institutes

Technical institutes are located in many districts The consultant visited the Apach Technical Institute A multi-purpose dryer has been built to dry maize, and plans are in place to build another one for other crops

The institute offers three courses in three subject fields tailoring, carpentry, and construction The Apach Institute has over 500 students and is located on a 100 ha farm Students are taught how to build dryers The Deputy Director talked about the importance of teaching students how to build and use dryers, and then of the possibility of students showing their parents how to build them

It may be worth exploring the utilization of technical institutes as an additional means of multiplying postharvest technologies Staff are trained in how to build and use dryers for institute farm crops Students are then taught dryer building and utilization techniques Since most students come from rural areas, they may be able to pass along postharvest technology to their parents along with the backup assistance of a local field agent This same multiplier concept might be worth exploring with other institutes and agricultural schools

4 Makarere University

This consultant did not have an opportunity to visit Makarere Several students have been involved in internship experiences with the KARI PHHS Unit according to reports This can be an excellent learning experience for students preparing to go into farming or private enterprise

Some research collaboration between NARO and the faculty of Agriculture and Forestry exist Joint collaboration in the postharvest technology field should be encouraged

Private Sector

There are a number of organizations in the private agricultural sector which are actively involved in promoting postharvest technologies for their members In addition, there is a growing interest among traders millers and exporters to adopt new postharvest technologies to add value to their products These organizations include Uganda National Farmers Association (UNFA), Uganda Cooperative Alliance (UCA), Multiple Training and Employment Association (MTEA), British-American Tobacco Company (BAT), Uganda Oil Seed Processing Association (UOSPA), Uganda Seed Company, and several private companies Their technological transfer capabilities are reviewed

1 Uganda National Farmers Association

Mr Daniel Wanzala, Vice Chairman of the Masindi Farmers Association, reported that the UNFA has 65 associations with over 100,000 members He noted that about 20 percent of the membership can be classified as semi-commercial farmers The associations generally have access to technical assistance through a field advisor

The UNFA recognizes the importance of postharvest technologies and is working closely with the PHHS at KARI The PHHS for example, conducted a one-day workshop on improved postharvest technologies for 30 UNFA farmers in Masindi The use and operation of the natural convection heated multi-crop dryer, the hand cranked maize shellers, and bean threshers were covered in the training A large dryer has been installed and is in operation at the Masindi Farmers' warehouse

The UNFA field agents have received postharvest training from the KARI/PHHS as well as district PHSMSs Local artisans trained by the PH Unit, helped UNFA members to build multi-crop dryers Mr Wazala indicated that the UNFA is willing to assign five to six field workers to work on postharvest technologies with their members at the district level He indicated these field workers should receive specialized training from the PH program The addition of at least one UNFA field agent in five districts, to work on postharvest technologies, is an opportunity that needs to be followed up by both the PH Unit and the UNFA While the UNFA already has developed some capacity to their membership, the addition of five district field workers concentrating on postharvest technologies would greatly increase the capacity of the organization

2 Uganda Cooperative Alliance

The consultant interviewed Dr Leonard Msemakaveli, Deputy UCA Director UCA has represented the interests of Ugandan farmers and the Primary Societies and District Unions in seeking and obtaining a new Cooperatives Statute, liberalization of import and export trade, and in extricating politics and politicians from the former parastatal cooperative units It has obviously acquired a large measure of influence and respect in the political arena to meet these ends

Currently, UCA has about 6,000 primary societies and 34 district unions This represents over 500,000 members There are approximately 15 field workers located at the district level and about 30 field workers working with various primary societies UCA field workers have attended PH Unit postharvest technology workshops Dr Msemakaveli, reported that UCA recognizes the significant postharvest losses experienced by their membership

Primary Associations build up savings that are available to members Members can borrow up to 1,000,000s , and a number of them have utilized loans to buy dryers and other types of postharvest technology UCA has worked closely with the IDEA Project and received some technical assistance through Volunteers in Overseas Cooperative Assistance (VOCA)

UCA has a Memorandum of Understanding with NARO to collaborate with their membership The Deputy Director indicates there needs to be increased assistance in the introduction of new PH technologies to farmers and training of their field workers The MOU may well be the appropriate vehicle to expand cooperative efforts

UCA appreciates the assistance already provided its membership through collaboration with the PH Unit Field workers have learned various PH technologies and built up a certain capacity level However, it is apparent that UCA represents almost 20 percent of the private sector of farmers Increased emphasis should be focused on building UCA postharvest technology capabilities

3 Multi-Purpose Training and Employment Association of Iganga

The Agricultural Development Center (ADC) has set up 25 MTEAs in the Iganga District An important aspect has been training farmers to deliver properly cleaned and dried maize The program has also demonstrated that the farmer and buyer could benefit by paying a premium

price for a quality product Farmers, who participate in the program and deliver quality maize, can earn an additional 15s /kilo over market price

The Director of each MTEA sells a quality product in terms of a clean 100 kilo bag of maize There are probably about 8,000 farmers participating in the program Each Center gathers 10 MT of quality maize and transports it to Kampala

Center directors in proper postharvest drying and grain management techniques to cooperating farmers A number of the directors have received PH Unit training and have encouraged farmers to build multi-purpose dryers introduced by KARI This consultant talked to two farmers who were MTEA members and had built and utilized dryers

A US$2 5 million grant from the E U has been approved to expand the MTEA concept Final details are being worked out with the GOU The grant would help finance and set up an additional 175 centers in maize growing districts MTEA directors already have benefitted from PH Program training and have passed this along to their members However, once the additional funding gets in place and another 175 centers are developed, this will represent an excellent opportunity to built up MTEA capacity One idea is to have MTEA assign one of their members to become a PH specialist, and to receive specialized training through KARI

4 British American Tobacco Company

Private sector based agricultural extension services, represent an attractive alternative or complementary approach for some small value added crops While the emphasis is on tobacco, BAT field workers also provide technical advice on food security crops Postharvest technologies and training for BAT field workers is worth developing BAT serves over 35,000 farmers

5 Uganda Oil Seed Processors Association

According to Peter Otimodoch, Executive Director for UOSPA, increasing soybean and sunflower materials to produce quality vegetable oil is a major objective of the association

Several UOSPA managers have received training and technical assistance from the PH Unit The oil mill in Lira has received assistance in the construction of a large dryer, and a mechanical cleaner is also being tested Some farmers have utilized dryers for sunflowers, but further work in specific techniques is needed The Lira plant employs about 25 sub county representatives to supply seed to farmers and then buy back seed This may represent a potential capacity-building opportunity to train farmers in PH technologies

6 Uganda Seed Company

The PH Unit has provided some technical assistance to USC An inactive 10 MT maize seed dryer in Masindi was reactivated through technical assistance work provided by PHH Team John Muyenzi, Seed Processing Manager of the Masindi Plant, expressed his appreciation for the activation of the dryer, and also the technical training received in terms of operating the dryer The enhance drying capacity enables the plant to dry maize from growers on schedule

7 Private Companies

The KARI/PHHS/PHP has worked with several private farm equipment companies, millers, and exporters New postharvest machinery and technologies, including agroprocessing equipment, have been introduced to farm equipment manufacturers in Kampala and Soroti These companies are now able to manufacture economical hand-operated shellers, food processing equipment, cleaners, and other simple technologies More than 2,000 small hand maize shellers have been made by a manufacturer in Soroti There is no doubt, that the technical capability of these manufacturers have been improved The secret is to get wide spread adoption of new technologies by farmers and then the cost of mass producing low cost equipment will become more affordable to the farmer A UNDP project is working on postharvest issues including cassava

Summary

The development of capacity of the private sector is the best opportunity for long term sustainability of new postharvest technologies UOG extension support may come and go, but the private sector is based on a more solid, long term base within a free market system

Invitations from the UNFA and UCA, representing about 25 percent of farmers in Uganda to strengthen postharvest collaboration with KARI PH Unit, definitely must be followed up The UCA already has a MOU in place with NARO The MOU might be the appropriate vehicle to begin strengthening collaboration UCA has 45 field workers who can be trained The UNFA has proposed assigning five district field workers to be trained by the PH Unit in postharvest technologies This presents an excellent opportunity to build up the capacity of the Association

The potential expansion of MTEA centers offer additional opportunities as well as expanded collaboration with other entities in the private sector The greatest constraint is the limited person power available at KARI to exploit these capacity building opportunities Operating support is also needed An investment in the private sector appears to have an excellent future payoff

Non-Governmental Organizations (NGO)

A number of Non-Governmental Organizations have been involved in the technology transfer aspects of postharvest technologies These NGOs include Appropriate Technology Uganda (ATU), Environmental Protection and Development Project (EPDP), Food Security and Marketing Project (FOSEM) of Agricultural Cooperative Development International (ACDI), Volunteers in Overseas Cooperative Assistance (VOCA), and a number of other NGOs A short description of each NGO and their technical transfer capacity follows

1 Appropriate Technology Uganda (ATU)

ATU, which is USAID funded, is in seven districts with programs directed at food security ATU does not generate postharvest technologies but seeks existing technologies at KARI ATU has

been working in collaboration with both the KARI PPHS Unit and the district PHSMSs ATU works with key core groups of farmers ATU conducts training in both postharvest and agroprocessing technologies

ATU's major activities include promoting training in postharvest management to small holder producers in selected districts with special emphasis on women farmers Training has been carried out in training households to use multi-purpose dryers and appropriate crops with special emphasis on the efficient use and management to ensure the viability of seeds ATU also provides refresher courses for trained artisans already working in the districts KARI professionals have conducted several postharvest training workshops for ATU field workers ATU offers an important postharvest training presence in seven districts and their field workers have developed post training skills to teach farmers

2 Environmental Protection and Development Project (EPDP)--EPDP funded through ACDI (Agricultural Cooperative Development International)

EPDP is working in five different districts The KARI PH Unit has trained EPDP field workers in construction of improved cribs and silos, construction and utilization of multi-purpose dryers, and simplified agroprocessing techniques EPDP works closely with District PHSMSs, NUFA, and other farmer groups EPDP field workers have gained postharvest skills and built up a certain level of capacity to teach farmers the requisite skills

3 Food Security and Marketing Project of ACDI (FOSEM)

The FOSEM Project is funded by a grant through the Monetization Project under a PL-480 program FOSEM is promoting the production and marketing of maize, beans, soybeans, cassava and small grains in the districts of Masindi, Tororo, Busia, and Iganga Ben Ekot, Project Manager, reported that the PH Unit trained eight field and office staff in a workshop concentrating on postharvest technologies and equipment for beans and maize The trained staff are now teaching farmers in the districts the new technologies

4 Volunteers in Overseas Cooperative Assistance (VOCA)

ANEPP has provided assistance through the VOCA Farmer-to-Farmer program to the PH Project with additional hands-on technical and agribusiness management The PHHS Project has utilized the services of several excellent volunteers The volunteers are usually only in Uganda for about six weeks and generally work on specific projects It is difficult to develop much individual or organizational capacity unless this is built into the terms of reference or if the assignment specifically calls for the training of professionals or field workers involved in transferring postharvest technologies

5 Other NGOs and Programs

There are other NGOs involved in postharvest technology work with end-users These include CARE, World Vision, ACCORD, World Learning, and other international and Uganda NGOs The consultant did not have time to visit and talk with representatives of these organizations

The Netherlands is developing a comprehensive infrastructure program in a number of districts This is a 15-year commitment Activities include micro-credit for agroprocessing and postharvest technologies Rice hullers have been introduced as well as hammer mills Credit for storage units for crops is also available for groups The program is working closely with Margaret Angom, the Lira District PH SMS

Building NGO capacity has proven effective within the limited life of the PH Project Efforts should be expanded However, a major constraint are the shifting priorities of NGOs and the uncertainty of continued long term funding by donors and private citizens

International Organizations

International Agriculture Research Centers such as the International Institute of Tropical Agriculture (IITA), the International Rice Research Institute (IRRI), Centro Internacional de Agricultura Tropical (CIAT), and others, provide a tremendous source of assistance in the development of postharvest machinery and technologies The organizations have helped provide the KARI PH Unit with a number of postharvest prototypes which have been further refined and tested This is an excellent source to draw on to strengthen KARI's technical and training capacity

U S universities are another important source that can be tapped to build capacity The Project has drawn on the expertise of Mississippi State University, the Postharvest Institute Program at the University of Idaho, the Agricultural Engineering Department at Kansas State University, and several other project collaborators The Food and Agricultural Organization (FAO) is another excellent international organization The development of the postharvest data base at KARI is an excellent example of building up information and data capacity There are over 45,000 postharvest references in the data base Support for the data base must continue to be supported

Summary

Building up the postharvest capacity of Uganda's human resources of agricultural professionals, field workers, and farmers is critical if the target to reduce postharvest losses, improve food quality, and improve farm family income is to be achieved Early in the Project it was recognized that essential to success of building of capacity within the UOG and collaborating organizations required commitment and support

The GOU currently budgets about 0 2 percent of its budget for agricultural research At the start of the project, 10 key specialists at the KARI Postharvest Program were engaged in postharvest work Of these, five were considered key project personnel Many of the specialists originally working with the project have been reassigned or promoted to other duties since it began In addition, the GOU has mandated the research specialist need to transfer generated postharvest technology to field workers and farmers The commensurate operational support from the UOG has not been forthcoming

A major constraint has been the inadequate GOU counterpart funding The in-cash counterpart fund, earmarked for the PHHS, came to a halt early in the project The PHHS project has been operating almost completely using its own funds and resources to keep its on-station and field activities operating USAID local funds, amounting to 25,000,000s , has enabled the project to support most operational activities

KARI senior staff members are well trained, however because of the many research activities of each KARI PHP member, they have only a very limited time for technology and training programs of the PHHS project Only four or five of the entire senior staff members are partially available for PHHS activities Even these staff, who are available, are already spread very thinly across the broad spectrum of their PH commitments The situation will continue to worsen as PH activities are expanded One solution would be to enlist the services of PH specialists from other research institutions such as AEATRI, Food Science Research Institute (FOSRI), and Namulange Agricultural Research Institute (NARI) Another option is for additional funding to be provided so that PHHS can hire its own field assistants under the low and high value crops components of the project This would alleviate the dependence of the PHHS Project on the participation of the already over-extended KARI PHP senior staff members These problems must be addressed if postharvest leadership and capacity at the national level is to be improved and made sustainable The true measure of the GOU, toward a commitment to project success, is in part the financial commitment needed to ensure project sustainability If postharvest losses can be substantially reduced, it will represent significant economic savings to Uganda and its farmers

An important aspect, toward project objectives, is building the capacity of the UAES, the private sector, and NGOs The UGO has greatly reduced support for the extension service Agricultural personnel are now assigned directly to the district governmental unit The five target district PHSMSs have been key contacts at the district level for the PH program All five specialists have other duties as well To date, the five SMSs have received intensive training from the KARI specialists, and they in turn are training agricultural agents, NGO field workers, and farmers in postharvest technologies This has been a successful first step in building capacity at the district level

The development of private sector capacity is the best opportunity for long term sustainability of new postharvest technologies President Museveni congratulated UNFA and UCA for their roles in providing farmers with agricultural advisory services, and noted that by offering the services on a demand-driven and cost recovery basis, that these organizations are empowering the farmers to assure agricultural sustainability

The UNFA and UCA represent about 25 percent of the farmers in the country About 20 percent of these can be classified as semi-commercial farmers The KARI PH Project has trained a number of UNFA and UCA field workers in postharvest technologies The UNFA leadership has proposed assigning five of their district field officers to work directly with the PH Project These officers would undergo intensive training at KARI with follow-up and refreshers courses in the field This offer needs to be further explored It does at least tentatively demonstrate the commitment of one of the two leading farmer organizations in the private sector Capacity building with large farmers, millers, exporters and farm machinery companies has been impressive and should continue

The NGOs especially ATU, EPED, and FOSEM are actively promoting postharvest technologies KARI/PHHS specialists have provided training for their field workers and farmers NGOs will continue to conduct effective postharvest technology programs and activities, however, a major constraint is the uncertainty of NGO funding depending upon the external donors and private citizens Continued support of NGO postharvest activities is essential Some capacity building of staff, and NGO farmers and groups has been obtained

Section VI Available Credit Programs in Support of Improved Production and Post Production Technologies

Overview

A central aspect of the daily struggle in Uganda is the peoples' insecurity to sufficient quantities of nutritious food A recent study indicated that 45 percent of rural children suffer a certain degree of malnutrition A number of factors contribute to this situation a heavy dependency on rain-fed agriculture, inadequate agricultural technologies including postharvest, limited extension advisory services, poor infrastructure, insufficient markets, and insufficient agricultural credit Approximately 80 percent of the rural population are classified as small holder farmers cultivating less than 2 5 ha of land The majority of the remaining 20 percent are classified as semi-commercial farmers

In Uganda, women provide about 75 percent of the agricultural labor force in a predominantly agricultural country, are responsible for about 80 percent of food crops, more than 50 percent of cash crop production, and for virtually all food processing Womens' contribution to rural households do not end with crop cultivation Women thus have primary responsibility in household management, food preparation and family health and welfare Women's contribution to the productive process as well as household duties is not matched by their control over the use of resources

Access of women to credit is most difficult Despite high labor force participation rate of women in agriculture, very few women have access to credit facilities Utilization of credit is limited by high interest rates, even with the Uganda Women's Finance and Credit Trust Fund The interest rates are as high as 28 percent annually Secondly, because of the lack of access to collateral (usually land title), need for a male co-signer, and low level of literacy, women are not able to tap the usual credit funds or revolving fund schemes Also, those most in need of credit, the poor women in general, are not in a position to come up with convincing proposals because of their low social, educational and economic status

A number of specific credit-oriented projects are being implemented in the country in which women through established quotas are benefitting One of these is the West Nile Credit project administered by the Ministry of Gender and Community Development with UNCDF and CARE funding The co-operative credit schemes also provide short term production credit to women farmer members of cooperatives IFAD also supports a number of projects in the country by providing loans to rural women

Credit programs have performed poorly, in general, in Uganda A study by the Bank of Uganda (BOU) reviewed the credit programs including the Rural Finance Scheme administered by the UCB, the Cooperative Credit Scheme, managed by the Cooperative Bank, credit components in the Northern Uganda Reconstruction Program, South Western Region Agricultural Rehabilitation Project, and the Smallholders Cotton Rehabilitation Project implemented by the Ministry of Agriculture, Animal industry, and Fisheries (MAAIF)

The Bank study indicated that all of the credit schemes performed poorly The report noted "bureaucratic culture has been pervasive at the levels of implementing agencies and intermediaries Ultimate borrowers often considered themselves to be rightful beneficiaries of government funds, made available for distribution as grants and not credits Such perception and behavior by management, staff, borrowers and politicians all contributed to damage financial discipline, low quality loan portfolio, misallocation of credit, diversion of loan use, high loan delinquency and defaults and weak financial institutions " This is basically the condition of the farm credit environment today in Uganda Some micro-enterprise loans are being made for small businesses, however, guidelines for these loans limit credit for agroprocessing and on-farm processing Therefore, the vast majority of farmers in agricultural production are marginalised from agricultural credit

Agricultural Credit Programs

The consultant talked to the representatives of a number of programs with credit subcomponents to determine if credit was available for agroprocessing or for postharvest technologies

1 Uganda National Farmers Association

The Credit and Marketing Support Project was to establish effective credit support to the marketing activities of the UNFA Business agents are selected by UNFA district committees The loans supply inputs, market the outputs and assist with medium-term and seasonal loans to about 300,000 households

DANIDA is assisting the UNFA in operating a farm credit program for about 2,000 members These loans can be used to purchase agroprocessing equipment and postharvest technologies The repayment rate on loans is almost 100 percent DANIDA is planning on greatly expanding this program in 1999

2 Uganda Cooperative Alliance (UCA)

The primary society (PS) is the basic building block of the cooperative movement Today there are about 6,000 of them, the majority (75 percent) of which are agricultural marketing societies dealing mainly with coffee and cotton Others deal with vegetables, dairy farming, transport, hides and skins, credit and savings and fishing Considering all categories of societies, the average membership is about 500 Membership usually is granted to heads of households Cooperatives represent a substantial percentage of the farming households in the country

Leonard Msemakeveli, Deputy Director of the UCA, reports that about 600 of the PSs have credit and savings programs Approved loans can go up to 1,000,000s The Deputy Director reported that many loans are approved to purchase agroprocessing and postharvest equipment

3 Foreign-based NGOs

Foreign-based NGOs which are specifically microfinance institutions and those which are multi-sectoral with microfinance as a component in their programs, include FINCA, World Vision, World Learning, Accord, etc

FINCA's target group is women The districts where FINCA is active make loans available for some agricultural purposes FINCA works with groups of 25-35 women Compulsory and voluntary savings, such as pre-loan savings must be 10 percent of loan principal and post loan savings must be 20 percent World Vision is currently implementing small business activities in eight districts They grant loans from 50,000 to 1,000,000s

The Uganda Women's Finance Trust Limited was founded in 1985 It is affiliated with the Women's World Banking in New York The Trust has nine centers Clients are women in urban and rural areas including Iganga, Soroti, and Mbale Clients for groups of from 10-25 members cannot exceed 20 percent men in their groups Loans up to 1,500,000s are made Like FINCA, they only lend to individuals who are attached to a group Most loan recipients are involved in agricultural and business ventures

The Private Enterprise Support, Training, and Organizational Development (PRESTO) Project The objective of the micro component of the PRESTO project is to strengthen institutions that provide savings and credit services to micro enterprises PRESTO has assisted NGOs that specialize in microfinance, including NGOs that have multiple programs, World Vision, Plan International, Oxfam, and Christian Rural Services

4 Other Credit Sources

There are a number of other organizations that provide loans to the rural sector One of these is the Village Bank concept There are now about 40 Village Banks in the country Banks are generally established in towns with more than 2,000 population The community, through coordination of a leader, express their desire to have a bank and services managed by them A bank needs to have about 400 members The membership entry fee is 10,000s and unit shares of capital are worth 50,000s Most of the loans are for micro-enterprises, but Mr Palmer, a VOCA volunteer, reported that some loans are made to support the purchase of agroprocessing and postharvest equipment The Village Bank is a private sector development venture

Uganda Cooperative Savings and Credit Union (UCSCU) was founded in 1972 Current membership is 200,000 with approximately US$100,000,000 in total share value A total of 40 percent of the members are women About 70 percent of the Unions are rural based

The Uganda Post Office Savings Bank (UPOSBI) works under the framework of the Uganda Posts and Telecommunications Corp One challenge for UPOSBI is to make institutional arrangements for cost-effective savings mobilization and delivery of other financial services, including encouragement of village banks and capacity building at the client level

In the Apac District there are two local credit sources These are the Maruzi Development Association and the Apac Development Fund The Apac Fund is capitalized at 50,000,000s and

loans can be made up to 200,000s Rural women can use this source to purchase materials to make multi-purpose dryers

The Uganda Oil Seed Processing Association funded under PL 480 is making 70,000,000s available to farmers in two districts to buy inputs The UOSPA Director said that farmers could borrow funds to build a multi-purpose dryer to utilize in the drying of oil seed crops

Table 10 Farm Credit Accessibility

Organization	Type of Credit for	Comments
Uganda Women's Finance & Credit Trust Fund	• Microenterprise Agroprocessing	• 28% interest • Male signer needed for loan to women
West Nile Credit Project	• Production Credit	• Targeted for women
UNFA	• Production Credit • Agroprocessing • Postharvest equipment	• 100% repayment • 33% interest • DANIDA support program will expand to >1,000,000s
UCA	• Production credit • Agroprocessing • Postharvest equipment	• 500,000s • Local societies • 23% interest
FINCA	• Some agroprocessing	• Women--target 25--35 • 50--1,000,000s • Pre-loan savings 100% • Post loan 200%
PRESTO	• Micro enterprise development including agroprocessing	• Women • NGO support
Village Banks	• Agroprocessing • Microenterprise	• 30% interest • 10,000s • Membership entry
Maruzi Dev Association	• Postharvest equipment • Agroprocessing	• APAC women • 200,000s
UOSPA (Uganda Oil Seed Processors Association)	• Multi-purpose dryers • Inputs for ag production	• Limited to 2 districts

Summary

Farmers in the rural sector encounter severe difficulties in trying to obtain credit for agroprocessing and postharvest technologies (example a multi-purpose dryer) Womens' access to credit is difficult because of educational, social, and low economic status

Historically, according to studies conducted by the Bank of Uganda, almost all credit schemes have performed poorly Major problems have been poor repayment records, development of attitudes that money loaned is in fact a grant, diversion of loan use and loan delinquencies

Credit for farmers is available through certain of the UNFA groups DANIDA is providing some financing in a pilot project Utilizing group pressure, UNFA leadership reports repayment of almost 100 percent of the loans DANIDA plans on expanding support for the program in 1999

UCA represents more farmers than any other organization in the rural sector Members can obtain loans in about 600 of the Primary Societies Loans are made for agroprocessing and postharvest technologies Interest on loans in the credit unions is 33 percent and interest on savings runs 25 percent

There are a number of foreign based NGOs which have program subcomponents to support micro-enterprises The PRESTO Project, which is USAID supported, strengthens the institutions that provide savings and credit services for micro enterprises PRESTO assists programs such as World Vision, Oxfam, Plan International, and many others Some possibilities may exist through these credit programs to obtain loans to purchase postharvest technologies

Forty Village Banks, Postal Credit Union, and Uganda Savings and Credit Union are other financial institutions which may provide credit for micro-enterprises Obtaining credit can enhance and build capacity of rural farmers to purchase materials for postharvest technologies A complete inventory of all credit sources available within each district would be a valuable resource for District PHSMSs and other field workers with postharvest technology responsibilities A summary of farm credit accessibility is listed in Table 10

Section VII Development of a Decentralized, Capacity Building and Sustainable Postharvest Technology Transfer Plan

Overview

The purpose of Section VII is to outline the development of a decentralized, capacity building, and a sustainable postharvest technology plan The plan includes a budget The development of a plan includes a budget to support essential activities to extend the transfer of proven postharvest technologies

The three major sets of technology transfer stakeholders include GOU, the private sector, and NGOs USAID/Kampala and external donors also have an important investment in the Project The original need for the Project was based on the fact that postharvest losses for Uganda of low value-added crops, including maize and beans, exceed an estimated US$18,000,000/year Maize postharvest losses often exceed 30 percent, and bean losses are estimated to range between 10-20 percent/year Soybean and sunflower seed losses also are in the 10-20 percent loss category Postharvest losses contribute a negative impact on the incomes of farmers as well as a constraint to exporting low value added crops such as maize and beans

The original grant agreement, totaling about US$2 9 million, was signed by the GOU and USAID in 1995 Mississippi State University served as the external contractor and provided long term technical assistance and support to the KARI Postharvest Program It was designed to increase its capacity to conduct postharvest field research and technology transfer Other functions were to carry out adaptive research, design and develop training programs and materials, develop a long term technological strategy and plan for providing postharvest research and technology transfer services to both the farm and commercial sectors

The PH Program started in about March 1996 A number of postharvest technologies have been developed under the KARI Postharvest Program One of the most impressive has been the development of multi-purpose dryers by the PHHS Project Over 100 of the dryers have been built in five target districts A number of technologies are being manufactured by local farm equipment manufacturers and field tested

The development of postharvest technologies at KARI are well advanced The major challenge facing the Project is gearing up to expand and multiply technology to technical transfer agencies, farmers and the commercial sector In addition to research responsibilities, the GOU has assigned the National Agriculture Research Organization (including KARI) researchers a technical transfer mandate This has been accompanied by major manpower reductions in the Uganda Agricultural Extension Service and the decentralization of remaining UAES field staff to district governmental units

In the original Project Paper, the GOU indicated a commitment to an expanded postharvest program in allocating personnel and other resources to postharvest technology development However, in light of severe economic constraints, the GOU has not filled many of the postharvest positions at KARI A number of postharvest researchers have been reassigned to other duties or have been promoted The long term technical advisor estimates that there are

only two researchers working part time on postharvest technology development and transfer duties This, coupled with the reduction of UAES staff and their reassignment to the district level, has reduced GOU manpower available to meet original Project goals and commitments This is a major constraint in building capacity at the national level in both research and technology transfer If these limitations continue, it seriously calls into question the development of country capacity and future sustainability of the program

The PHHS Project has achieved some initial technological transfer progress The PHSMSs, working in the five target areas, have been effective facilitators in collaborating with the KARI/PHH The PHSMSs train extension, NGO field workers, farmers, and collaborate with PH researchers' demonstrations and adaptive research Initial contacts have been made with the Uganda Farmers National Association and the Uganda Cooperative Alliance These two associations from the private sector represent the interests of more than 600,000 farmers The UNFA's leadership has proposed assigning five of their district staff to work full time on postharvest technology activities The development of the private sector has received the enthusiastic endorsement of Uganda's President Museveni In 1997, President Museveni stated,

> *"I congratulate the UNFA for its role in providing farmers with agricultural advisory services, and to take note of the fact that by offering the services on a demand-driven and cost recovery basis, you are empowering the farmers to take charge of their destiny by making the right choice, at the right time, and ensuring the future sustainability of the service"*

The strengthening of the capacity of the private sector will ensure Project sustainability over the long run

The KARI/PHH researchers have worked with traders, millers, and exporters Large commercial dryers have been tested and adopted by millers, and a variety of other equipment including cleaners are being utilized Field workers from the commercial sector have also been trained in postharvest technologies

The KARI/PHHS have developed strong ties with NGO donor funded projects There are a number of NGOs that include postharvest technologies as part of their program mandate These include Appropriate Technology Uganda(ATU) affiliated with Enterprise Works Worldwide, formerly Appropriate Technology International (ATI), EPED, FOSEM, and others NGO field workers have been trained and new postharvest technologies introduced NGOs are important stakeholders in the technology transfer process The major NGO constraint is that funding is often dependent on the "good will" of external donors and private citizens

The potential economic impact in reducing postharvest losses is well documented The reduction of losses and improvement in value-added quality of crops increases farm income Dr Norman Borlaug pointed out that governments must invest in both agricultural research and technical transfer organizations in order to realize the full economic potential and benefit Studies conducted by the IARIs indicate that significant investments by African governments can realize a return of from 100-300 percent for each dollar invested in research/technical transfer programs

The current KARI/PHHS program has made adequate progress in the development of postharvest technologies Funding for the project terminates at the end of December 1998, however, a proposal for a no-cost extension to the end of December 1999 is currently being developed by Mississippi State University, and it will be submitted to USAID/Kampala The extension would enable the long term TA to continue along with general project support However, the financial and manpower limitations will continue to constrain the Project from fully realizing its objectives This consultant was asked to review the Project in terms of its current technology transfer, and to develop a plan which could enhance long term capacity building and sustainability The Plan is outlined in the next section

National Postharvest Technology Transfer Plan

The Plan outlined in this report is a proposal developed by this consultant and based on his observations, interviews with stakeholders and review of project documents The Plan is generic in nature and focuses on technology transfer A basic assumption is that a great deal of postharvest technology has been developed and tested at KARI, and that the major task remaining is to promote widespread diffusion of the technology to farmers and the commercial sector

This consultant also recognizes that a one year, no-cost extension to be funded by USAID, stands an excellent chance of being approved This would continue the project for an additional year Some of the activities and strategies outlined in the Plan may well overlap and duplicate those in the PPHS Project The major concern of this consultant is to outline those activities, strategies, and the resources needed to design a postharvest technology transfer plan that builds capacity and ensures sustainability of project goals A budget is also included The proposed plan is budgeted for a two year period including external technical assistance Specific sources of funding will need to be worked out by the stakeholders in order to support the Plan Budget The GOU financial commitment is also outlined

Plans for guiding the development of a technological transfer plan can be drawn from the work of many decades of partnerships between international agencies, NGOs, the private sector and national governments The basic steps are (1) Project Design and Strategies, (2) Leadership, (3) Financial Sustainability, (4) Monitoring and Evaluation, (5) Beneficiary Participation, and (6) Structured Flexibility While it is recognized that a country's macroeconomic environment and policies in such areas as exchange rates and agricultural pricing are critical to technological transfer activities and agriculture as a whole, they are more properly part of a larger policy dialog between donors and recipient countries Major components of the plan are discussed, and relevant activities, leadership roles, and basic assumptions are outlined

Project Design and Strategies

Project Design and Strategies implies that the first step in the development of the plan is for the stakeholders leadership to meet in a workshop setting to reexamine and agree on goals for the Plan Project Leadership at KARI should take pivotal role in dialoging with UAES, District Government, UCA, UNFA, AI, EPED, FOSEM, and other private sector and NGO

representatives Specificity implies careful target selection in order to maximize project outputs and project resources For example, specific targets for the Plan may be limited to semi-commercial farmers and the commercial sector

Critical for enhancing sustainable project development is an early and effective dialogue regarding goals and procedures between the various stakeholders Mutual agreement is basic to assist the stakeholders in achieving their articulated short term project goals while at the same time promoting sustainable development for a continuous flow of long term benefits This step should be carried out as soon as possible Once the goals are in agreement, then specific strategies, activities, monitoring and evaluation can be more easily agreed upon Goals and objectives for the plan will, in fact, be very similar to those of the PHHS Project The stakeholders implementing the current PPHS Project component, have twice gone through a similar exercise since the start of project implementation, but a similar activity will still be required

Certain activities and commitments such as baseline studies, applied field postharvest research, training programs, development of training programs, conducting farmer trials and demonstrations, monitoring and evaluation procedures, and other activities can be planned once project goals and objectives can be agreed on

Leadership

The KARI PH Program already has the national mandate for postharvest technology research and transfer This critical cadre of researchers needs to be expanded, especially if the long term capacity at the national level is to be maintained This is especially important with the departure of the long term technical assistant at EOP This consultant recommends that the equivalent of three FTEs be assigned on a permanent basis to the Project The FTEs, for example, could be full time personnel or researchers on part time assignments Some of the researchers at AAETI might be assigned to the unit The GOU would be responsible for salaries, benefits, travel, and support The development of this critical leadership group is central in supporting the long-term sustainability of the project

This consultant also recommends that a short term technical technology transfer consultant be brought in after the departure of the long term TA to provide continuity and help build national technical transfer capacity during the two year plan The short term technical technology transfer consultant should be brought in on three, and six-week assignments The VOCA program or one of the current PHHS subcontractors might be a source for the short term consultant

Financial Sustainability

Cost issues will continue to dominate technology transfer planning and design Large scale systems place significant burdens on national budgets, while smaller initiatives usually have higher per capita costs These costs and their recurrent implications need to be recognized and quantified in the early stages of the Plan

There must be a commitment by the GOU at the highest levels to provide the financing based on a realistic assessment of the value of postharvest technology transfer Without this commitment, experience has shown that technology transfer financing, particularly for operating costs, is an easy target for budget cutters The result is often a crippled program in which personnel lack the mobility, materials, and morale to perform effectively Sustainable commitment also needs to be considered

GOU support for upgrading manpower requirements at the KARI/PHH program was outlined in the previous section There are currently five PHSMSs at the district level This consultant recommends that these five specialists be allowed to work at least 75 percent of their time on postharvest technology transfer work, and that five additional PHSMSs be recruited to work in other districts The current specialists are doing an excellent job of training field workers and farmers These specialists thus help to build capacity in terms of field workers and among farmers Operational support of these specialists should also be included The District PHSMSs are the program facilitators, and contribute key leadership to the decentralized program

The private sector is another important stakeholder in the postharvest technology program The current KARI PHH program has strengthened exporter, trader, and producer associations and built up the capacity of these associations to maintain effective support services for their members The private sector represents country specific organizations that serve their members, as a demand driven basis, with partial cost recovery for these services

Enhancing the capacity of the private sector for postharvest technology transfer, represents one of the greatest prospects for improving project sustainability utilizing cost effective indigenous organizations The Uganda National Farmers Association, for example, has over 100,000 members, and provides them with technical services including some credit UNFA leadership in preliminary discussions indicated they would like to assign five of their district field workers to postharvest technology responsibilities The understanding is that UNFA would provide full support for their field staff The district staff could undergo intensive training at KARI and then receive refresher courses on an on-going basis

The Uganda Cooperative Alliance (UCA) currently serves over 500,000 members through more than 6,000 primary societies UCA field workers provide technical advice and service to primary society members The UCA Deputy Director indicated his interest in pursuing further collaboration with the KARI PH Project UCA has a Memorandum of Understanding with NARO, and this could provide the vehicle to expand collaborative efforts The opportunity to build capacity and sustainability with the largest producer association in the country should be followed-up

The Multi-Purpose Training and Employment Association Project in Iganga District provides marketing and technical assistance to over 8,000 maize producers Center Directors collaborate with District PHSMSs in the training of maize producers to properly dry maize as an added value crop The EU has approved a US$2 5 million grant to facilitate the expansion of an additional 175 centers Increased collaboration with the MTEA Directors and farmers provide another opportunity to further build capacity at the district level

NGOs are another important set of stakeholders Most NGOs receive donor assistance and include postharvest technologies as a subcomponent of their programs Appropriate Technology Uganda (ATU) operates agricultural programs in a number of districts Many of their field workers have received postharvest technology training through the PH Unit ATU's field workers have assisted farmers in building multi-purpose dryers, for example EPED, FOSEM, and other NGOs have also collaborated with KARI and the District PHSMSs Strengthening needed manpower requirements at the KARI PH Unit and at the district level lead to upgrading NGO capacity in postharvest technologies The key to building national capacity and sustainable postharvest technology programs is increasing the skills and talents of private sector and NGO agricultural professionals at the district and local levels

This consultant recommends the addition of a short term consultant to assist KARI, the private sector, and NGOs in the development of the overall technical transfer plan and its implementation of the two year period recommended for the Plan The consultant can be recruited from one of the current project subcontractors or through VOCA This consultant recommends assisting the stakeholder in the planning/implementation of programs to achieve technology dissemination Also, to measure the impact of these technologies involving client identification, program delivery methods, collaborators and criteria for selecting technologies This would be closely coordinated with input from two other short term consultants recommended for the Plan

Monitoring, Evaluation, and Impact Assessment

Monitoring is a management tool needed to track performance within programs and in conjunction with feedback from the field to quickly bring problems to light Monitoring should not be confused with longer term program evaluation Indirect measures evaluate both education results (change in attitudes, etc) and changes in practice change/performance

This consultant recommends that the services of two short term specialists (VOCA, for example) be utilized during an early stage of the Plan The first consultant would be employed to conduct an economic analysis of the best bet postharvest technologies This would serve as the base upon which the best technologies with the greatest economic benefit could be transferred to farmers The data would assist KARI/PHH specialists and the key district PHTT officers at the district level in planning and conducting programs The second consultant would be employed to assist KARI and the other stakeholders develop an evaluation plan and strategy to measure program outcomes, including both indirect measures, practice changes, and the use of best postharvest technologies This consultant can also assist KARI personnel in developing proposals to capture resources sufficient to carry out technology transfer and impact assessment programs Both consultants should be utilized early in the development of the Plan Both consultants should assist project leadership to develop a system to measure project impacts--both economic and quality of life indicators

Beneficiary Participation

A critical element of sustainable institutional carry-over, is the commitment throughout the entire system, that the beneficiaries have a voice in exercising choice and becoming managers of their own future Fortunately, farmers who are members of the UCA and UNFA groups, have a direct voice through their societies and associations A major emphasis must be placed on improving program access to women and assist them access loans to purchase postharvest technologies

The approach to postharvest technology programming is viewed as significant in supporting the goal of sustainable development By empowering both male and female farmers, they can gain skills in making more informed decisions and in accessing needed inputs Involving beneficiaries in project planning and decision-making encourages a sense of ownership that is directly related to long term sustainability

Structured Flexibility

A structured program for implementing the Plan is essential Management strategies that are flexible and open to change, reinforce the adaptation that is necessary in operating PH technological transfer projects in changing environments A willingness to remain flexible can prove to be a major component in providing the capacity of the stakeholders to make improvements

Summary and Application

The six steps involved in the development of a decentralized, capacity building and sustainable postharvest technology transfer plan have been outlined A specific list of steps, stakeholders and responsibilities are outlined in Table 11 A budget, including both external and GOU commitments to support the proposed Plan, is noted in this section along with a list of short term consultants needed Specific financial commitments, to ensure project sustainability are outlined, and they are noted in the budget Specific sources of funding that may be considered to support the Plan include USAID/Kampala, UOG, NGOs, UNDP, EU, IFAD, foundations, IARCs, and other potential funding sources Mississippi State University is currently developing a one year, no-cost extension for USAID/Kampala Some of this funding might be utilized to support the Plan A complementary, plan outlining activities, leadership roles, and assumptions is located in Table 12 Table 12, instead of focusing on the specific components of the Plan, outlines the necessary steps/activities of the Plan in a chronological manner The two approaches cover the same basic activities and time frame, but allow the stakeholders to consider both key components and essential activities to carry out the plan The GOU contribution to the project is costed out at about US$141,000 and external donor support at US$352,000

Again, the Plan is specifically developed to enable the KARI PH Unit and major stakeholders to build increased program capacity and sustainability Conditions that facilitate sustainable development and support participation of the beneficiaries is an important part of the Plan The

process needs to start in the design phase where the stakeholders can identify and articulate their objectives to improved sustainable development

Steps Involved in Development of PHTT Plan

Table 11 Steps Involved in the Development of a Decentralized, Capacity Building, and Sustainable Postharvest Technology Transfer Plan

Components	Stakeholders	Tasks
Project Design and Strategies	• KARI	• Initiate project design discussions with NGOs, UCA, UNFA, UAES, MTEA, donors, commercial sector
	• KARI	• Contract services of PHTT consultant to assist with project design
	• KARI	• Plan and conduct project design and strategy workshop with stakeholders
	• KARI	• Develop two year PHTT Plan • Agree on goals/objectives • Develop policy statements supporting goals • Define target clients, baseline studies, farmer trials/demonstrations • Develop organizational operation procedures • Review of roles and responsibilities in terms of program implementation • Agree on general training strategies and needs • Discuss possible M & E strategies
	• KARI	• Continue throughout project PH research and TT work
Leadership/ Program Implementation M 1 & 2	• KARI/USAE UCA/UNFA	• Recruit staff •KARI--3 researchers •UAES--5 PHSMSs •UNFA--5 District field workers
	KARI/PHSMSs	• Train key NGO, private sector, and district field staff in PH technologies/TOT skills
	• KARI	• Recruit economist to conduct study of best bet PH technologies Involve all stakeholders in study • Incorporate best bet technologies into workplan

Components	Stakeholders	Tasks
Program Implementation (LOP)	KARI/PHSMSs • NGOs • Private Sector	• Conduct applied PH field research • Conduct farmer field research • Conduct commercial farm trial/demonstrations • Carry out demonstrations and training for exporters/ processors/ traders • Continue development of PH information center • Maintain M & E activities
Sustainability (LOP)	• All Stakeholders	• Review GOU/donor budgetary procedures and reporting requirements • Review and adjust workplan after 3 months
Monitoring, Evaluation Impact Assessment (LOP)	• KARI	• Recruit M & E consultant • Assist PHSMSs/NGOs/private sector stakeholders upgrade M & E component of workplan i e , practice changes • M & E consultant will train stakeholder specialists and field officers to develop PH grant proposals (about six months into project) • Stakeholders submit monthly, quarterly, and yearly reports • Stakeholders hold workplan review meetings -- every six months
Beneficiary Participation (ongoing)	• All Stakeholders	• Review procedures for obtaining end user inputs • Evaluate women's access to PH programs • Review farmer access to credit programs/coordinate at district level
Structured Flexibility	• All Stakeholders • Inputs for ag production	• Periodically review and adjust workplan to changing conditions

*The Sustainable/Capacity Building Approach is an interactive approach The basic components, stakeholders, and roles of stakeholders are outlined in a general and generic nature Specific details will need to be worked into a more comprehensive plan

Table 12 Development of a Centralized, Capacity Building, and Sustainable Postharvest Technology Transfer Plan (This plan is outlined in a more traditional time/chronological approach)

Goals 1 Increased usage by small scale farmers of various improved PH technologies with emphasis on women farmers

2 Increased involvement of traders, farmers' associations, processors, and exporters of improved PH technologies

Activities	Leadership	Assumptions
• Initiate project design discussions with key stakeholders NGOs, UCA, UNFA, MTEA, commercial sector	• KARI	• Sufficient number of staff/resources available
• Recruit PHTT consultant to assist with project design/implementation	• KARI	• PHTT consultant will work with KARI on project on three short term assignments over the two year project

• Conduct project design/strategy workshop with stakeholders
• Develop agreed upon workplan including
  • goals and objectives
  • policy statements
  • resource commitment
  • define target, clients baseline studies, farmer trials/demonstrations
  • organizational operational procedures
  • roles and responsibilities
  • training needs/plans
  • M & E plan and strategies
	• KARI	• Secure stakeholder project/financial commitment and agreement to plan
		• Many of these activities are on-going

• Recruit required project manpower
  • KARI--3 researchers
  • GOU--10 District PH SMSs
  • UNFA--5 District field workers
	• KARI
	• NGO
	• Private Sector
		• Recruitment includes staff training
		• Staffing also requires needed operational support

• Recruit M & E consultant and incorporate recommendations into updated workplan	• KARI	• All stakeholders involved
• Recruit economist to conduct best bet PH technologies	• KARI	• All stakeholders should be involved in planning for consultancy activities

Activities	Leadership	Assumptions
• TDY (economist) shares recommendations incorporated into workplan	• KARI • Stakeholders	• Consultancy should be scheduled early in project development
• Training of extension/NGO staff	• KARI • District PHSMSs	• Sufficient staff and monetary resources available • Sufficient technologies ready for dissemination
• Reporting	• KARI • Stakeholders	• Review and adjust workplan every three months • Review GOU/donor procedures and reporting requirements
• Continued sensitization and testing of selected technologies with traders, exporter, and others	• KARI	• Developed prototypes available • Testing and field demonstrations increased
• Technology adoption evaluation	• KARI • Stakeholder Leadership	• Technologies/# of farmers/ exporters/ millers who adopted new technologies assessed
• Dissemination of technologies on a wider scale	• KARI • NGO • Private Leadership	• Resources available to support a sustained and expanded program
• Communications with UOG, donor, and international community	• KARI • Stakeholders	• Communication of positive benefits to farmers and the economy may generate expanded project support

Budget to Support Proposed Plan

The following is a proposed budget to support the two year plan The first budget element is calculated in U S dollars for the external support needed

Cost Element	Year 1 2000	Year 2 2001	Total
Short Term Consultant Wages (6 5 PM)	$80,000	$50,000	$130,000
Allowances	15,000	10,000	25,000
Indirect Costs	25,900	15,600	41,500
Travel and Transportation	41,000	24,500	65,500
Expendable Equipment	3,000	4,500	7,500
Training	35,000	12,500	37,500
Other Direct Costs	13,500	21,700	35,200
Grand Total US$	$213,400	$138,800	$352,000

VOCA is a potential source of short term specialists The current PHHS contractor or subcontractors may also be sources for consultant recruitment Occasionally, consultants are available from one of the IRACs A two year external TDY would cost US$500,000

It is assumed that KARI will provide in-country transportation and support during the consultants in-country assignment

Specific funding sources have not been identified, however, it is evident that USAID, foundations, UNDP, and other national and international organizations are possible sources

GOU Support for the Plan

The GOU will provide an office and working space for the short term consultants and support staff supplied by KARI and MAAIF The GOU will supply three FTEs or equivalent to provide program leadership for postharvest technology research and technical transfer The KARI senior staff professional will be designated as the key person to act as the counterpart for the short term consultants This FTE support may come within current positions in KARI or the required personnel may be transferred from AAETRI

The annual GOU contribution to the PH Unit at KARI is valued as follows

	Uganda Shillings (s)
A Professional staff and benefits	45,000,000s
B Support staff salaries and allowances including training and expendables	38,000,000s
C Office accommodations including support of the KARI PH Data Center	17,500,000s
Total annual GOU contribution to PHHS component	100,500,000s

The annual GOU contribution to 10 District PHSM specialists to support the project

A Professional staff and benefits-10 FTEs	130,000,000s
B Support staff salaries and allowances includes training and expendables	42,350,000s
C Office accommodations	10,000,000s
Total annual GOU contributions to field PHHS program	182,350,000s

The exchange rate of 1,300s to US$1 00, this contribution is valued at some US$141,000 over the two year life of the proposed plan

The contributions from the NGOs, UNFA, UCA, the private sector and other donors should be substantial A detailed GOU budget follows

Government of Uganda Contribution

1 Staff Salaries

Personnel	No	Cost (s)	Time units(PM)	Total (s)
Scientists	3	300,000	24	21,600,000
District PHSMSs	10	200,000	24	48,000,000
Technicians	5	90,000	24	10,800,000
Total Salaries				80,400,000

2 Housing

Personnel	No	Cost (s)	Time units(mo)	Total (s)
Scientists	3	150,000	24	10,800,000
District PHSMSs	10	70,000	24	16,800,000
Technicians	5	100,000	24	12,000,000
Total Housing				39,600,000

3 Medical and Education Contributions

Personnel	No	Cost (s)	Time units(mo)	Total (s)
Scientists	3	60,000	24	4,320,000
District PHSMSs	10	40,000	24	9,600,000
Technicians	5	35,000	24	4,200,000
Total Contributions				18,120,000

4 Cost sharing for staff allowances as determined by counterpart budget provision to be determined during annual budgeting

5 Cost sharing for vehicle maintenance and running cost as determined by counterpart budget provisions to be determined during annual budgeting

6 Office Accommodation

Facility	Cost (s)	Time units(mo)	Total (s)
Offices	160,000	24	3,840,000
Lab	30,000	24	720,000
Foundry	160,000	24	3,840,000
Farm Yard	50,000	24	1,200,000
Total Accommodation			9,600,000

7 Other

Expense	Cost (s)	Time units(mo)	Total (s)
Water	50,000	24	1,200,000
Electricity	160,000	24	3,840,000
Telephone	160,000	24	3,840,000
Total Other			8,880,000

8 Support of the KARI PH Data Center 26,250,000s

Grand Total 182,350,000s

Note Cost sharing as in allowances and vehicle cost are determined per annual counterpart provision in the Postharvest Program

With the exchange rate of 1,300s /$1 00, this contribution is valued at US$144,600 over the two year life of the program

The contributions from the NGOs, UNFA, UCA, the private sector and other donors should be substantial

Short Term Consultants for PHTT Plan

1 Postharvest Technical Transfer Specialist (4 1/2 PMs)

The major responsibilities of the PHTTs will be to provide project continuity after the departure of the present long term TA The present TA will probably stay to the end of 1999 if a one year, no-cost extension, is approved by USAID/Kampala

However, some outside expertise will be needed after the departure of this TA This consultant is recommending that a short term consultant provide postharvest technical support to the KARI PH unit with special emphasis on the development and implementation of postharvest technologies Experience and training in postharvest technologies, teaching and extension, TOT, and 10 years overseas experience managing technical transfer programs are recommended The PHTT consultant would make three visitations over the two year period of the program Each visitation would be six weeks in duration The consultant needs to have experience in facilitating technology transfer dissemination, client identification, program delivery methods, criteria for selecting the technologies, and measuring the impact of the technologies The consultant can be recruited through an IARC, one of the contractors or subcontracts of the PH Project, or through VOCA The same consultant should serve all three in-country assignments to provide continuity

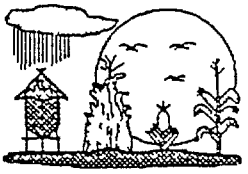
2 Impact Assessment Economist

The program needs to employ a consultant to conduct an economic analysis of its best bet technologies The project needs information regarding the economic impacts of field tested and adopted PH technologies in order to maximize the technology for the benefit of end-users (1 person month)

3 Evaluation Consultant

A consultant will be needed to assist KARI and other key stakeholders to design an effective monitoring, evaluation, and impact assessment plan The same consultant can provide training for KARI personnel in developing proposals to capture resources sufficient to carry out technology transfer and impact assessment programs (1 person month)

Appendix A Scope of Work



POST HARVEST HANDLING AND STORAGE PROJECT
Agricultural Non-Traditional Export Promotion Program
Kawanda Agricultural Research Institute
P O Box 7065, Kampala, Uganda
Tel (256) 41-567-708

MEMORANDUM

TO Jim Goharl
Acting SO1 Team Leader
USAID Uganda

FROM Ulysses Acasio
Team Leader, PHHS/ANEPP
Kawanda Agricultural Research Institute

DATE 8 September 1998

SUBJECT Request for the Approval of a Proposed Technical Assistance to Prepare a National Plan to Produce and Transfer Post Harvest Technologies Under the PHHS/ANEP Project in Uganda

Request for the approval of a Proposed Technical Assistance in the preparation of a national plan to produce and transfer post harvest technologies for cereal grains and oil seeds in Uganda The planned activity will enhance the delivery capability of PHHS during the life of the project and to sustain it after the project ends

The detailed Scope-of-Work and the curriculum vitae of the consultant nominated for the activity are attached

I would like to request further for the country clearance of the proposed consultant should this activity be approved by your office

Thank you for your support to the project

cc

Ms Ruth Sempa, SO1 Project Assistant, USAID Kampala
Dr Flavia Kabeere, Officer In-Charge NPHRP/KARI
Dr Sherman F Pasley, Program Coordinator, CASP/MSU

Proposed short-term technical assistance to develop a sustainable national technology transfer program to address the post harvest constrains in the cereal grains and oil seeds industries in Uganda

I Background

The Post Harvest Handling and Storage Project component of ANEPP aims to help rural men and women increase their incomes through agricultural exports This can be achieved by assisting NTAE producers increase the total amount of their produce available for market through the reduction of post harvest losses attributed to improper handling and storage of the commodities The goal and objectives above can be achieved through four major activities namely (a) technical assistance (b) generation and transfer of appropriate post harvest technologies, (c) training of target groups and (d) capacity building

The above activities are being provided by two sub-components of PHHS, namely (a) Post Harvest Handling and Storage of Grains (maize and beans) and (b) Post Harvest Handling of High-Value Crops (fruits, spices, and vegetables)

The PHHS/NPHRP has developed many appropriate post harvest technologies applicable to cereal grains and oilseeds which are now being disseminated in five districts for different target groups The post harvest technologies include among other technologies available at KARI are the following (a) threshers and shellers (b) mechanical grain cleaners and sorters, (c) small and medium scale biomass-heated grain dryers, (d) commercial grain dryers, (e) hand tractor with trailer for rural transport/traction, (f) hybrid solar drying technologies, (g) small scale bulk storage structures, and (h) environmentally safe pest management techniques

II Rationale

In order to achieve the stated goals and objectives above, there is a need to develop a sustained plan to deliver the above technologies to the end-users The plan must be in conformity with the decentralized extension service in Uganda and supported by donor agencies The plan should also build on the critical mass that has been generated by government programs and enhanced by donor-funded projects on post harvest loss prevention and income generation activities Furthermore, the plan must be environmentally acceptable and sustainable even after funds from international donors have ended

For this technical assistance, an extension specialist, Dr Tom Trail, with wide ranging experience in development work overseas, has been nominated by the University of Idaho and will be contracted by the PHHS Project through Mississippi State University Office of International Programs The technical assistance will be for a period of one month commencing on 21 September 1998 Dr Tom Trail's Resume is hereby attached

III Scope-of-Work

The consultant will visit the target districts and meet with major stakeholders, including district officers of the recently decentralized extension service, to get first hand information on the various constraints in delivering post harvest technologies to target groups in the cereal grains and oil seeds industries

The specific tasks of the consultant will be to

1 Gather all pertinent data and information relevant to the assignment This includes production, consumption and marketing statistics on cereal grains and oil seeds in Uganda and the region

2 Identify the major causes of post harvest losses in cereal grains and oil seeds in Uganda and how they are being addressed by the stakeholders

3 List and assess the technology transfer capabilities of major players in the cereal grains and oil seeds industries such as those in the private sector, research institutions, NGOs, and PVOs

4 Inventory relevant technical skills and farm equipment manufacturers available in Uganda This includes national research institutions, vocational institutes, universities, and private sector

5 Identify available credit programs in support of improved production and post production technologies in Uganda

6 Write a decentralized, attainable and sustainable plan to produce and deliver the required PH technologies to the end-users The plan should include a detailed budget to implement it for possible funding by the national government and international donor agencies

The consultant will submit a complete and coherent copy of the draft plan to the PHHS Team Leader at least 5 days before departure from Uganda Copies of the draft plan will be distributed to all concerned prior to an exit interview with the USAID, PHHS, AND NPHRP, officers to be conducted a day before departure from Uganda

Within two weeks upon return to the United States, the consultant will submit 3 hard copies and floppy disk(s) form of the final plan to the Office of International Programs at Mississippi State University The plan should incorporate any amendments and revisions suggested by the PHHS/NPHRP/USAID during and after the exit interview The OIP of MSU will be responsible in sending two copies of the plan and floppy disk(s) to PHHS/Uganda

Final payment of consulting fees will be made by Mississippi State University only after receipt by PHHS/NPHRP Uganda of an acceptable version of the final plan

IV Support

International travel expenses and per diem while in Uganda will be provided by the Mississippi State University Office of International Programs The PHHS Project will provide the consultant with transportation, relevant supplies and equipment, and assistance while performing his tasks laid out in the Scope-of-Work above

PROPOSED BY

Dr Ulysses A Acasio
Project Team Leader
PHHS/ANEPP USAID
Kampala, Uganda

Date Sept 7, 1998

RECOMMENDED BY

Dr Flavia Kabeere
Officer In-Charge
National Post Harvest Programme
KARI/NARO, Uganda

Date 7/9/98

APPROVED BY

Mr Jim Gohan
Acting Team Leader, SO1/USAID

Date 9/10/98

Appendix B Documents Reviewed

Environmental Protection and Economic Development Project-Phase II July 1998-June 1999

Background to The Budget, 1998-99, Ministry of Finance and Planning, Kampala, Uganda, 1998

Post Harvest Food Losses for Maize, Beans, Groundnuts, and Cassava, AT/Kampala, 1998

Proceedings of the Uganda Workshop on the National Policy and Strategic Framework for Micro and Rural Finance, Sponsored by GOU, EU, UK/DFID, and USAID, Kampala, Uganda, May 5-8, 1998

Quarterly Report (ANEPP) 1 November 98 - 30 April 98 PHHS Project/KARI, Dr Acasio, Kawanda, Uganda

An Evaluation of Farmer Participatory Research and Extension Project on Oilseed Production in Northern Uganda, VOCA, 1997

The Uganda Commodity Exchange Investors Plan and Donor Intervention Proposal, Compiled by IDEA/USAID, 1997

Strategic Action Plan for Maize Production and Exports Development An USAID Contribution to Overcome the Challenge of Poverty and Growth in Uganda with Focus on Women in Development, Kampala, 1997

Master Plan on the Establishment of Agriculture Engineering and Appropriate Technology Research Institute, NARO, Kampala, 1997

Quarterly Report (ANEPP) 1 August 97 - 31 October 97 PHHS Project/KARI, Dr Acasio, Kawanda, Uganda

The Farmer's Voice, UNFA Magazine, June 1997

Quarterly Report (ANEPP) February 1, 1997 - July 31, 1997 PHHS Project/KARI, Dr Acasio, Kawanda, Uganda

Quarterly Report November 1, 1996 - January 31, 1997, PHHS Project/KARI, Dr Acasio, Kawanda, Uganda

Proposal for Cooperative Agreement PostHarvest Handling and Storage Component of the Agricultural Non-Traditional Export Promotion Project (ANEPP) in Uganda-Kampala, 1996

Rural Credit Facilities for Food Crops Production and Exports, Export Policy Analysis Unit, Ministry of Finance and Economic Planning, EPAU Research Study No 1, 1996

Co-Operative Reform Development Programme, 1995-96 Plan Uganda Cooperative Alliance, Kampala

Operational Plans for Title II, Monetization of Vegetable Oil in Uganda 1995-1996, USAID/Kampala

IDEA Project Paper, USAID, Kampala 1995

Annual Progress Report, Cooperative Agriculture and Agribusiness Support Project (CAAS), ACID, 1995

Final Evaluation Report, Cooperative Agriculture and Agribusiness Support Project (617-0111), USAID/Kampala, 1994

Export Policy Analysis and Development Unity, Opportunities for Non-Traditional Agricultural Exports from Uganda--Spices and Oils, ISTI, Washington, D C 1993

Appendix C Individuals Contacted

Acasio, Dr Ulysess A , Project Leader, PHHS/ANEPP

Agena, Anthony, farmer, Lira

Angom, Margaret, Postharvest Extension Specialist, Lira

Barimunsi, Amos Mwesigye, Program Officer, ACDI/VOCA

Byekwaso, Mrs Florence, farmer, Iganga District

Ekoot, Ben R O , Project Coordinator, ACDI/VOCA/FOSEM

Eyep, Patrick, Head of Carpentry Section, APAC Technical Institute

Galton-Fenzi, Dr Julian, Agricultural Marketing/Credit Coordinator, Netherlands Development Project, Lira

Kabeere, Dr Flavia, PH/Seed Technologist, KARI

Kagino, Fred, District Agricultural Officer, Extension Service, Iganga District

Kibirige, Deo, Manager, Akony Kori Company, Lira

Kolijn, Dr Sicco, Postharvest FAO Consultant, KARI

Kristensen, Jens, Advisor, UNFA, DANIDA, Kampala

Kymangwa, Michael, Vice Chairman, Masindi Seed Growers Association

Laker-Ojo, Dr Rita, Director, ATI, Kampala

Magumba, A B , District Extension PH Subject Matter Specialist, Iganga District

Msemekeveli, Dr Leonard, Deputy Director, UCA, Kampala

Mugisa, B B , Seed Production Manager, Uganda Seed Company, Masindi

Mutyaba, Cedric, Agricultural Engineer, KARI

Muyenzi, John, Seed Processing Officer, Uganda Seed Company, Masindi

Nahdy, Dr Silim, Director, KARI

Nantango, Harima, FOSEM Extension Officer, Masindi

Obote, George, Sub County Chief, Acokero

Odogola, Dr W , KARI, Kampala

Odongo, Pratello, Chairman, Awila Trading Center

Ogwang, Victor, APAC Extension Postharvest Specialist

Ogwang, Yovan, APAC District Agricultural Officer

Okello, Joe, Subcounty Officer, Acokero

Okumya, Alfred, Head of Block Laying Section, APAC Technical Institute

Opio-Oming, Tom, General Manager, Commodity Export International, Kampala

Otimodock, Peter, Executive Director, UOSPA, Kampala

Oweta, Jacob B , Chief Agricultural Officer, Lira District

Owori, Dr Constance, Postharvest Specialist, KARI

Pasley, Dr Bud, Director, International Programs, Mississippi State University

Sengendo, Kavuma, Partner, Tonnet Enterprises, Kampala

Sempa, Ruth, SOI Project Assistant, USAID

Shumann, Richard, ACDI/VOCA, Associate Director, Africa

Sonanie, Karim, Owner, Commodity Export International, Kampala

Stryker, Dr Ron, ADO, USAID

Turamye, Benson, Senior Planner, EPED, Masindi

Turyatunga, Frank, EPED, Masindi

Waismwa, Mrs , farmer, Iganga District

Walthum, Peter, Monitoring and Evaluation Specialist, ADC

Wanzala, Daniel, Vice Chairman, UNFA, Masindi Farmers Association

Wood, Mark, ADC, IDEA Project

Zinunura, Samuel, Extension Officer, EPED, Masindi

Appendix D Case Studies

Iganga District

Mrs Waiswa is a semi-commercial farmer in the Iganga District She has 15 acres of farm land characterized with mixed crops including maize, beans, cassava, millet, groundnuts, bananas, pineapple and other crops She raises 5 acres of maize

Mrs Waiswa, with the help of the KARI Postharvest Program and the Iganga District Postharvest Subject Matter Specialist, A Magumba, built a dryer for an estimated cost of 240,000s She furnished bricks, wood and labor for the construction of the dryer She received the help of a local artisan trained by the KARI team to build the dryers She has utilized the dryer to dry about 30 bags of maize She can dry 4-5 bags of maize a day (500 kilos) Mrs Waiswa estimates that she received 15s /kilo more for the dried maize from local traders because of the improved quality

She estimated that this realized her an added gain of 46,500s In addition, because of the postharvest technology, she estimates that she saved at least 15 percent of the potential postharvest losses in the field This conservative estimate means that she was able to realize a harvest of an extra 450 kilos of maize She sold the maize at a market price of 125s /kilo This was an added 56,250s profit Mrs Waiswa reported utilizing the extra shillings for school fees and putting a new metal roof on her house

Mrs Waiswa has taught fifteen neighboring farmers how to use the dryer, and they are utilizing it to dry various crops She does not charge other farmers to use the dryer She believes that since she received the help with the new technology, that she needs to provide the dryer and technical assistance free to her local neighbors Several of the local farmers have indicated an interest in building a dryer Mrs Waiswa is also interested in building a dryer for pineapple

Another farmer in the Iganga District, Mrs Florence Byekwaso, estimates her added profits from using the new drying technology has added over 1,000,000s profit to her operation She is a semi-commercial farmer with 38 acres of mixed crops Both cases illustrate the economic benefit and impact of the dryers to individual farmers and the acceptance of the new technology by neighboring farmers

Uganda Cooperative Alliance Project in 1994

The following case studies illustrate positive economic and quality of life impacts through Uganda farmer participation in USAID funded projects The studies were written by Dr Trail as USDA team leader evaluating a Uganda Cooperative Alliance Project in 1994

Case Study The Kashekuro Cooperative Society

The Kashekuro Cooperative Society is located in Southwestern Uganda near Kitagata The Society was registered in 1955 The main cash crop in the area is coffee Bananas are another major crop of importance The membership totals 300 members, including 290 men and 10 women The Society markets coffee produced by its members through the Banyankore Cooperative Society The Society made a profit of US$445,000 in 1993

In 1993 the Society was awarded a matching grant through the Cooperative Agriculture Association Systems (CAAS) project The Society purchased a hammermill with the grant and matched their share with the construction of a grain mill to house the hammermill During the first year of operation the Society milled almost 160,000 kgs of maize The first year profit was 2,869,359s

The impacts of the hammermill in increasing the income and improving the quality of life of the Society members are impressive The profit from the hammermill enables the Society to advance members for the purchase of coffee and to extend loans ranging from 50,000s to 100,000s to various members In the past, members had to take their maize 18 miles away to another mill This was a weekly trip which cost 3,000s /family The new mill eliminates the weekly trip, resulting in substantial savings of 150,000s /family each year The aggregate saving for the 300 members of the society is about 45,000,000s

Traditionally the preparation of maize took two hours of work per day The mill now saves local women two hours of shelling maize per day and the weekly trip to the mill, located 18 miles away The release time is being utilized by women to grow more maize, millet and beans as cash crops Soybeans are now grown for family consumption It is clear that society members recognize that soybeans supply essential protein that improves the health of the family The release time also allows women to gather green leafy vegetables and egg plants in the banana plantations for family consumption

Added income now enables families to pay school fees for children and has served as an incentive in the recruitment of new members The project has a positive impact on other farm families and organizations in the area, including churches and schools Families and organizations can now mill their grain at the mill, thus realizing a savings in transportation costs to town, and release time saved by milling grain is used to grow new cash crops, which are milled by the Society The hammermill has increased incomes and improved the quality of life of the members and others in the area

Case Study Kyambura Farming Primary Society, Kichwamba

The 690 members of the Kyambura Farming Primary Society earn 90 percent of their cash income from the production of cotton Cotton is produced on individual plots within a 450 acre parcel of land owned by the Society as well as on individually owned parcels of land Until recently, harvested cotton was stored on farms where it posed a fire hazard or in remote stores left by the Lint Marketing Board, which were inaccessible after rains A store built under the Matching Grant program now allows members to collect their cotton in a central location before transporting it to the ginnery in Kasese The store also serves a variety of other functions, including storage of other crops in the off season, attraction of new members to the Society and as a site for training sessions and the annual general meeting

Annual cotton production averages about 700,000 kilograms, although poor weather reduced production to 330,000 kilograms last year At expected yields of 700 kilograms per acre and recent prices of 260 shillings per kilogram, gross returns average 182,000 shillings per acre (primarily for plowing and chemicals), and farmers realize net returns averaging more than 150,000 shillings per acre

Because of the strength of this society, supported in part by CASS project activities, it was awarded two tractors in national competition among cotton cooperatives Tractor members' plots can be cultivated on a timely basis at a cost of 13,000 shillings per acre (as opposed to the 20,000 shillings it previously cost to hire tractor services) With about 1200 acres in cotton, members realize savings of over 8 million shillings per year In addition, the Society plows non-members' land for a fee of 15,000 shillings per acre, generating cash income for the society and benefiting non-members through lower costs as well

Case Study Bokooli Joint Women's Association, Bugiri

The Bukooli Joint Women's Association is a primary society consisting of 35 women who have received assistance from the CAAS project and from the European Development Fund (EDF) EDF assistance came in the form of a small oilseed mill after the women purchased a plot of land and constructed a building in which to house the mill Through the Cooperative Bank, CAAS provided a loan of 15 million Uganda shillings to complete construction and pay for electricity CAAS also supplies the women with sunflower seeds and arranged for Volunteers in Overseas Cooperative Assistance (VOCA) training in maintenance and operation of the oil mill

As a result of these initiatives, the women have begun producing about four acres of sunflowers each They find it an easy crop to produce and can harvest two crops per year With yields averaging 700 kilograms per acre and recent prices of 180 shillings per kilogram, gross returns average 126,000 shillings per acre Cash costs (mostly plowing) are about 50,000 shillings per acre, so that net returns average about 76,000 shillings per acre One member (a widow) told the evaluation team that with four acres and two crops annually, sunflower production thus meant an increase of more than 600,000 shillings in her annual income This increase allowed her to afford school fees for the seven of her ten children who are currently in school She was also able to build a structure in which to begin rearing about 50 chickens and now has both chickens and eggs for home consumption and sale

With their oil mill, they can product 20 liters of oil from 100 kilograms of sunflower seed Since their oil is filtered, it sells at a premium (about 23,000 shillings per 20-liter jerry can), and they earn a profit of about 8,000 shillings per jerry can Because of mechanical and cash-flow problems, however, many of the women sell their seed to other local millers As a result, the Society has yet been unable to repay their loan

The women have also been encouraged to produce soybeans, which most have begun doing on a small scale Rather than selling the crop, however, they keep it for home consumption with maize and green leafy vegetables, recognizing its nutritional qualities

The women have also initiated other income-generating projects They buy cement and make concrete pit-latrine covers for sale to the district water and sanitation office, which distributes them in the surrounding community And they have begun building concrete water tanks for "water harvesting" and for sale Construction of a store was begun under a CAAS Matching Grant of 4 million shillings, but has been delayed by district authorities due to the hazard posed by utility poles leaning over the site