Final Report

Uganda Manpower for Agricultural Development Project

Project No.617-0103

United States Agency for International Development

Ohio State University

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Primary funding for this Project was provided by the USAID Mission in Kampala, Uganda. Over the life of the Project it provided $16,350,000 to Ohio State University, the prime contractor, and allocated an additional $8,600,000 for USAID project management, commodity procurement and other Project-related activities. Without this support, the Project would not have been possible, nor would it have contributed substantially to Ugandan agriculture.

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Acknowledgements

MFAD is recognized by all to be a highly successful project. The contents of this final report bear this out. Many entities and personalities have contributed to this success. Without the contributions of all, it would have been less successful. In particular, success is due to major inputs from USAID, particularly through its mission in Kampala and REDSO/Nairobi. Subcontractors provided key technical assistance and procurement inputs. Our Ugandan collaborators brought their knowledge of Uganda, their human resources and their leadership to the project. OSU team members contributed their enthusiasm, expertise and spirit of cooperation throughout the life of the project.

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Project achievements are the result of inputs by all of the above personnel and by others who will go unnamed. All are acknowledged and thanked.

Executive Summary

The project goal of the Manpower for Agricultural Development project was to "assist the Government of Uganda in its recovery program to stimulate small farmer agricultural production". The project's purpose was "to assist the GOU to rehabilitate, retrain and redirect its agricultural manpower and institutional capability in food crop production".

The first Project Agreement was signed on August 26, 1983 setting the Project Assistance Completion Date (PACD) at August 26, 1993. Total AID bilateral funding for the project was $24.9 million. Counterpart funds from GOU amounted to nearly $15 million. The prime contractor, Ohio State University, committed slightly over $2 million to the project. Total project funding was just under $42 million.

During the ten-year life of the project it functioned under three USAID Mission Directors, two Project Officers and three Chiefs of Party. Besides the prime contractor, the following institutions/companies served as sub contractors: (1) University of Minnesota; (2) Fort Valley State College; (3) Experience Incorporated; (4) Winrock International; and (5) two Nairobi procurement agents for rehabilitation materials.

The implementation elements of the project included: (1) rehabilitation, in addition to primary construction of some staff housing, and, subsequently, maintenance of three research stations and the Faculty of Agriculture Building on the Makerere University campus; (2) technical assistance in research, teaching and rehabilitation/maintenance; (3) training which included external degree at both the Masters and Doctoral level, degree training at Makerere University, short term external training in the U.S. and at IARCs, conferences and workshops, regional conference travel and in-service training programs; and (4) rejuvenation of the research and education functions of the Ministry of Agriculture, Animal Industry and Fisheries and the Makerere University Faculty of Agriculture and Forestry.

Physical rehabilitation was accomplished as follows:

- Four primary units were physically rehabilitated during the life of MFAD:
  - Namulonge Agricultural Research Station (MAAIF);
  - Kawanda Research Station (MAAIF);
  - Makerere University Agricultural Research Institute at Kabanyolo; and
  - The Faculty of Agriculture and Forestry building on the Makerere University campus in Kampala.
- The electrical distribution, water/supply distribution and drain/waste systems at all four locations were completed. Farm buildings, administrative units, laboratories, warehouses, staff housing, sheds, stores, clinics and workshops were rehabilitated between 1987 and the end of 1990.
- A maintenance program was designed and implemented which phased out MFAD project input and phased in station input over three years. The primary constraint to sustainability will be fiscal-based and not skill-based..
- Eighty-five vehicles were purchased for MFAD use between late 1984 and mid - 1993. Distribution was MAAIF-55%; MU/FAF-40% and USAID-5%. This facilitated at least 6,000,000 kilometers of travel to all regions of Uganda in order to achieve project objectives.
- Field and laboratory equipment has been equally divided between MAAIF and MU/FAF. This equipment has enabled MU/FAF and MAAIF to increase research, teaching and agricultural production capability several fold.
- Office equipment was purchased and strategically distributed to both organizations. The magnitude of professional paper generation, academic coursework materials, correspondence and reports can be directly attributed to the availability of this equipment.

The following was accomplished in human resource development :

- 65.3 person-years of long term technical assistance were provided.
- Over 5.3 person years of short term technical assistance from diverse technical fields and organizations were provided by 92 individual visits to Uganda.
- Over 100 person-years of degree training were provided to 38 national staff from MAAIF and MU/FAF at 11 different U.S. universities.
- At least 60 person years of degree training were provided to 35 national staff from MAAIF and MU/FAF at Makerere University.
- At least 18.6 person years of external short term training were provided to 97 individuals. Fifty seven percent (10.6 person years) were provided to MAAIF and 8.0 person/years (43%) were provided to MU/FAF.
- At least 26 conferences and workshops were either totally or partially sponsored by MFAD between December, 1986 and June, 1993; an average 4 to 5 per year. Over 1720 persons attended these functions.
- By the end of 1991, all national, regional, district, and county employees of the Ugandan Extension Service attended three to five day work-shops on the proposed new organizational structure for the Ugandan Extension Service. MFAD staff provided a multi-session training program that included program development and evaluation, leadership principles, and adult learning principles.
- At least 50 in-service programs on research/extension linkage issues to more than 3,000 MAAIF research and extension staff covering research/extension linkage issues were provided by AEE staff of MU/FAF.
- TA helped Ugandan researchers program maize research reports, the first MAAIF Newsletter in 15 years, and Extension fact-sheets in the following areas:
  - Potato Production
  - Bean Production

- Sunflower Production
- Cotton Production
- Cassava Utilization
- Ground-Nut Production
- Sweet Potato Production

Rejuvenation of research and education:

- Over sixty research projects and national commodity research programs were implemented. Over 70 new technologies, crop varieties, production practices and policy recommendations have been generated.
- The MU/FAF undergraduate curriculum was completely revised and the postgraduate program was restored. The Faculty Handbook was entirely redone and a Five-Year Development Plan completed.
- On-farm research achieved the following:
    - During the first 3 years of Phase II of the project (1988-1990) there were 517 on farm maize trials, 523 soy bean trials and 408 sunflower trials conducted by extension agents in collaboration with farmers.
    - During the years 1991-1993 farmers managed 1,400 maize, 1,450 soybean and 759 sunflower demonstration trials
    - New crop varieties (Longe 1 - Maize, Nam 1 - Soybean and Sunfola-Sunflower) produced yields which were 25 to 60 percent higher than local varieties.
    - The on-farm research program trained 90 extension workers and over 3,500 farmers.
    - The project has had a major impact on farm production in the participating districts. Numerous neighboring farmers have adopted new varieties and improved production practices. Participating farmers have planted 60% of their land to improved crop varieties and 1.2 % of all farmers in the 6 districts have adopted improved crop varieties.
    - Participating farmers have increased their over all farm productivity by 31%; their farm income by 300%; and their farm size by 83.3 %.
    - Five participating farmers have won national awards in agricultural competition.
    - The Uganda Seed Project now produces the new varieties of maize (Longe 1), soybean (Nam 1) and sunflower-(Nnew Sunfola) for sale to farmers.
- Animal traction investigations disclosed that:
    - The use of oxen as a source of farm power is possible for most soils and crop conditions in Uganda
    - Female animals can be utilized as draft animals. They are easier to train than males and can also be utilized for milking.
    - The use of a collar on trained oxen can result in greater power output when compared to yoke.
    - A team of well-trained oxen can furnish power for the cultivation of 10 acres or more of row crops per season.
    - Working oxen can be kept healthy with proper disease control and feeding, but must be well-fed if worked hard.
    - The cost of purchasing a team of oxen is generally less than a 200 liter barrel of diesel fuel. The present cost of a pair of animals, cost of training and all necessary implements is less than 5% of the cost of a 10 horse-power tractor and implements.
    - The use of oxen for seed bed preparation and cultivation of maize reduces the person- hours per acre by 800% (20 hours as compared to 156 hours).

- Not all oxen are suitable for training. There are genetic differences which can have a tremendous impact on how long the training will take.
- Four farmers near Namulonge have now had their oxen trained and over 80 farmers from Mpigi district have requested assistance in training of their oxen.
- Use of oxen reduces labor requirements for primary and secondary tillage.

Achievements Measured against the Project Log Framework:

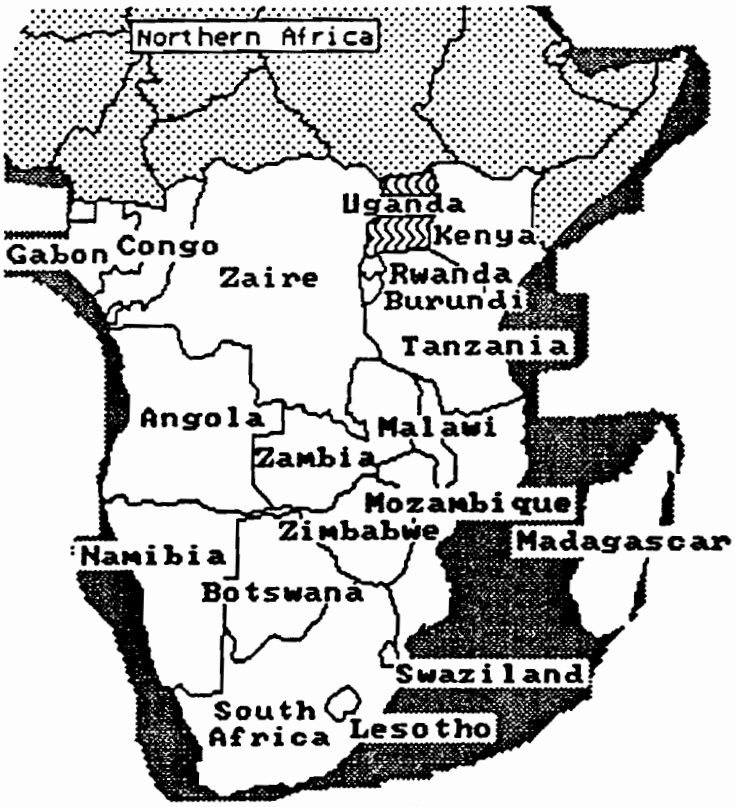
All were met or exceeded with one minor exception under external degree training where the PhD goal was short by two. However, the MSc goal was exceeded by three.

List of Acronyms

AAO	Assistant Agricultural Officer
AID/USAID	Agency for International Development
AO	Agricultural Officer
AVRDC	Asian Vegetable Research Development Center
BSc	Bachelor of Science
CIMMYT	International Maize and Wheat Improvement Centre
CIP	International Potato Centre
COP	Chief of Party
DAO	District Agricultural Officer
DFI	District Farm Institute
EI	Experience Incorporated
FAF	Faculty of Agriculture and Forestry (Makerere University)
FSR	Farming Systems Research
FVSC	Fort Valley State College
GOU	Government of Uganda
IARC	International Agricultural Research Centre
ICIPE	International Centre for Insect Physiology and Ecology
IFDC	International Fertilizer Development Centre
IITA	International Institute for Tropical Agriculture
INTSOY	International Soybean Program
KRS	Kawanda Research Station
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MFAD	Manpower for Agricultural Development
MSc	Master of Science
MU	Makerere University
MU/FAF	Makerere University/Faculty of Agriculture and Forestry
MUARIK	Makerere University Agricultural Research Institute Kabanyolo
NARO	National Agricultural Research Organization
NiFTAL	Nitrogen Fixation of Tropical Agricultural Legumes
NARS	National Agricultural Research System
NRS	Namulonge Research Station
OSU	The Ohio State University
PhD	Doctor of Philosophy
PO	Project Officer
PRO	Principal Research Officer
PSA	Procurement Services Agent
REDSO	Regional Economic Development Services Office
RO	Research Officer
SAO	Senior Agricultural Officer
SCS	Soil Conservation Service
SMSS	Soil Management Support Services
SO	Scientific Officer
S & T	Science and Technology Bureau (AID/Washington)
SRO	Senior Research Officer
SRS	Serere Research Station
SSO	Soil Survey Officer
SSRO	Soil Survey Research Officer
TA	Technical Assistance/Technical Advisor
TOR	Terms of Reference
TSMM	Technology for Soil Moisture Management
UM	University of Minnesota
USDA	United States Department of Agriculture

I. Introduction

Uganda covers an area of 236,040 sq. km. of which 36,000 sq.km. is water, mostly Lake Victoria. This makes it slightly smaller than the State of Oregon.



It straddles the equator and shares a common border with Kenya to the east, Tanzania and Rwanda to the south, Zaire to the east and Sudan to the north. Most of Uganda is a dissected, undulating, laterite-capped plateau. Uganda is blessed by bi-modal rainfall ranging from 800mm in some areas of the north to over 2,000 mm per annum in certain areas of the south. In most years two crops can be grown without supplemental irrigation. The soils are, in general, quite low in phosphorus and nitrogen. Soil fertility is a problem even though the arc around Lake Victoria is often referred to as the "fertile crescent". The primary reason that it is "fertile" is rainfall distribution and an average elevation of 1,000 - 1,500 meters above mean sea level. This translates into somewhat higher equilibrium levels of soil organic matter due to milder air temperatures.

Uganda has never been featured in the world media by drought and famine. Food security is a concern and low to medium grade malnutrition can be found in some parts of the country. During the colonial and immediate post-colonial era, Uganda was an exporter of many crops including coffee, cotton, sugar and tea. It was a prosperous but still developing country. This prosperity continued for several years after independence in 1962. With the overthrow of the first Obote government by Amin in 1971 economic decline set in. As a result most public institutions and their human capital declined. Scientists and administrators fled the country in droves. Research and extension programs in the Ministry of Agriculture slackened to a crawl. Makerere University became a shadow of what it once was. At the low point of the late 70s the academic staff was down to only nine to service six academic departments. Operating funds were nil, morale nearly non-existent and fear was ever present. With Amin's overthrow in 1979 donors slowly came back. But political equilibrium and positive economic growth were still elusive. The second Obote regime was overthrown in mid - 1985 which precipitated a six-month civil war. This was a particularly damaging time in terms of loss of human life and general destruction of physical infrastructure.

After an initial attempt in late 1984, MFAD was reimplemented in mid- 1986 following the civil war. The project goal of MFAD was to "assist the GOU in its recovery program to stimulate small farmer agricultural production". The project's purpose was "to assist the GOU to rehabilitate, retrain and redirect its agricultural manpower and institutional capability in food crop production".

The logframe targets for MFAD Phase II were as follows:

1. Improved quality of education by training 22 PhD, 14 MSc. (out of country) and 35 MSc. participants at Makerere University.
2. Joint Research Coordination systems established.
3. Establishment of a National Agricultural Research Organization.
4. Research stations rehabilitated and re-equipped.
5. Research priorities established.
6. Research Extension Linkage strengthened; Research Extension Plan prepared, and on-farm trials being conducted.
7. Faculty of Agriculture rehabilitated and re-equipped.
8. Accelerated Food Crops Production Strategy completed.

Basic project data are summarized as follows:

1. **Country:** UGANDA
2. **Project Title:** Manpower for Agricultural Development
3. **Project Number:** 617-0103
4. **Project Dates:**
   a. First Project Agreement: August 26, 1983
   b. Final Obligation Date: FY 92
   c. Project Assistance Completion Date (PACD): August 26, 1993
5. **Project Funding:**

a.	AID Bilateral Funding (grant) (000s)	$24,900
	Actual Feb. 28, 1990:	$19,500
	FY 1991	$4,000
	FY 1992	$1,400
b.	Ohio State University contribution	$2,000
c.	Host Country Counterpart Funds	$14,955
	Total	$41,855

6. **Mode of Implementation:** Contractor: Ohio State University Research Foundation
   Subcontractors: University of Minnesota; Fort Valley State College; Experience Incorporated; Winrock International; Utah State University
7. **Project Designers:** USAID Kampala, REDSO/ESA, Government of Uganda Ministry of Agriculture and Makerere University Faculty of Agriculture and Forestry
8. **Responsible Mission Officials:**
   a. Mission Directors: I. Coker, 1984-86; R. Podol 1986-July 89; K. Sherper August 89-present
   b. Project Officers: F. Sands 1984-Nov. 87; A. Agard Nov. 87-present
9. **Project Evaluations:** Final Evaluation PHASE I: November, 1987
   Midterm Evaluation PHASE II: July 17- August 24, 1990
   IG Audit: August 21- September 25, 1990

II. Rehabilitation/Maintenance

A. Rehabilitation program

Four primary units were physically rehabilitated during the life of MFAD:

- Namulonge Agricultural Research Station (MAAIF);
- Kawanda Research Station (MAAIF);
- Makerere University Agricultural Research Institute at Kabanyolo; and
- The Faculty of Agriculture and Forestry building on the Makerere University campus in Kampala.

The electrical distribution, water/supply distribution and drain/waste systems at all four locations were completed (Appendix A.1.). Farm buildings, administrative units, laboratories, warehouses staff housing sheds, stores, clinics and workshops were rehabilitated between 1987 and the end of 1990.

Originally under Phase I, the MAAIF Serere Research Station was to be rehabilitated. Some work was initiated there in early 1985. With the outbreak of the civil war this effort was abruptly terminated in July, 1985. The rehabilitation advisor for Serere was not brought back in 1986 when the project was resumed. The North continued to be unstable through the end of 1986 when it was finally decided to suspend all project activities in Serere. Funding for MFAD was cut upon resumption of MFAD Phase I and several re-assignments were made. A farm management specialist position for MUARIK was discontinued. The farm mechanics advisor to MUARIK was re-assigned to rehabilitation of the Kawanda Research Station. The administrative - supply management officer was re-assigned to rehabilitation of Namulonge Research Station. The advisor assigned to rehabilitation of MUARIK continued to work at that location.

Each of the three rehabilitation advisors found themselves heavily involved in farm management assistance including maintenance of farm equipment and mechanization of field operations in addition to rehabilitation of facilities, ordering rehabilitation materials, receiving and inventorying, controlling issue and use of these materials, liaison with farm management on equipment orders for farm operations, receiving assembling, and training operators on this equipment and ordering and inventorying parts for maintenance of farm equipment. Some of the older non-functioning tractors and farm equipment, laboratory and teaching and processing equipment were made operational by the MFAD rehabilitation TAs.

The effect of rehabilitation at each of the three stations has been dramatic. In 1985, the MFAD Project was the only donor at these stations and research results were minimal. Today, virtually the entire farm is in research production and training. The same is primarily true for the other two stations. With the rehabilitation of housing and research and training facilities, researchers and technicians have been able to fully implement activities relevant to their mission. The MFAD rehabilitation program has promoted input from other donor agencies for support to agricultural research and development projects at all three stations.

Some of the rehabilitation work, including construction of five new staff houses at MUARIK, was contracted out (Appendix A.2.). This included refurbishing of TA housing at Namulonge, Kabanyolo and Kawanda (for CIAT); and the women's Hostel at

Kabanyolo. The amount spent on these contracts was 1.1 million U.S. Dollars and slightly more than 100 million Uganda shillings. Some local currency from the MFAD support budget was utilized for rehabilitation contracts. Work under these contracts included electrical renovation, roof repairs, plumbing, road grading and other general repairs for which skills did not exist within the estates crews at the time(Appendix A.3.).

Rehabilitation officially closed at the end of December, 1990. Some rehabilitation continued into 1991 to complete commitments to that program.

B. Maintenance

In June of 1990 the rehabilitation advisor for MUARIK was extended for two years to implement a maintenance and training program on the three stations in conjunction with phasing out the rehabilitation program. Maintenance was being done on a limited basis along with rehabilitation as some of the structures had been completed 2 -4 years before and were in need of regular scheduled maintenance to sustain them at rehabilitation level.

The maintenance program was designed and implemented to phase out MFAD project input and phase in station input over a three year period. It included hand over of maintenance funds and inventory from the MFAD project and assistance in establishing a program to sustain maintenance beyond the life of the project. The program started in FY 90/91 with cost shares MFAD 75%/GOU 25%. At that time, maintenance of vehicles, tractors and farm equipment became the responsibility of the stations as their 25% input. Parts and supplies for tractors and farm equipment were available for that use or had been turned over to farm control.

During FY 91/92, cost shares were MFAD 50%/GOU 50%. Maintenance of housing and facilities operated primarily on the MFAD 50% input, and in some emergency and high priority cases, MFAD funds were used for equipment repair. With these limited funds for maintenance, the program had to focus on emergency priority maintenance and had little opportunity to carry on a regularly scheduled program to sustain facilities at rehabilitation levels. Also there were periodic instances of thievery, mostly on electrical components, which placed a heavy load on maintenance funds. Fluctuation of electrical supply continues to limit some units to a very short life.

For FY 92/93, cost shares were MFAD 25%/GOU 75%. Control and responsibilities for the MFAD input funds were turned over to farm management. The use of these funds is determined by cooperation and consultation among the estates manager, farm manager and farm director. The FY 92/93 maintenance budget for facilities was submitted by farm management with assistance/advice from the MFAD TA.

The inventory in the MFAD warehouse has been listed and transferred to farm management at the three stations. It is now under control and responsibility of station management. The inventory consisted of maintenance supplies for housing and facilities, spare parts and maintenance supplies for tractors and equipment, and vehicles to carry out maintenance activities. Systems of issue and control of warehouse items have been established to assure proper use in maintenance and monitoring by estates and farm management.

Estates maintenance sections at the three stations have personnel with adequate skills to sustain a viable maintenance program. Estates managers are capable of managing and organizing work, procuring materials and liaison with farm management and departments within the station structure. Most of the estates sections are well staffed with exceptions in some where the age of technicians will become a problem for sustainability, and in some

where the head of section is not capable of management and organization of his crew for efficient work progress. In some cases, the estates manager has filled this need so operations don't suffer; in others, changes should be made to enhance future work output.

Trained personnel are present in the mechanics sections but most of their formal training has been in vehicle mechanics. Their knowledge of farm tractors and equipment has primarily been gained through experience. Present skill levels in operations are adequate, but some staff could benefit from stronger management and organizational skills.

Tractor drivers suffer some of the same traits as the mechanics. Their formal training has been limited to driving vehicles. Some have been provided a tractor driver training session. This has produced drivers, but not tractor and equipment "operators". There is a real need for continued instruction and training in field operation of equipment and tractors. This training has been provided by the MFAD project through the years, but, in most cases these skills need to be addressed and stressed each season. Managers of field operations should be skilled in tractor and equipment adjustment and operation. They should know more than the tractor operators in order to properly monitor and implement field activities for optimum results. The key to sustaining the level of activity now being implemented at the research stations will be the availability of maintenance funds. With the phase out of the MFAD Project (25% for 92/93) the GOU must provide input to support the maintenance of these stations. The service sector is presently capable of sustaining activities provided that funds are available for materials and parts needed to perform their functions. Acquired skills, by themselves, cannot support the activities of the stations.

The MFAD program has provided formal training to six tractor drivers (two from each station) and one carpenter and one mechanic from MUARIK. Additional formal training was sacrificed so that the MFAD TA could spend time at the Kawanda Station on maintenance, which was not included in the program. This was considered to be higher priority use of the TA time. During rehabilitation and maintenance, supervision by MFAD TAs provided continued instruction and "on the job" training in the skilled construction trades as well as in mechanics, tractor operation, equipment use in the field and stores management and control. Classroom instruction and field demonstration in tractor operation, equipment use and adjustment, and maintenance was conducted by the MFAD TA at the three stations.

C. Lessons Learned

Several conditions could have expedited and enhanced the performance and progress of this program. Tools and equipment were minimal to carry out work progress when the MFAD TAs arrived. If more funds had been provided for local purchase of basic workshop tools or procured for arrival coinciding with TA arrival, several months of minimal activity during start up could have been avoided.

Several tractors and field equipment units from earlier donor programs were operational at the stations upon TA arrival. Most were in poor condition due to lack of maintenance. If funds had been available for local purchase and external procurement of parts, most could have been rebuilt to near new condition for 1/4 the cost of new units. This would have provided continuity in field operations as breakdown time was excessive with these units. Rebuilding tractors and appropriate equipment would be a more valuable exercise than continually providing new units. Skills acquired in rebuilding would be valuable experience for mechanics in farm equipment and mechanization. The program could convince host country managers that this equipment is designed to last 15 to 20 years with proper maintenance and repair, and that the cost of maintenance and repair is more economical than

replacement with new units every 2 to 4 years. If the GOU or any private enterprise is to sustain an operation, new tractors and equipment cannot be run until they have major breakdowns. This same point applies to research and lab equipment that is still current in technology.

There are still tractors at the stations, purchased by other projects prior to MFAD, that could be rebuilt and economically put into operation rather than joining the increasing graveyard of tractor carcasses and abandoned equipment.

External procurement of rehabilitation material was at times disruptive and created delays in work progress. Some local funds were made available for purchases, but not to the magnitude needed. It is recommended that control and responsibility for procurement be turned over to the project thus dispensing with the majority of bureaucratic procedures involved in bid letting, etc. The system used was claimed to take a maximum of three months, but more often it was six to nine months. Materials procured from Europe, UK or USA were of better quality than those purchased in Kenya, especially with regard to plumbing and electrical supplies and hand tools.

The lunch allowance program was a major factor in implementing the program. Instituting this earlier in the project would have increased work progress at the beginning of the project.

More cooperation between project personnel and station management in establishing section crews could have built service sectors to a higher skill level which would have resulted in a more sustainable program at the end of the project. At some of the stations, much of the rehabilitation work was contracted out in order to accomplish the work load. This resulted in some of the farm sections having a minimal work force at the end of rehabilitation. The problem in rectifying this situation was complicated by civil service freezes and cut backs. Throughout the five years of major rehabilitation activity, the stations experienced three to five turnovers in farm mangers/directors.

Regarding procurement of major farm and research equipment from the States, it would be advisable and valuable for a project TA, knowledgeable with these units, to spend time with the procurement agent reviewing the final PIO/C. He could advise on the purchase of equipment that would be appropriate for in-country conditions, review spare parts packages with dealers to obtain the optimum in parts for sustainable maintenance and operation, monitor the interpretation of specifications from draft to PIO/C and emphasize the quality of equipment needed. This type of input would greatly improve the impact on project implementation and sustain the operation to a more normal life expectancy of these units.

III. Technical Assistance

A. Long Term

Sixty-six person years of long-term technical assistance was provided to GOU under the MFAD Project. Of this, 17.5 person/ years were devoted to rehabilitation and maintenance; 33.6 person/years to research and teaching and 14.2 person/years to project administration of which nearly 6 years were used by USAID for project management (Appendix B. 2.).

During Phase I, 23 person years of long term technical assistance were provided; 41% was devoted to rehabilitation, 36% to research and training and the remaining 23% for project administration. Phase II provided 42 person years of long-term technical assistance broken down as follows: Research and Training - 59%; Rehabilitation and Maintenance - 20%; and Project Administration - 21% (of which USAID Project Management accounted for 12%). Of the rehabilitation and maintenance technical assistance in Phase II approximately 22% was devoted to implementing the maintenance program.

Person months of long term technical assistance:

	Phase I		Phase II		
	MAAIF	FAF	MAAIF	FAF	Total
Rehabilitation	75	39	54	29	197
Maintenance	0	0	12	6	18
Research	84	16	120	181	401
Administration	44	23	55	55	177
Total	203	78	241	271	793

Nearly 5 person years (equally divided between research and rehabilitation) of long-term TA were lost due to the TAs being on evacuation status between July, 1985 and May, 1986. This amounted to 22% of the total long term technical assistance effort in Phase I which was lost due to the Civil War in Uganda. In addition, nearly 13 months lapsed from the time that the Project Agreement was signed and the arrival of the first technical advisor in Uganda. Subsequently a total of 23 months (38%) of MFAD Phase I were lost to productive development work. In terms of "on-the-ground" technical assistance, 64% of the total was provided in Phase II and in many respects this reflected the level of overall project accomplishment.

Percentage breakdown of technical assistance:

	Phase I		Phase II		
	MAAIF	FAF	MAAIF	FAF	Total
Rehabilitation	9%	5%	7%	4%	25%
Maintenance	0%	0%	2%	1%	2%
Research	11%	2%	15%	23%	51%
Administration	6%	3%	7%	7%	22%
Total	26%	10%	30%	34%	100%

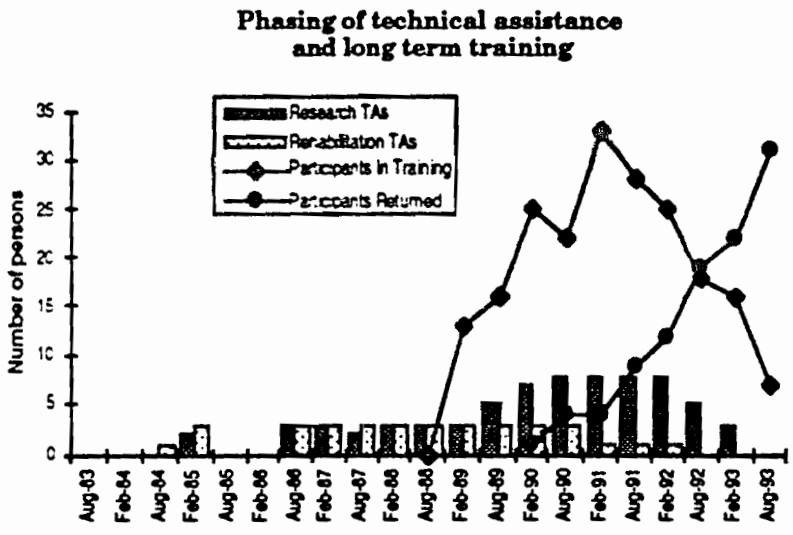
When the long term technical advisors returned from evacuation status in April - June of 1986 project management decided that the Farm Management Specialist and Rehabilitation Assistant/Serere positions would not be continued. Serere was dropped from further support due to continued civil unrest in the North and Namulonge was added in Serere's place. The curtailment of level of effort reflected GOU wishes that some MFAD funds be diverted to relief and humanitarian efforts needed to offset the effects of the war. The changes in rehabilitation

technical assistance responsibilities caused by this are covered in the previous section of this report. The loss of time and skills in the areas of farm management and mechanics manifested itself in several negative ways. Over the past four years, the agricultural production advisor at Namulonge devoted at least 25% of his time to farm management activities. This distracted him from more thorough monitoring of the on-farm research program. Rehabilitation advisors at Kabanyolo and Kawanda found themselves involved in equipment mechanics and field operation due to the absence of farm management technical assistance. The Administrative - Supply Management Officer was switched to full-time rehabilitation at Namulonge. From early 1987 through 1990 responsibilities for this position were handled on an ad-hoc and erratic basis. This left the Team Leader with the major task of reconstructing commodity records over a four year period when no one on the project had been assigned the responsibility for this.

Overall technical assistance effort was both successful and generally harmonious. Between late 1989 and early 1992 the size of the technical assistance team averaged 10 people. Technical assistance effort was effective, among other things, in development of national commodity production teams; forging strong ties between the Ministry of Agriculture and Makerere University and between research and extension; covering teaching, research and administrative responsibilities for MU/FAF while academic staff were in the U.S. for long-term degree programs; and shaping a more service-oriented attitude among GOU staff in the agricultural sector.

The technical advisors assigned to MU/FAF were heavily involved in curriculum development, course design and teaching in addition to assisting academic staff in the design and implementation of research programs in the areas of crop science, agricultural engineering, agricultural engineering, agricultural economics and agricultural extension education. Research TAs assigned to Namulonge worked with national commodity research teams for sunflower, soybean, maize cassava, rice and other crops. Typically, TAs worked with junior staff while more senior staff were in the U.S. for further long-term degree training.

B. Short Term



Over the life of MFAD of over 5.3 person-years of short-term technical assistance was provided. Over two person-years was funded from sources other than the USAID grant to GOU to implement MFAD. These 2+ years contributed significantly to both expanding and deepening the MFAD base of impact on agriculture and its' institutions in Uganda. Noteworthy contributions were made

to:

- survey and characterization of soils at Kabanyolo, Kawanda, Namulonge and Kachwekano DFI;
- establishment of the Food Science and Technology and the Agricultural Extension Education Departments of MU/FAF;
- development of horticultural research;
- articulation of academic programs between national agricultural colleges and MU/FAF;
- elaboration of the Five-Year Development Plan for MU/FAF;
- forestry and forest products research at MU/FAF;
- teaching and research in weed science;
- extension education curriculum development and practical training at Kabanyolo;
- Food Science and Technology curriculum and industry development;
- integrated pest management research and training;
- University library management and allocation;
- supervision of MFAD-funded participants conducting research in Uganda;
- assessment of horticultural potential in Uganda;
- surveys of farmer demand for research and researcher perceptions of farmer needs in Uganda; and
- several person-months of home-office administrative input within Uganda.

Salary, travel and per-diem costs for these activities were borne by Ohio State University, University of Minnesota, Fort Valley State College, Lincoln University, Rockefeller Foundation, INTSORMIL, SMSS, NiFTAL, INTSOY and the American Association of Small Colleges and Universities.

Major contributions to achieving the objectives of MFAD and to agricultural development in Uganda were made by USAID/MFAD-funded short term consultants during the life of the project. Due to implementation delays and the civil war, the use of short-term consultants didn't begin until three years after the Project Agreement was signed. Due to budget limitations in the Ohio State University contract resulting from cost over-runs in long-term participant training, the amount of short-term technical assistance was further curtailed during the last two years of the project.

A partial list of significant contributions made by USAID/MFAD-funded short-term consultants follows:

- Ernest W. Sprague. 1987. Plan for maize research and seed production in Uganda. Dr. Sprague defined the breeding/ agronomic research strategies for MAAIF and MU/FAF which led to formation of a national maize commodity research team. From this was generated the first new maize variety release (Longe 1) in 1991. Seed production is still a problem to be addressed as the national seed production program is still unable to supply potential and real demand.

- Carl N. Hittle. 1987. Soybean development in Uganda. Hittle outlined production factors and the feasibility of soybean development. In an agro-climatic sense soybeans are well adapted to Uganda. Their immediate use is as a supplemental food stuff. With proper oil extraction technology and increased demand for soy cake as livestock population rises, soybeans were given a high priority for research resources. A national research team was established and new varieties released. Recent surveys indicate that acreage planted in soybeans in several areas of Uganda is rapidly increasing.

- David Yost and Hari Eswaran, SCS/SMSS. 1990. Major Land Resource Areas of Uganda. Soil Management Support Services conducted a detailed soil survey of the principal MFAD research sites including physical, chemical and mineralogical characterization of the main soil groups. These maps and data have greatly facilitated improved research and production management decisions during the life of MFAD. Existing soils data were interpreted and updated to produce a national land resource map. Demand for this report has been increasing among public sector planners and decision -makers and from private sector sources interested in developing medium and large scale agricultural enterprises.

- Arlo Thompson. 1988. An assessment of sunflower production potential and a research plan for Uganda. Thompson evaluated the suitability of sunflower production in Uganda. Report recommendations were implemented including formation of a national sunflower research team. Subsequently a new sunflower variety has been released. Development of a hybrid breeding program has evolved slowly due to poor seed industry infrastructure. Sunflower is best suited to the climate and soil conditions of northern Uganda.

- ISNAR. 1988. Establishment of a National Agricultural Research Organization (NARO). This report led to the establishment of NARO in 1992.

- John Blaisdell. 1991. Concepts for the Development of the Food Industry of Uganda, and Curriculum development for the Department of Food Science and Technology (MU/FAF). Through these two reports, Dr. Blaisdell revamped the curriculum and extensively surveyed the food industry of Uganda. From these reports has been generated World Bank and possible further USAID support for this department after MFAD is finished.

- Calvin Martin. 1991. Development plan for Kalengyere Agricultural Research Station. Kalengyere's central role for highland research was secured and more precisely defined by this consultancy. It also helped generate increased USAID support for solanum potato research at this station.

- D. S. Muduuli, I. Okello-Uma and P.M.T. Hansen. 1988. Establishment of a Department of Food Science and Technology at Makerere University. This consultancy laid the ground work for a new academic department in the Faculty of Agriculture and Forestry. The department was established in 1989. It will receive support from USAID in its follow-on project after MFAD. Further assistance from other donors may be forthcoming.

- MU/FAF. 1991. Five-Year Development Plan. This was a joint effort by Ohio State University and the Faculty. It laid out, in detail, plans for each of the eight academic departments. Subsequently, the plan has been instrumental in attracting support, outside of MFAD, from several donors including Rockefeller Foundation, Japan, and World Bank.

- D. Ericksmoen. 1990. Maintenance Program and Rehabilitation Phase-Out Plan for MFAD. Several alternatives were defined for the phase-out of rehabilitation and establishment of a maintenance training program for Kabanyolo, Namulonge and Kawanda. The recommendations facilitated management decisions regarding efficient use of project funds for a viable maintenance program.

- B. Sundquist, S.R. Thompson, B. Bashaasha, and D. Ngambeki. 1991. Feasibility of establishing socio-economic research capability within MAAIF. These consultants

established recommendations and guidelines for assuring socio-economic input into agricultural research in Uganda. From this study there is now in place a mechanism for insuring this contribution to every national commodity research program. The only limitation at this time is an insufficient number of trained agricultural economists and rural sociologists to fill the needs of these commodity programs.

- E. Hartmans. 1989. Five Year Food Crops Research Plan 1989 - 94. The second volume for this report was never completed, but Volume 1 and the draft of Volume 2 were incorporated into the National Agricultural Research Strategy Plan which was the basis for the establishment of NARO and the World Bank-funded Agricultural Research and Training Project (ARTP).

- Borton R. and G. Sheldon. 1989. Report of the College/University Articulation Task Force. The agricultural technical colleges in Uganda are under the aegis of MAAIF. Until recently students enrolled and graduated from these institutions were on completely separate tracks from those at Makerere University. This report defined the ground rules for transfer of credits to MU/FAF so that technical college graduates would not have to start from the beginning of the FAF undergraduate program. Many of its recommendations have now been implemented.

- C. Martin, W. Wiles and W. French. 1992. Management plan for Kawanda, Namulonge and Kabanyolo research institutes. This consultancy more precisely defined the roles and organization of the research institutes and their relationship to NARO.

- L. Tweeten, T. Buchanayandi and C. Amorin. 1990. Uganda accelerated food crop production strategy. Of all the MFAD consultancy reports, this has been in greatest demand over the past three years. The authors lay out the parameters and status of food crop production in Uganda along with research and extension strategies to increase production levels.

Other consultancies worth noting include an assessment of the agricultural extension system in Uganda (1987); review of irrigation research facilities (1989); and MFAD project evaluations in 1987 and 1990.

IV. Training

A. External Degree program

Thirty-eight participants trained in the U.S. for Masters and Doctorate degrees between August 1988 and June 1993. One participant (Agricultural Extension Education) died on course in April 1989 and another failed to complete his PhD in Agricultural Economics. A third, Mr. Valentine Kasenge, is counted for a PhD to be awarded from Makerere University. Mr. Kasenge did his course work at Ohio State University, conducted his research in Uganda and then returned to OSU to analyze his data and to complete a draft of his dissertation (Appendix C.1.).

Over 100 person-years of degree training were provided under the OSU contract. Of this more than 25% was in the general area of crop sciences with the principal focus on plant breeding, plant pathology, agronomy and entomology. The crop focus was on maize, soybeans and horticultural crops. Nearly 50% of the training provided was in socio-economics and agricultural extension education reflecting a future emphasis on technology transfer, education and marketing. Soil science training (15%) emphasized soil microbiology (biological nitrogen fixation), soil conservation, soil water management and soil fertility. The two agricultural engineering participants were trained in areas related to appropriate technology for primary and secondary tillage including small scale mechanization and animal traction.

Five of the participants were women: MU/FAF - 3; (PhD - 2; MSc - 1) and MAAIF - 2 (PhD - 1; MSc - 1). This represents only 13% of the total, consistent with the percentage of women in the professional agricultural work force. This ratio is steadily improving due to a determined effort by GOU to increase opportunities for women. The ratio continues to improve with each new undergraduate class in MU/FAF.

Over one-third of the participants ended up being placed at Ohio State University. Every effort was made to diversify placement. The basic problem was that most candidates were in the age range of 30 - 45 years and were many years removed from their undergraduate and/or post-graduate training. This translated into lower graduate record exam scores which then made placement in many universities difficult. Placement was facilitated by personal contacts between OSU faculty and technical assistance team members, who were familiar with individual participant candidates, and colleagues in the U.S. University system who were familiar with the recent history of Uganda. Many of the participants had to take remedial coursework which increased the amount of time necessary to complete their advanced degrees. Over one third of the participants conducted some or all of their field research in Uganda which assured that their research topics were a positive factor in agricultural development and contributed directly to the objectives of MFAD. With one or two possible exceptions every single research topic was directly related to developing country agriculture if not specifically to Uganda (Appendix C.2.).

Several participants were successful in obtaining external funding to cover part or all of the costs associated with their research in Uganda. This was greatly beneficial because it reduced overall participant training costs and provided these participants with valuable experience in the process of obtaining grant funding. The positive impact of "grant-pursuit awareness" is evident for several returned participants who have attained supplemental external funding for their research programs in Uganda.

Although there was no direct long term training support for the MU/FAF Department of Food Science and Technology, Ohio State University was able to assist in obtaining

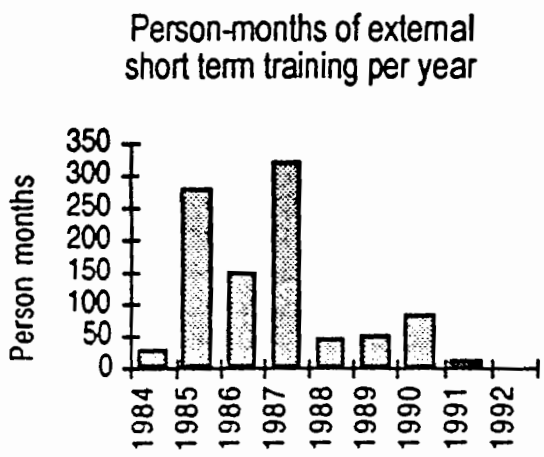
scholarship support for two individuals at the PhD level: Winifred Wafwayo and Mike Ameny. Ms. Wafwayo has been on a fully-supported OSU-funded graduate assistantship at Ohio State University for the past four years and will be finishing shortly. The OSU home and field offices assisted Mr. Ameny in obtaining a church-sponsored assistantship for a PhD in food science and technology at Louisiana State University. Both of these individuals are expected to provide the department with excellent research and academic leadership.

As of June 30, 1993, 29 participants have returned to Uganda and are now actively pursuing their teaching and/or research obligations in the MAAIF and MU/FAF. Most will play a leadership role in the National Agricultural Research Organization (NARO). Six returned MSc participants are now or will shortly be pursuing PhD degrees under World Bank, Rockefeller or private funding. Unfortunately eight of the PhD degree participants will not have completed their degree programs before the termination date of the OSU prime contract. ARTP will pick up each of these participants until the completion of their degrees in late 1993 or early 1994.

The principal problem associated with the long-term degree program was the assumption that a PhD degree would take only 33 person-months and an MSc only 18 person-months. In reality the average length of time for a PhD under MFAD was over 44 person-months (range 37-56) and for a MSc degree it was over 23 person-months (range 15-34). Unfortunately the OSU participants training budget assumptions were based on the lower figures. In most developing countries it should be assumed that it will take from 42 - 48 person-months for a PhD and 24 -30 person-months for MSc degree.

B. External Short Term

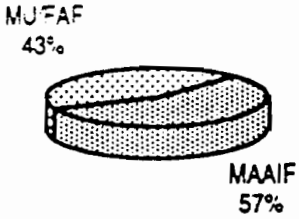
A grand total of 967.5 person weeks(18.6 person-years) of external short term training, were provided under MFAD. Of this, over 180 person-weeks (19%) were provided under Phase II (Appendix C.5.



Only 70% of the total of 256 person-weeks programmed for Phase II was utilized, primarily due to cost over-runs from long-term participant training, mentioned previously. This curtailment did not have serious programmatic implications as several of the candidates scheduled were ultimately offered similar training opportunities from other sources. Most external short-term training took place in Phase I. The years of 1985 and 1987 experienced the heaviest volume of short-term trainees at 275 and 325 person-weeks, respectively.

The drop-off in 1986 was precipitated by the coup-de-etat and civil war in Uganda during mid- 1985 to early 1986.

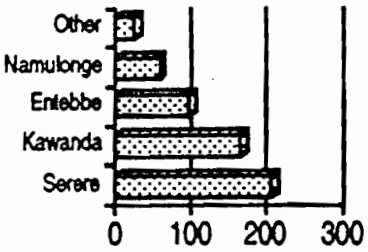
Division of external short term training



Fifty seven percent (10.6 person/years) of short term TA were provided to MAAIF and 8.0 person-years provided to MU/FAF. Approximately 25% of the training was for Serere Research Station staff while Kawanda accounted for a little less than 20%.

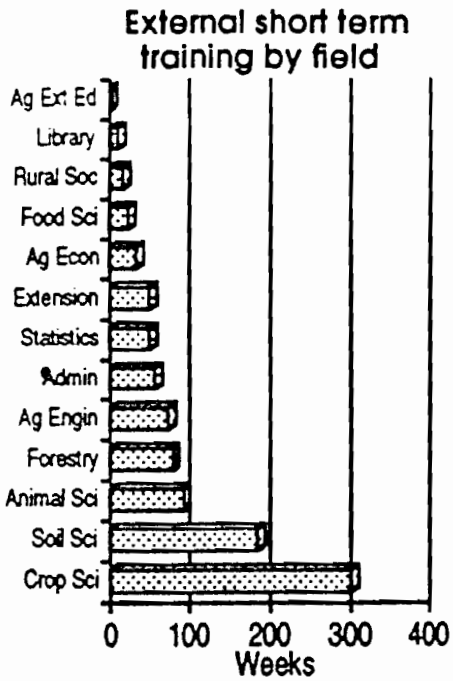
In late 1986 through 1987 many of the Serere staff were transferred to other research stations in Uganda.

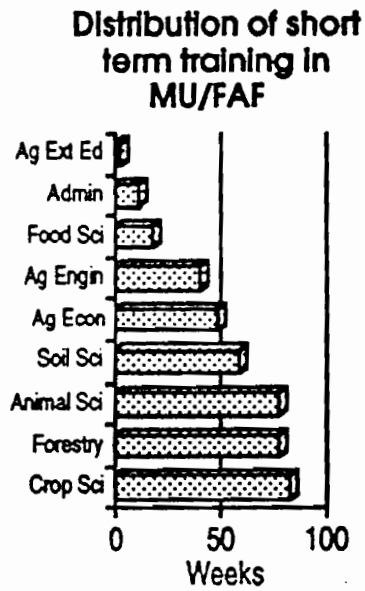
Months of external short term training by unit in MAAIF



The largest single area of training was the crop sciences with 6.1 person years followed by soil science with 3.4 person-years. These two areas accounted for over half of the short term training effort. All eight academic departments of MU/FAF received training including eight person-weeks for university administration. One and one half person-years of training were provided to the Crop Science Department followed closely by Animal Science and Forestry at 1.4 person-years each.

Due to the annual crop focus and decreased total funding for MFAD after the civil war, Animal Science and Forestry were not emphasized for technical assistance and long term training in Phase II.





External short-term training under MFAD proceeded very smoothly due to excellent home office and field office coordination, a facilitative USAID Mission and unwavering support from MAAIF and MU/FAF administration. The impact of this early training effort has been felt in several ways. First it helped lay the groundwork for the long-term degree training program. Most of the long-term participants were involved in the short-term training program. Second, short term participants returned to Uganda with a refreshed professional perspective which quickly translated into heightened research and teaching activity. Long dormant areas of research were rediscovered, redesigned and re-started. As research and teaching technical assistance geared up in Phase II, technical advisors were joined by a cadre of revitalized professionals once more interested in their work. As the last large wave of trainees returned in 1987, the local currency support program for research was implemented which helped maintain the training edge. Finally, through the short-term training program, the first of several collaborative research efforts between U.S. University faculty and MAAIF and MU/FAF staff were initiated. This led to faculty exchanges in the areas of animal science, crop science and forestry and to the formation of the Makerere University/Ohio State University faculty liaison committee.

C. In-country M.Sc. program

Thirty-five candidates for Masters degree entered MU/FAF on July 1, 1991. This intake represented a rapidly progressing effort on the part of MU/FAF to increase its capacity and capability to handle postgraduate students. The postgraduate program in MU/FAF never totally died during the "bad" times, but it was moribund. At the very time that the Faculty was (1) developing and implementing a new four-year undergraduate curriculum; (2) releasing eighteen of its key staff for long-term training in the U.S. under MFAD; and (3) developing and finalizing its Five Year Development Plan, it undertook the complete resuscitation of its postgraduate program. MFAD technical assistance assigned to MU/FAF played an especially positive but not dominating role in this effort.

The MU/FAF academic staff are to be highly commended for the vigor and dedication shown in assuring the success of this program. Outside assistance from professionals employed by other organizations such as CIAT, the MAAIF, the Agricultural Secretariat and OSU has assured that each masters candidate has received high quality supervision and guidance throughout course work and thesis research. The return of Dr. Adipala Ekwamu from his MFAD-sponsored PhD greatly enhanced the programs of several crop science students. In April of this year at a special graduation at Makerere University, thirteen students, including five from the MU/FAF Department of Agricultural Economics staff, were awarded the masters degree in Agricultural Economics. The convocation was addressed by President Museveni and Vice Chancellor Kajubi. Both were very complementary of the role that MFAD has played in assistance to the University and to agricultural development in general.

The remaining candidates (Crop Science 15; Agricultural Engineering - 3; Forestry - 2; Soil Science - 1; and Animal Science - 1) graduated in June, 1993. Twenty-three of these students came from MAAIF research staff while the remainder came from MU/FAF. (Appendix C.3.) Many will be excellent PhD candidates under ensuing donor assistance programs. All 35 are poised to make significant contributions to agricultural research, education and development in Uganda over the coming years.

Thesis topics have addressed agricultural and natural resource issues from supply response of maize farmers, to land tenure, to rabbits, to finger millet to soil erosion (Appendix C.4.). Local currency support from USAID played a critical role in assuring the financing of this program. A positive aspect of this program was it's cost effectiveness. A conservative estimated cost to train a Ugandan participant in the U.S. for a Masters degree is approximately $50,000. The Makerere Masters program costs around $10,000 for a two year program or only 20% of a U.S. Masters. Due to the level of training and qualification that the faculty has achieved under MFAD these MSc degree holders will gain ready entry to PhD programs throughout the world.

D. In-country Conferences and Workshops

Over 26 conferences and workshops were either totally or partially sponsored by MFAD between December, 1986 and June, 1993; an average 4 to 5 per year. Attendees over this 6.5 year period numbered over 1,720(Appendix C. 6). Topics covered have included soil science, soybeans, extension-research linkages, on-farm research, bean research, irrigation technology, biological nitrogen fixation, curriculum development, horticulture, integrated pest management, farming systems data analysis, implementation of agricultural and rural development projects, agricultural communication and media strategies, root crops, maize research, pastures, laboratory methods of soil and plant analysis, leadership and management skills for women in agriculture and management of agricultural research for senior managers.

Many of the conferences were regional and brought together agricultural scientists in an atmosphere of collegiality. .This had a positive influence on MAAIF and MU/FAF staff who had been isolated from their neighbors for so long. As a result of these conferences and workshops, many of Uganda's scientists have once again risen to levels of regional leadership in their respective fields of research. It has also provided the opportunity for scientists from East and Southern Africa and the rest of the world to observe first hand that the agricultural sector is addressing the problems of agriculture and natural resources in Uganda and the region. Finally, Ugandan scientists have had the opportunity to publish findings from their research projects in the proceedings of these conferences.

V. Commodities

A. Vehicles

Eighty-five vehicles were purchased for MFAD use between late 1984 and mid - 1993. (Appendix E.) Fourteen of these were motorcycles purchased for use in on-farm research, rehabilitation and general research support activities. Of 71 four-wheeled vehicles, 16 are no longer on the road due to theft, wrecks and wear. Five vehicles were stolen, mostly during the 1985 - 86 period of civil unrest. A surprisingly large number of vehicles purchased between 1984-87 are still operable.

The of all vehicles at original purchase date is a little over 1.11 million dollars. The breakdown is as follows:

Assign ment	Value	% of total	# of 4 - wheeled vehicles	# still oper ating	% still oper ating
MAAIF/ NARO	616,152	55	38	27	71%
MU/FAF	443,210	40	30	25	83%
USAID	52,825	5	3	3	100%
TOTAL	1,112,187	100%	71	55	77%

Of the 30 four-wheeled vehicles purchased and delivered prior to 1988, 53% are still operating and performing useful project work. This figure would have been higher except for the five vehicles stolen during periods of civil unrest.

	Period	
	1984-87	1988-93
# purchased:	30	41
# still operating:	16	39
% still in use	53%	95%

The impact of these vehicles on achieving the purpose and objectives of MFAD can in no way be over-rated. Some of the earlier vehicles have now clocked over 250,000 kilometers based on log book and odometer observations. A reasonable estimate is that these vehicles have traveled over a combined 8,500,000 kilometers during the life of the project. Regional testing of maize, soybean, sunflower and potato varieties would have been impossible without adequate transportation. Consequently none of the new varieties of these commodities would have been sufficiently tested under diverse growing conditions and subsequently none would have been released for farmers' use as early as they were. The implementation of an active and growing on-farm research program would have been impossible if Namulonge scientists had to depend on public transportation. The overall picture is one of transportation support thoroughly integrated into the programmatic objectives of the project.

B. Laboratory and Field Equipment

As of this writing $706,317 worth of field and laboratory equipment was purchased under MFAD. It was equally divided between MAAIF and MU/FAF.

Location	Amount	%
Kawanda	$147,784	21
Namulonge	$198,054	28
NARO/Entebbe	$6,515	1
Subtotal	*$352,353*	*50*
Kabanyolo	$296,918	42
Makerere	$57,046	8
Subtotal	*$353,964*	*50*
TOTAL	$706,317	100

The distribution of equipment reflects shifts in project objectives and focus over time. Originally Serere and Kawanda were to receive most of the MAAIF resources. Kawanda was subsequently given a perennial and horticultural crops mandate which was not central to MFAD objectives. Namulonge replaced Serere and was also given the annual crop mandate which included the three-crop (maize, soybean and sunflower) focus of MFAD.

Field equipment (such as tractors, planters, cultivators. plows, slashers., harrows, seed cleaners and grain dryers) has been a key factor in returning the research stations to full productivity. Land which had turned to bush and thicket has been returned to well-groomed research plots and production fields which contribute to station operating funds and low-cost food stuffs for poorly paid staff.

Items, such as lathes, grinders, saws, sanders, hammer drills, and compressors, have contributed immensely to rehabilitation, maintenance and general farm operations. Because stations are in rural settings it is critical to efficient field operations to have workshops with proper equipment on site.

Laboratory equipment such as pH meters, atomic absorption spectrophotometers, micro kjeldahl digestion units, glassware and chemicals have made much needed chemical and physical analysis of plant and soil specimens possible over the past four years. Without such data there would be no way to interpret and explain crop responses to fertilizer, water and pest management. Consequently the research would not be acceptable for publication nor be useful for agricultural production. These data are now appearing in professional papers which eventually lead to extension publications and farmer recommendations.

There are some parts which have yet to arrive for the atomic absorption spectrophotometer and the fume exhaust hood in the Soils Laboratory at Kawanda. The long delay was caused by (1) an incomplete order in 1988 and (2) suspension of all commodity purchases for two years due to an IG audit of the project.

C. Office Equipment

Computers, photocopiers, printers, office desks, chairs, filing cabinets, calculators, transformers and surge protectors represent the tools for getting scientific output into print and keeping the records necessary for effective research and academic management. Several offices located in Kampala, Kawanda, Namulonge, Kabanyolo and Entebbe were key administrative elements of MFAD. Each administrative office along with academic department offices at MU/FAF and national commodity research programs at Namulonge and Kawanda were in need of computer processing and record maintenance capabilities. Through MFAD $104,880 worth of office equipment was purchased and distributed. Later, as MU/FAF academic departments expanded their research and teaching programs, the demand for data processing increased to the point that some local currency purchases

were made for computers, printers and power regulators. This became more feasible because the Uganda shilling stabilized against the U.S. dollar and the cost of electronic equipment dropped to rates competitive with U.S. purchase plus shipping. The procurement of power regulators was crucial to protect investment in computers and peripherals. In recent months electrical supply has been more uniform. Electricity supply has been characterized by frequent black-outs, brown-outs and surges. Numerous power failures necessitated procurement of UPS (uninterruptable power supply) equipment.

The impact of office equipment procurement on MAAIF and MU/FAF is evident. The large number of professional papers, academic coursework materials, correspondence and reports can be directly attributed to the availability of this equipment. (sections III, IV and VI of this report).

An important phenomena has occurred during the life of MFAD, namely the evolution of computer equipment and software. When MFAD began in 1984, central processing units were slow, operating systems were non-intuitive and mastery of application software involved a steep and long learning curve. Today CPUs are 10 - 20 times faster, Windows and Macintosh graphics user interface (GUI) operating systems are easy to learn and application software is at least 10 times more powerful and 20 times easier to comprehend and use. Just as importantly all of this extra processing power costs only half as much. Much of the computer equipment purchased through MFAD 5 - 8 years ago is now dated and will need to be upgraded in the near future.

D. Other commodities

Based on MFAD office records, approximately $340,000 was spent over the life of the project on furniture and appliances for the technical assistance team. All of these items were purchased directly by USAID/Uganda and provided to the technical advisors. All PIO/Cs for furniture/appliance sets are on file at USAID. Two sets have been returned to USAID for re-assignment. The value of project furniture and appliances provided to each TA averaged $23,677. There are usable appliances stored at Serere Research Station which are not on the list in the inventory database maintained by the OSU field office at Makerere University.

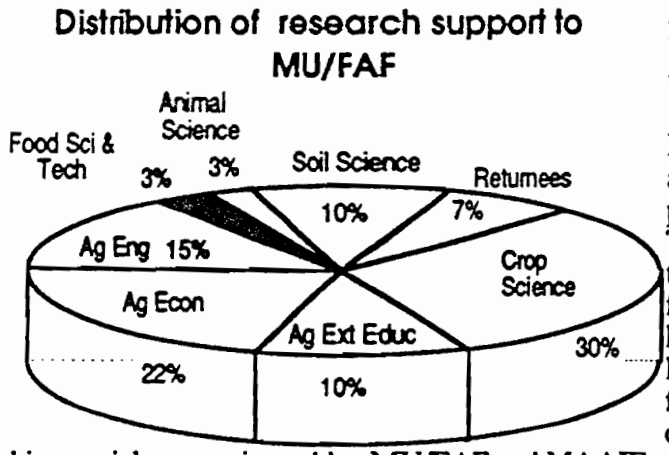
A complete printout of the OSU inventory database has not been included in the appendix. The inventory database is stored on computer diskettes in both DBase IV (DOS) and Filemaker Pro (Macintosh) formats. Hard copy may be obtained on request from OSU or the field office.

E. Problems Encountered

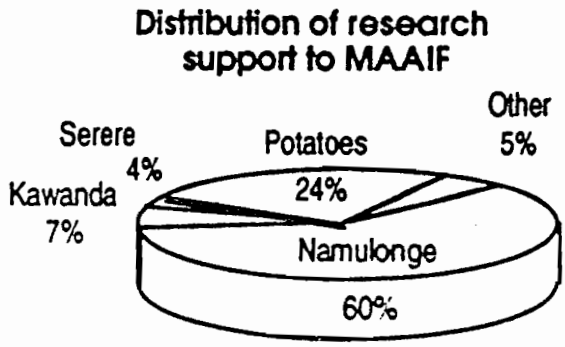
It has been our experience that procurement through an agent not closely tied to the prime contractor resulted in major delivery delays, slippage in interpretation of specifications, erratic quality of materials and mistaken charges. Such problems were most prevalent with PSAs contracted by USAID and with PSAs utilized in Nairobi for procurement of rehabilitation materials. The best balance was achieved through procurement orders handled by the University of Minnesota. The primary reason for this was that Minnesota had a programmatic interest in the project and went to extra lengths to assure that what was needed in the field was what we received.

VI. Research and Teaching Activities

From 1987 to the PACD for MFAD, local currency support has been provided to assist agricultural research in both MAAIF and MU/FAF. In Fiscal Year 1992/93 120 million shillings were supplied to MU/FAF and 165 million to MAAIF. About half of this was furnished to projects in which there was direct TA involvement. Primary recipients for MAAIF were the research programs at Namulonge Research Station. Of this, 40 million went to the On- Farm Research program, 25 million to maize, soybeans and sunflower and the remainder to national research programs in rice, yams, cassava and animal traction. Some of these activities were not research. MFAD support for the cassava program was to help multiply certain varieties for distribution to mosaic and leaf-blight infested regions of the country. The animal traction project was primarily a demonstration program which has been extended to Mpigi District DFI and to several small farmers in the area. Socioeconomic research is being conducted in association with the project.



During the past three years an average of over 50 research projects were supported per year. To attempt to provide the results of this effort in detail would make this final report impossibly long. Only highlights will be presented here. Detailed reports are in the MFAD files, in Technical Advisor quarterly and termination reports and in special reports issued by MU/FAF and MAAIF. As shown in Appendix D the list of professional and extension publications continues to grow each month.



A. MAAIF

1. Maize

The staff in maize research has increased. It now includes two breeders, one pathologist, two entomologists, one agronomist and 11 assistant agricultural support staff. National and international efforts have resulted in a cadre of well-trained maize researchers.

Research reports as early as the second season 1988 showed promising results. Germ plasm from IITA and CIMMYT was quickly introduced and progeny and variety trials were initiated in a search for superior varieties . During the next five years the program devoted its efforts to population improvement and variety development. Potential parents for hybrid maize have been identified and tested. Although there is a market for hybrid seed, there is still no Uganda seed production agency which has the capacity to produce and market hybrid seed.

The maize program has evolved as follows:

- Collection and screening of local and international germplasm.
- Development of breeding population by compositing germplasm.
- Improvement of populations by selection.
- Development of varieties to release to farmers.

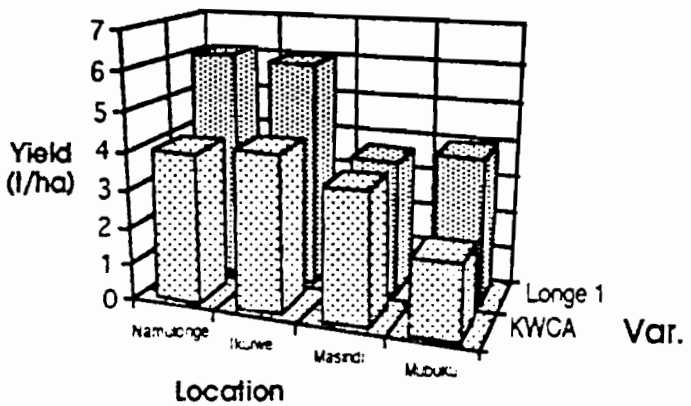
During the past five years maize variety evaluation has been carried out in the major maize producing areas of Uganda. Yields under good management have been excellent. Experimental yields were often more than 6 tons per ha.

Agronomic trials carried out during the same period revealed the need to use fertilizer for high yields. Insecticides were evaluated for control of stem borers, and the effect of herbicides on weed control was evaluated. Work in maize pathology resulted in the incorporation of blight resistance in promising maize germplasm materials. Staff of the project were quick to recognize the potential of hybrids in maize production. Using IITA maize hybrids, tests were conducted against open pollinated varieties.

The testing of parents for hybrid production has continued. In the 1990 annual report a single cross hybrid from IITA Nigeria produced the highest yields in 4 out of 5 locations tested (Hybrid 8535-35). The program has multiplied several in-bred trials which will allow for study of numerous combinations.

In 1991 the Namulonge Research Station released a new maize variety named Longe 1. This open pollinated variety was jointly produced by IITA and the national maize program. Longe 1 is resistant to maize streak, is approximately 1 meter shorter in stature than the local varieties, and matures 2 weeks earlier. The following graph illustrates the yield potential of the new variety as compared to the local variety KWCA.

Comparison of yields of maize varieties, Longe 1 and KWCA at various locations in Uganda 1990

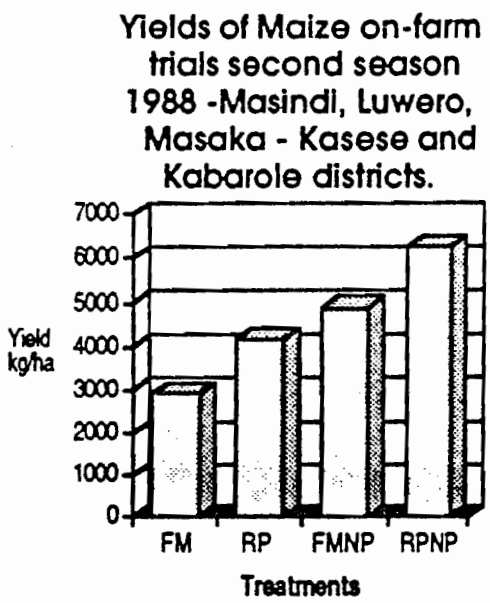


This variety has been tested extensively in farmers fields for the past 4 growing seasons. It is accepted by farmers. Even under low input management produces it yields approximately 1 ton/ha more than KWCA, the local variety .

During the second season. 1992, more than 1900 Uganda farmers were given the opportunity to grow Longe 1 seed furnished by the Namulonge Research Station in cooperation with

USAID. The Ministry of Agriculture seed farm at Masindi has included Longe 1 in its maize seed production program.

On-farm trials conducted by research staff at Namulonge in the second season 1988 clearly illustrated the value of new technology in maize production. Results of trials conducted at 18 locations in the Masindi, Luwero, Masaka, Kasese and Kabarole districts are shown below.



Treatments were as follows: farmers method of planning (FM); row planting (RP); farmers method of planting with nitrogen and phosphorus fertilizer (FMNP); and row planting with nitrogen and phosphorus fertilizer (RPNP).

Nitrogen and phosphorus fertilizer were applied at the rate of 90Kg N/ha and 60Kg P_2O_5/ha.

Numerous fertilizer trials conducted by Namulonge Research staff over the past 5 years have shown that nitrogen and phosphorus fertilizer are very important in maize production on most soils of Uganda. On most farmers fields maize produced without use of fertilizers, on continuously cropped land, yields less than 1 ton per ha. Research results indicate that in general 1Kg nitrogen per ha will boost yields approximately 30Kg per ha when other production factors do not limit. The future for sustained production of high yields of maize will depend upon farmers using practices which will supply nitrogen to the maize crop. This could be animal manure, legume crops or nitrogen fertilizer. Without the benefit of applied nitrogen, yields will be restricted because of the low nitrogen levels in the soil.

The national maize research program has made great strides in the past five years in developing germplasm which will result in new improved varieties for Ugandan farmers.

Through the efforts of MFAD/USAID, two senior plant breeders and other research staff have completed long term training programs and are now carrying out aggressive research programs. The research program is receiving assistance from CIMMYT and British AID but with the termination of the USAID/MFAD project, additional assistance will be needed to sustain the present research program. It is imperative that this research continue although staff have been able to develop germplasm with resistance to northern corn leaf blight and yellow streak, a new disease, downy mildew, has been observed in several maize fields. It is certain that this disease will become a major constraint to maize production unless resistance to the disease is incorporated into new Ugandan maize varieties.

2. Soybeans

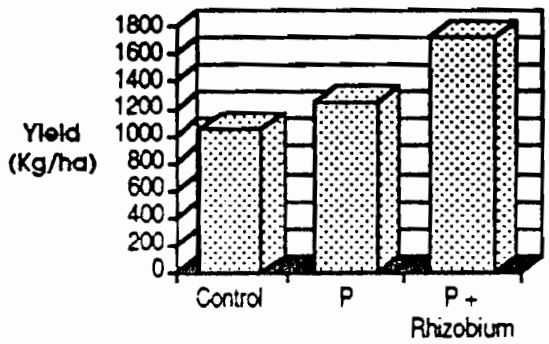
For several years prior to 1987 the soybean improvement program had been seriously hampered by lack of personnel to carry out sustained research activities.

In 1987 with the assistance of Dr. Carl N. Hittle the seed of many soybean breeding lines and varieties were received in Uganda, via USAID. The variety and seed lots were divided among the Kawanda, Namulonge and Kabanyolo research stations. In August 1987 seed of 445 breeding lines were planted at Kawanda. In addition 384 of the 445 breeding lines were planted at Bukalasa. International variety trials were also planted at Mubuku, Bukalasa, Kabanyolo and Kawanda. Although personnel changes were frequent even until 1987, in early 1988 Dr. Gadi Gumisiriza arrived in Uganda, after receiving training abroad, and became team leader of the soybean program. The team leader and staff screened the materials already planted and during the second rainy season of 1988 placed trials at Namulonge, Nabango and Mubuku.

They found that the lines of soybean from IITA gave higher yields than INTSOY materials. This better performance was largely due to the longer growing period of the IITA lines. The yields of soybeans grown at three locations in the second growing season of 1988 gave encouraging results compared to the check yield of Kabanyolo 1. The seed yield was increased from 918Kg/ha to over 3000Kg/ha for some of the new varieties. Under the guidance of Dr. Gumisiriza, the soybean program flourished and several new professional staff members were added namely, P. Tukamuhabwa -breeder and Moses Mbalule Idembe - agronomist. Since 1987 soybean research and development have flourished.

Research on use of phosphorus fertilizer and inoculum on soybean resulted in significant increases in yields. In June 1989 a new soybean variety was released by the Ministry of Agriculture. The soybean variety, known as NAM 1, was found to be superior in yield to Kabanyolo 1 and possessed more resistance to lodging. During the second season, 1988, soybean trials conducted in the Masindi and Luwero districts at five locations illustrated the value of inoculum and phosphate fertilizer on soybean production under farmer conditions. Results were obtained as shown to the left.

Yields of Soybean - (Farm Trials) Masindi district - 1988 (5 locations)

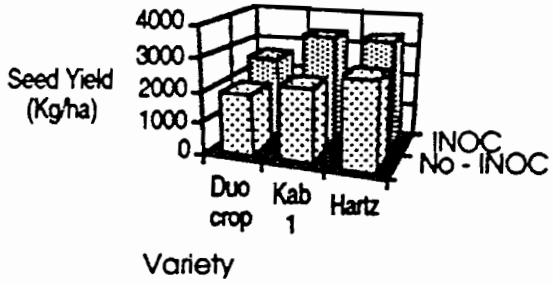


Control is under farmer management and P is phosphorus fertilizer applied at the rate of 60 kg P_2O_5 per hectare.

Trials conducted in second season 1988 at Namulonge show clearly the effect of proper inoculation of soybeans on seed yield.

Research activities on soybean production at Namulonge are now under the leadership of P. Tukamuhabwa. He has developed an ambitious program in breeding new varieties which are resistant to disease and pests. His colleagues are also investigating management practices which will result in higher economical yields of soybean. This modest but efficient research group has several new varieties of soybeans which will soon be candidates for release to farmers. On-farm trials placed in 6 districts of Uganda during the past 5 years have shown that soybean can be grown in many areas of Uganda and produce good yields with proper management.

Effect of Inoculation on yield of 3 Soybean varieties at Namulonge (1988/2).



Uganda climate and soil conditions are well suited to the production of soybeans. The crop is relatively free of disease. It is more drought resistant than most cultivated crops and is more easily stored for food than other crops. Although there is wide interest in production, farmers have found it difficult to market as a cash crop. Prices are relatively low since its use at present is mainly as a food crop at the farm level. With increased ability to process the soybean it could well become the major source of vegetable oil for Uganda as well as a source of animal and human food.

The USAID/MFAD efforts in soybean research and development have been significant. Through long and short term training, a viable soybean research and development group has been assembled. With modest incentives the group has produced research and production results which can serve Uganda well. Further efforts should be made to assure that this group and its work is sustained.

3. Sunflower

An analysis of the oil seed situation was prepared in October, 1989 and much of what it called for is now in practice. The two largest oil mills distribute seed to growers. Sunflower is now generally supported as an oil seed that has an opportunity to break Uganda's 98% dependence on imported oil. In October, 1990 the President's Task Force Committee on Edible Oil endorsed this analysis.

Two cycles of maternal recurrent selection were undertaken within the Australian variety Sunfola and the improved version was released in 1991 and named New Sunfola. It is in the production fields of over 5,000 farmers who collectively planted 10 tons of New Sunfola in the Tororo area alone. Oil millers in Kampala and Tororo recognize the value of moving from the 10% oil varieties to New Sunfola with 40% oil.

Production of hybrid sunflower seed had never been attempted in Uganda until the first rains of 1991 when the National Sunflower Research program grew 2.5 tons of two sunflower hybrids. The surplus seed was sold for 7 million shillings, which was more than the annual budget of the program. It is hoped that this profitable venture will stimulate hybrid seed production for Uganda and its neighbors.

In July of 1991 Mrs. Ruth Ssebuliba, who had just received her MSc degree in Kenya, became the new leader of the National Sunflower program and was the first person with an advanced degree assigned to the program. The staff are now capable of developing and producing open pollinated varieties and producing hybrid seed.

The sunflower program is far ahead of the schedule outlined by Dr. Arlo Thompson in his 1988 Assessment of Sunflower Production Potential and a Research Plan for Uganda.

Hybrid varieties have consistently shown a 30% to 50% yield advantage over open pollinated varieties such as New Sunfola. The Sunflower TA obtained 30 seeds each of the parental lines of several desirable hybrids from USDA. These have been increased in isolation and this season there may be enough seed (800,000 seed) to plant 40 acres of seed production of a single cross hybrid and a half acre of a three way hybrid. This means that Uganda can soon be self sufficient in the production of both single cross and three way hybrids.

Based on two years of hybrid sunflower evaluation trials the following conclusions are possible:

- Hybrids are superior to open-pollinated varieties in seed yield and, compared to the best hybrid, New Sunfola is low in seed yield but it's oil content compares favorably.
- Hybrids stand stress better than open-pollinated varieties.
- Hybrids are more uniform in maturity date than open-pollinated varieties.
- Bird damage is one of the greatest constraints to small-farmer sunflower production when open-pollinated varieties are used.
- One or more hybrids appear to have some bird resistance.

4. Beans

The National Bean Research Program was under the leadership of Mrs. Teresa Sengooba until 1992 when she assumed the position of Director at Namulonge Research Station (now Institute). The program is still located at Kawanda, but there is some discussion about moving it to Namulonge. Specific research projects in the bean program include breeding, agronomy and on-farm research, BCMV investigations and weed management. Technical assistance input has been through the CIAT regional bean program which is officed at Kawanda. Detailed accounting of research results and progress can be found in the annual bean program reports. The bean program released three new bean varieties in 1991.

5. Cassava

Cassava is the most important root crop in Uganda. Present production exceeds 30 million tons of fresh cassava roots. It is grown in all districts of Uganda, particularly in the drier Eastern and Northern Regions.

Cassava is mainly grown by small farmers on land areas from 0.1 to 1 ha. It is often intercropped with beans, maize and groundnuts. Use of fertilizer and herbicides is rare. In several districts of Uganda the sale of cassava can represent up to 98% of the total cash earnings from the farm.

Cassava yields are restricted in many areas by cassava mosaic virus and bacterial blight. Additionally the cassava green mite and mealy bug have substantially reduced the output of cassava production in Uganda.

In 1970 the International Institute for Tropical Agriculture(IITA) embarked on a program to develop cassava cultivars which were resistant to mosaic virus and bacterial blight. Significant progress has been made and there are now cassava materials available which are resistant to these diseases and produce high yields of good quality. Staff of the cassava project at Namulonge have secured a number of these new genotypes and have evaluated them for yield and quality at several locations in Uganda. Encouraged by the results of these trials, efforts were made to multiply several varieties for introduction to farmers.

Multiplication of cassava varieties

With funds furnished by the MFAD project, staff at Namulonge initiated a program for supplemental multiplication of cassava planting materials. Starting in April, 1991, land, which had not been under cultivation for more than 12 years, was cleared for production.

It was necessary to cut and remove many small trees and pull their stumps with a tractor. The fields were sprayed with a herbicide (Roundup) and plowed with a tractor after two weeks. This plowing was followed by disking and smoothing with a field cultivator. The soil was tested and phosphorus fertilizer was applied at the rate of 90 kg P_2O_5 per hectare on phosphorus deficient soils.

Rows for planting the cassava were marked by using a row crop planter. Cassava (mini-stems), 8 - 10 cm in length, were planted 75 cm apart in the row. After emergence, a row crop cultivator was used to control weeds. Later as plants reached a height which did not allow for the use of a tractor cultivator, weeds were removed by use of a hoe.

Nine varieties were planted on 50 acres (20 ha). After approximately 9 months, stems were harvested and distributed to farmers throughout Uganda. The table below shows the number of stems distributed by variety during the 1st and 2nd growing seasons.

Variety	Stems	Area Planted (ha)
TMS 30337	21,380	16.4
TMS 60142	10,787	7.5
TMS 30786	20,895	16.7
TMS 30572	52,860	42.3
TMS 4(2) 1425	5,280	3.7
TMS 60140	1,020	0.7
Ebwanateraka	71,936	71.9
Bao	14,910	14.9
Bukalasa II	14,452	14.4
Totals	**204,000**	**188.5**

During the 1st season, 1993, 84,500 stems were distributed from 30.5 ha of cassava. Through the efforts of Father Collins, Nsambya Hospital in cooperation with cassava staff, 111 families suffering from AIDS in the Mpigi District have received cassava planting materials. One hundred stems were supplied to each family.

The total effort of planting and distribution was accomplished for less than 5 million shillings. Multiplication is continuing and the on-farm testing of cassava genotypes has been established in several districts. The 1991 annual report shows the yields obtained on some of the varieties. In addition to yield, acceptability of the cassava genotypes by farmer was monitored. The following table shows the yield of cassava varieties tested at 4 locations in the Luwero district. The ranking in terms of farmers acceptability is also shown.

Variety	Yield t/ha	Rank of acceptance
TMS 60142	28.3	1
TMS 30337	32.0	2
TMS 30572	25.6	3
TMS 30786	24.7	4
Bao	24.7	5
Teraka	22.6	6
Mpologoma	17.7	7
Senyonjo	19.0	8
Bukalasa II	13.1	9
Kasirye	8.2	10

In general, TMS varieties from IITA were highest yielding and ranked the best in respect to the farmers taste and suitability in his cropping systems.

The cassava program at present is strong and is making excellent progress in research and distribution of varieties. USAID has made a significant contribution to the development and distribution of cassava varieties in Uganda. The establishment of the IITA East and Southern Africa Regional Center for the improvement of cassava at Namulonge should further strengthen the efforts to improve this crop which is very important to Uganda and Africa.

6. Irish Potato

The MFAD office has been the conduit for local currency support to this CIP-managed project. Research results have been encouraging and progress has been made but at a high cost compared to the other crop commodity programs. Moving potato production to the Uganda equivalent of the lowlands is still problematic and is highly dependent on education and acceptance of relatively sophisticated True Potato Seed (TPS) technology. Detailed research results are available through the International Potato Center and it's field representative in Uganda.

7. Rice

MFAD assistance to rice research has been limited to the growing seasons of 1992 and the 1st growing season 1993. A small staff has been developed through supporting funds from the MFAD project. At present there are two research officers - one at the Ph.D. level, two Assistant Agriculture Officers and six laborers.

The project received new stimulus with the arrival of Dr. Justus Imanywoha who recently returned from long term training in the U.S. and will take on a leadership role.

Although rice has been a minor crop in Uganda, the 1992 agricultural statistics show that over 100,000 tons of rice were produced on approximately 73,000 ha. of land. Districts close to the Kibimba rice scheme, i.e. Tororo, Pallisa and Iganga produce significant amounts of rice. In addition the districts of Kitgum and Gulu accounted for nearly 40,000 hectares of rice.

Most of the rice is raised in lowland or swampy areas. Upland rice varieties have been tested in Uganda for several years, but there has only been a limited effort to test upland rice varieties on farmers' fields.

During the 1991 second rainy season, 11 upland rice varieties were secured from IITA for testing in addition to local rice varieties obtained from Doha, Pallisa, and Kasese. The local collection proved to be swamp rice varieties and were of little value. They were late maturing and not suitable for upland conditions.

Based on yield data from trials conducted during the second rains, 1991, 4 varieties were selected for further evaluation. At present 6 upland rice varieties are being tested in advanced yield trials including the following:

- IITA 257
- IITA 150
- IITA 305
- IITA 325
- CNA 762069
- IRAT 112

The variety IRAT 112 has been evaluated by staff in the farming systems project in Tororo for several years. Other research activities include plant population studies, intercropping with soybean and groundnut, and rate studies for nitrogen use. On-farm trials of 7 varieties are being tested in Masindi (DFI) and Mityana.

There is need to secure additional germ plasm from international collections at WARDA, IITA and IRRI. Attempts are now underway to obtain appropriate testing materials.

Records of the Ministry of Commerce(April, 1993) indicate that the average farm price for rice is 586 shillings/kg and that the farmers of Uganda received approximately 60 billion shillings from the rice crop in 1992. While the maize farmers received 81 billion for their maize crop, it was produced on nearly 500,000 hectares compared to 73,500 ha. of rice. Increased efforts should be placed on upland rice research and development of the rice industry.

Rice appears to be rather easy to market and is desired as a food crop. In comparison to other cereal crops it can produce nearly twice the calories of food on a given area of land when compared to wheat and maize. It takes only 1kg N to produce a 60kg yield increase in rice .

There is a separate research program on rice at Namulonge which has been conducted by a North Korean group. Initially the group was working on lowland rice varieties that took more than 140 - 150 days to mature. It appears that their emphasis has shifted to upland varieties which are earlier maturing.

The two upland rice research activities should be merged so that efforts in rice research can be under one leadership.

8. Animal Traction

The lack of power for land tillage is one of the most important constraints to the development of agriculture in Uganda. Many of Uganda's two million farmers depend upon the hoe to till the soil for crop production. The tractor and tractor-drawn equipment is unavailable to most farmers. Studies indicate that further development of agriculture based on the use of tractors as the main source of agricultural power, is capital consuming and in most cases not economical.

Uganda has had a history of employment of oxen for the purpose of land preparation and crop cultivation. Farmers, particularly in the north-eastern districts of Uganda, trained and utilized oxen in crop production unlike many other African countries. Uganda is well situated for livestock development and extensive use of oxen for traction.

The economic and political crisis of the late 1970s caused a severe decline in animal production. On one hand the widespread looting during and after the liberation war reduced the number of cattle and oxen being used for power. On the other hand the breakdown of disease control programs and shortage of drug supplies resulted in serious cattle losses from diseases. The cattle population is estimated to have been reduced by as much as 20%. These losses, plus the lack of technicians who can train and handle oxen for land cultivation, has led to a marked decrease in the use of oxen for draft power.

If Uganda is to increase its agricultural production soon, the use of oxen as draft power must be developed and fostered. It is estimated that, although the average farmer has approximately 5 acres available for cultivation, only 1 - 2 acres are normally tilled. Ox-cultivation will allow him to increase his cultivated area. Research on ox-cultivation is not new in Uganda. Prior to 1985 an animal draft unit was functioning at the Serere Research Station.

An animal traction unit was established at Namulonge with the assistance of MFAD/USAID. Research and demonstration was undertaken in order to identify, assess, and qualify the various problems associated with the utilization of oxen for draft power in crop production.

The objectives of the Animal Traction unit were as follows:

- To train locally procured oxen for animal draft power.
- To assess the practicability of use of oxen as draft power on various soils and soil conditions at Namulonge. (Many agriculturists believe that oxen can only be used on the sandy loam soils of northern and eastern Uganda).
- To collect and utilize various ox-drawn equipment for land preparation and cultivation of crops.
- To demonstrate the value of livestock husbandry - i.e. disease control, feeding programs and management.
- To investigate the use of pastures and forage legumes as feed for livestock and soil building.

In July 1991 the animal traction unit was initiated through the purchase of two-cross breed heifers (Holstein and local breed) and their subsequent training for use in animal traction. Later local steers (zebu type) were purchased and added to the work stock.

Staff for the project included:

- an assistant agriculture officer with previous experience in ox-training and utilization of oxen for animal traction.
- a Ugandan farmer with previous experience in ox-training and utilization of animal traction (ox-trainer).
- 2 laborers to assist in training of oxen and field operations.

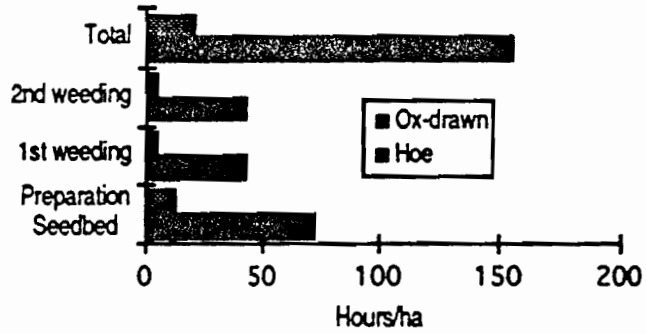
Equipment for plowing, smoothing of seed bed and row-cultivation were obtained from the local market and previous animal traction projects. Land which had not been cultivated for 15 years was selected as a site for crop production and development. The land was cleared of vegetative cover by slashing by hand. It was then plowed twice with oxen.

The cross-bred heifers were trained to work with collars developed by project staff. The animals were easily trained and could be utilized to plow after two weeks of training. As the female animals obtained more training they were utilized to pull a two wheel cart, fabricated by the project. It was found that one animal could easily pull the cart loaded with

2 - 5 barrels of water. As the project evolved, oxen were purchased from local cattle herds and trained to pull the plow, harrow and cultivator. The staff cultivated 10 acres of crops mainly maize, beans, sweet potatoes, cassava and pineapple. The unit was used as demonstration for neighboring farmers and field days. Considerable interest has been stimulated and, if capital is available, farmers in the area are purchasing animals and training then for cultivation. One farmer near Namulonge has purchased and trained oxen for cultivation and was able to discharge 20 laborers who were formerly his source of cultivation power.

Data collected on Namulonge Research Station indicated the following labor requirements for plowing land and weeding for the maize.

Labor requirements for land preparation and weeding of maize by hand labor and ox drawn implements



The total person hours per acre was 156 for the hoe and only 20 for the ox-drawn implements. The preceding crop was maize.

Several farmers in the Namulonge area have trained oxen for plowing and are now renting them to neighbors for soil preparation. The use of oxen power fits well in the small farms of Uganda. Much crop cultivation is carried out by women and children. This back-breaking, tedious method is now restricting the amount of land that can be cultivated. On many farms the land under cultivation in any growing season is usually 2 acres or less. Priority in production is given to the production of food crops. There is little opportunity to cultivate land for cash crops. This severely limits the opportunity for farm families to accumulate capital to enlarge their farm business, educate their children and obtain the inputs necessary to adopt modern agriculture technology.

A good start has been made in re-establishing animal power in Uganda agriculture. It is believed that the demonstration of animal traction throughout the country can result in a quantum leap in its adoption. A program for training farmers and the opportunity for farmers to purchase animals and equipment is needed.

Significant findings of the animal traction project - Namulonge:

- The use of oxen as a source of farm power is possible on most soils and crop conditions in Uganda
- Female animals can be utilized as draft animals. They are easier to train than steers and can be utilized for milking as well.
- The use of a collar on trained oxen can result in increased power output when compared to a yoke.
- A team of well-trained oxen can furnish power for the cultivation of 10 acres or more of row crops per season.
- Working oxen can be kept healthy with proper disease control and feeding, but must be well-fed if working hard.

- The cost of purchasing a team of oxen is generally less than a 200 liter barrel of diesel fuel.
- The use of oxen for seed bed preparation and cultivation of maize reduces labor time per acre from 156 hours to 20 hours.
- Not all oxen are suitable for training. There are genetic differences which can have a tremendous impact on how long the training will take.

9. On-Farm Trials

On-farm trials of crops have been placed on farmers fields in Uganda by extension agents of the national extension service and researchers from Namulonge Research Station for eleven growing seasons. For the first four growing seasons (1988 - 1989) the trials were research oriented. New varieties of soybean, maize and sunflower were tested against farmers varieties and farmers method of planting and management.

Data from these trials indicate that the new crop varieties and management practices are superior to the farmers existing varieties and management. The trials produced higher yields, better quality and more economical returns for labor. Project staff recognized that these research plots provided excellent evidence for the value of the new varieties, fertilizer use, early weed control and recommended plant populations.

The plots, however, were too small (25 sq. meters in size) for the farmer to appreciate the increase in yield. Furthermore, yields from the plots neither significantly increased the farmers income nor allowed for capital accumulation. Farmers in most cases did not have the finances to include the inputs in their farming systems.

The decision was then made by project staff to enlarge the size of the trials so that there would be an opportunity for farmers to view the crop production on a larger scale and allow them to accumulate capital which would allow time to acquire inputs to enhance their future farming operations.

On-farm trials have been established by extension agents and farm families in 6 districts (Luwero, Masindi, Mubende, Mityana, Mbale and Kasese) for the past seven growing seasons (1990 - 1993). Trials consisted of one-half acre maize and sunflower fields and one-fourth acre soybean fields. They were placed on farmers' fields by 43 extension agents. Trials included use of new varieties of maize, soybeans and sunflowers produced by research staff at the Namulonge Research Station.

Initially fertilizer was furnished to the farmers by the project. Phosphorus fertilizer was applied to the maize and soybean crop at the rate of 45 kgs. of P_2O_5 per acre. Nitrogen was applied to the maize and sunflower crops at the rate of 90 lbs. of nitrogen per acre. The planting and spacing of the crop was a joint undertaking by the farmer and the extension workers. Rhizobium was utilized in soybean production.

The new technology provided a quantum jump in production for the farmers. New varieties, fertilizer use, better plant population and early weed control have combined to produce yields which were often double those normally obtained by the farmer. In most cases accumulation of capital from the trial has been significant. The return for labor often exceeds 50,000 shillings. Yields of maize range from 3 to 5 tons per/ha and sunflower and soybean yields range from 1200 to 2000 kg/ha. These yields are more than double the national average. During the first crop season of 1991, 10 more agents were trained for placing trials on farmers' fields in the Mbale district.

From 1988 - 1993, 5,146 farmers have participated in the project as follows:

Year		No. of farmers	Plot Size
1988	1st season	15	research plots
1988	2nd season	20	research plots
1989	1st season	440	(small plots)
1989	2nd season	560	(small plots)
1990	1st season	228	(1/2 acre plots)
1990	2nd season	228	(1/2 acre plots)
1991	1st season	286	(1/2 acre plots)
1991	2nd season	356	(1/2 acre plots)
1992	1st season	490	(1/2 acre plots)
*1992	2nd season	1,932	(1/2 acre plots)
1993	1st season	591	(1/2 acre plots)
* Includes seed distributed to farmers by CARE project (1300 farmers)			

Ninety extension agents received training in the program. The program was coordinated by 8 extension staff. In 1991 Dr. Ngambeki was named national director of the Ministry of Agriculture program for on-farm trials. Under his guidance and leadership the program has grown and blossomed. Under his supervision a guide to the placement and management of on-farm trials for Uganda was developed.

In 1991 the distribution of fertilizer was discontinued due to logistics and increased farmer participation in the program . As a result farmers average yields declined. The program focused its attention on low input technology i.e. seed, early planting, row planting and early weed control.

Previous trials had shown that the introduction of a new variety of maize, soybean or sunflower resulted in the greatest return per shilling invested. The table below illustrates the rather high return from use of a new maize variety.

Location	Local variety	New Variety	Return UgShs. invested x 1,000
	Yield/kg/ha		
Masindi	1400	3413	32.5
Luwero	1300	3303	32.4
Masaka	800	1825	16.1
Added cost seed - 1200 shillings		Maize - 20 UgShs/kg	

Starting in 1990, seed production became a major activity of the project staff as the Namulonge research station planted, harvested, treated and distributed the seed to extension agents.

Seed distributed by years was as follows:

Year	Amount	# seasons
1990	4.5 tons	2 seasons'
1991	6.4 tons	2 seasons
1992	23.2 tons	2 seasons
1993	5.9 tons	1 season

In the second season of 1992, 13 tons of maize was distributed to farmers by CARE. The maize seed (Longe 1) was produced by staff of the Namulonge Research station.

Impact of on-farm research program in Uganda

1. During the first 3 years of Phase II of the project (1988-1990) there were 517 on farm maize trials, 523 soy bean trials and 408 sunflower trials conducted by extension agents in collaboration with farmers.

2. During the years 1991-1993 farmers managed 1400 maize, 1450 soybeans and 759 sunflower demonstration trials .

3. Yields of new crop varieties Longe 1 - Maize, Nam 1 - soybean and Sunfola-Sunflower produced yields which were 25 to 60 percent higher than local varieties.

4. Over 50 extension workers have been trained through the on-farm research program and over 3500 farmers have participated in the program.

5. The project has had a major impact on farm production in participating districts. Numerous neighboring farmers have adopted new varieties and improved production practices. Participating farmers have planted 60 percent of their land with improved crop varieties and 1.2 percent of all farmers in the 6 districts have adopted improved crop varieties.

6. Participating farmers have increased their over all farm productivity by 31 percent; their farm income by three hundred percent and their farm size by 83.3 percent.

7. Five participating farmers have won national awards in agricultural competition.

8. The Uganda Seed Project is now producing the new varieties of maize Longe 1, soybean Nam 1 and sunflower-Sunfola for sale to farmers.

Summary and conclusions

- Despite communication problems and meager incentives, the Uganda extension worker became an experienced advisor to the farmer in maize, soybean and sunflower.
- Many agents became full partners with the farmer in carrying out work on the on-farm trials.
- Balanced farmer recruitment allowed the extension worker to work with both the small farmer as well as the more affluent farmer.
- The spread effect of the on-farm trials has not been accurately measured but, based on observation, new varieties of crops, row planting and early weed control has spread rapidly in most areas. Fertilizer use has not spread.
- Farmers in general recognize the value of the new crop varieties and in many cases are growing them for seed to sell to other farmers (particularly maize and soybeans). The increase in size of plot from a small research plot to 1/2 acre of maize and sunflower and 1/4 acre of soybeans was often difficult due to labor constraints in preparing seed beds. But the results at harvest allowed the farmer to accumulate more capital and broaden their production base.
- The project provided an excellent opportunity for the research worker, the extension agent and the farmer to identify critical crop production problems.
- Trials and demonstrations proved beyond a doubt that improved varieties, proper plant population density and fertilizer use can produce economic increases in crop yields.
- Trials involved the introduction of technology which has been a part of emerging agriculture in the world for the last 4 decades.

- Crop yields for trials carried out at 15 locations in three districts during the 1st rainy season of 1988 illustrate the impact of new technology.use.

Crop	Farmer's plot	Researcher's plot
	Yield kg/ha	
Soybean	700	1024
Maize	2543	5017
Sunflower	729	1334

- Uganda farmers currently cannot adopt complete technology packages because capital is often not available to purchase inputs.
- Farmers in Uganda will be limited in production. They can expand the acreage they are now cultivating. Lack of power seriously limits soil preparation for planting and weed control . Animal traction is needed.

10. Other

A. Serere Research Station

As already mentioned in this report Serere Research Station was to have been a primary rehabilitation and research site under MFAD. The Serere area experienced continued insurgency following the 1985-86 civil war. Subsequently the sorghum, millet, root crops, oil crops, grain legume and animal traction research programs were moved to other locations in Uganda during 1987. Very little research took place at Serere until early 1992.

In January 1992 Dr. Peter Esele returned to Uganda after completing his Ph.D. at Texas A&M University under MFAD. Dr. Esele assumed program leadership at Serere for sorghum and millet and subsequently became acting director of the station. With minimal assistance from the MFAD local currency account, Dr. Esele has managed to get Serere moving again. All of the research programs have moved back to Serere except root crops and to some extent oil crops. However, experimental work on these crops has resumed at Serere.

The primary limiting factor is staff housing. When the station was abandoned, squatters took over the houses which are badly damaged. Staff have been slow to return to the station. Dr. Esele has now received commitments from USAID and IFAD to renovate 18 houses. When he returned there was only one pick up and a tractor still operating. He now has five vehicles and four tractors in operation.

The station has not had electricity since 1987. The Uganda Electricity Board is slowly repairing the line from Kumi. Over 100 poles have been delivered along the line. Water is also a problem but hand pumps at boreholes have been repaired and the main water pump generator is being repaired by MFAD. A piped water supply to the station will be restored.once the generator is repaired. Variety trial centers at Kumi, Soroti, Apac, Lira, Gulu and Kitgum have been revived. Serere will get some support from the World Bank Agricultural Research and Training Project. After 8 years of malaise, Serere Research Station is once more attending to the needs of agriculture in Northern Uganda.

B. Yams

During FY 92/93 modest local currency support was provided to yam research at Namulonge. The yam research program has focused on

(1) rapid rural appraisal of yam in the farming and food systems;
(2) rapid multiplication and production of mother seed and
(3) optimum plant population for higher tuber yield and quality of local yam.

Rapid rural appraisals indicate that yam is the most expensive food item and has high potential as a source of cash for farmers. It is second in preference to matooke as a sturdy staple. Constraints to production include

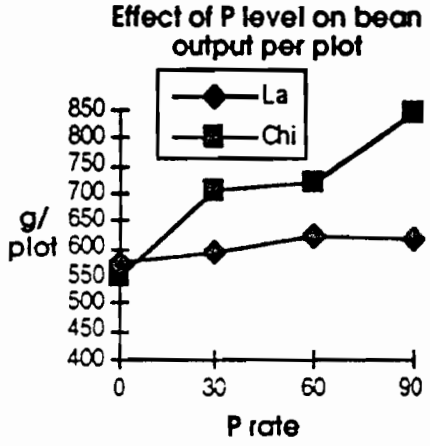
(1) poor planting materials
(2) lack of improved agronomic packages
(3) pest and diseases
(4) limited processing and utilization.

Mother seed yam was multiplied on 0.6 ha. of land at Namulonge in 1992. Optimum plant spacing for tuber yield was 1 meter by 0.75 meters (26,666 plants per hectare) giving a yield of 44 tons per hectare for the local variety.

C. Kawanda Soils Lab

The return of newly-trained soil scientists such as Mathias Magunda, Drake Mubiru, O. Semalulu and the interest of the soil survey group has increased the productivity of the Kawanda Soils Laboratory. Lab technicians are excellent and experienced. Operation of the lab has been hampered by missing components of the atomic adsorption spectrophotometer which has restricted plant and soil element analysis. Other limiting factors include erratic electrical supply and inadequate daily management. The staff recently benefited from a training course jointly sponsored by MFAD and the Tropical Soil Biology and Fertility Program/UNESCO. The course covered laboratory methods of soil and plant analysis. The staff now have a procedural manual covering the latest and most appropriate methodologies for laboratory analyses.

D. Fertility Capability Classification (FCC) System



This project was designed to investigate bean response to fertilizer as affected by the FCC soil group. FCC is an agronomic classification system developed for the tropics which facilitates the grouping of soils so that soil test results can be more precisely interpreted. The FCC group was highly significant in predicting bean response to phosphorus as shown in the graph to the left. This was a collaborative project between CIAT, the National Bean Research program at Kawanda and MFAD.

E. Soil Survey

A detailed soil survey of the Kalengyere Research Station was completed and published in late 1992. Ten distinct soil map units were identified, characterized and classified. Predominant soils on the station derive from volcanic ash and are classified as Udic Eutrandepts and Lithic Dystrandepts. Other soils include Plinthohumults, Palehumults and Ustoxic Dystropepts. Eutrandepts are much more fertile than the Humults and Dystropepts. These soils are typical of the volcanic highlands associated with the rift system in East Africa.

F. Support for Returning US Graduates

Drake N. Mubiru and Onesimus Semalulu recently returned with MSc degrees in Soil Science from the University of Kentucky. They are assigned to the soils program at Kawanda Research Institute. They are jointly conducting a research project on lime requirements for beans and maize grown at Kawanda and on farmer fields at Wapeewo village on the Gayaza road. They are also using their research project to promote increased farmer interest in routine soil testing.

B. MU/FAF: Research and Education

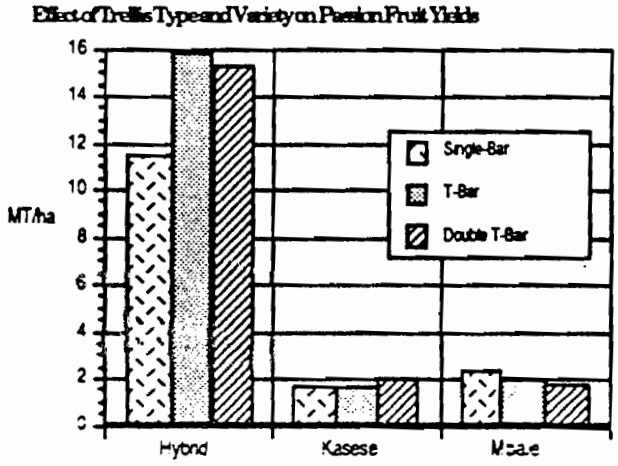
1. Crop Science

Grain legume improvement & nematode pests

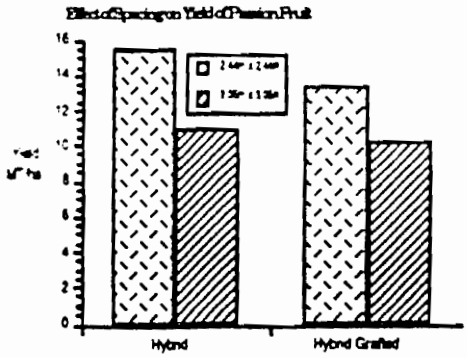
Two research bulletins were published in 1992. The first included unpublished conference papers and the Germplasm Collection Report for 1990-91. The conference papers were presented at the First Scientific Conference on Food and Agriculture, 10-15 Dec 1990 in Kampala. These papers were on the (1) current status of cowpea production, research and utilization in Uganda and (2) status of the Grain Legume Genetic Resources Unit at MUARIK. A third paper reported on legume germplasm collection in Uganda (groundnut, pigeonpea, and cowpea) done in collaboration with ICRISAT. The second research bulletin summarized progress to date on research of cowpeas and pigeon peas. Until recently work has focused on evaluation of promising lines from ICRISAT and other sources including lines from local collections. Research has now been initiated on the effects of plant population, fertilizer levels and pest control on yields of promising varieties of both of these crops.

Effect of trellises on passion fruit production

The primary objective of this project has been to determine the effect of trellis type, grafting and spacing on passion fruit yields. A postgraduate and an undergraduate student have been assigned to it. Data collected since February 1992 indicates that the T-bar configuration is superior to either single or double T-bar for the Kawanda hybrid. however, yields are so low for the local purple varieties that trellis type is of little importance.



Mean fruit yield, number of fruits and fruit size are all higher for the Kawanda Hybrid than for the local purple types. Yields are greater (30-40%) when plant population is increased by 60% to 1680 plants per hectare. Non-grafted hybrid yields were about 10-15% higher than those of the grafted hybrid.



Forage germplasm collection and evaluation

Over 90% of Ugandan livestock derive their feed from natural pastures which fluctuate seasonally in feed quality and quantity due to a scarcity of improved forage legumes that would sustain their productivity. The project was designed to resurrect pasture research to increase livestock, crop production and sustain soil fertility and the environment. It started in 1987. Since then 200 forage legumes and 30 grass species have been collected and evaluated. A field gene bank has been established. As a result 15 adaptable forage legumes have been identified as capable of being integrated into crop/livestock production systems. For example, Desmodium uncinatum was successfully oversown in a natural pasture and persisted for three years under grazing. Incorporation of this legume significantly increased maize grain yield when the field was planted to maize.

Potato germplasm evaluation in lowland areas

Since 1990 germplasm which is adapted to warmer tropics has been screened and work conducted on plant population density and yield components of genotype/tuber yield and fertilizer requirements. Several promising genotypes with high yields in 70-75 days after planting and combining this earliness attribute with relative tolerance to Bacterial wilt were identified in screening experiments conducted at Kabanyolo. These genotypes are: Piratini, CIP 800947, Sangema, CIP 800938 (AVRDC), Cruza and Caxarmarca. These are called wilt tolerant genotypes. During 1991 numerous multi-locational adaptive trials were conducted in Mityana. The following varieties showed good performance:-381379.9, 381381.20, P5, LT, CEW69 and Cruza. These were called potential genotypes.

Performance data from two series of experiments (one with six potential genotypes and a control (local white) and the other with selected wilt tolerant genotypes and a control (local red)) is now being compiled for the different localities and dates of planting. Data indicate significant yield differences among genotypes form both series of experiments. However, genotypes Piratini, CIP 800947, Sangema, 381379.9, 381381.20, P5, LT9 and CEW69 have shown consistent good performance. These varieties are now being evaluated in multi-locational adaptive on farm trials in the districts of Masaka, Iganga, Mubende,. Luwero, Mukono and Mpigi (3-5 sites/district). Makerere University had a lead role in the districts of Mubende, Luwero and Mpigi whereas the National Potato Program (Ministry of Agriculture, Animal Industries and Fisheries) has a lead role in the remaining districts. In March 1992 the appropriate spacing patterns for potato in the lowlands were evaluated. Yields ranged from 13.4 tons/ha for wide spacing (90 x 45cm) to 18.8 tons/ha for (75 x 30cm) spacing. The 75 x 30cm spacing pattern is now being adopted as optional for lowland potatoes and is being used for all on station and on-farm trials.

Collaborative Research with the National Potato Program

Potatoes are now recognized as a crop with great potential in the lowland areas of Uganda both as a cash crop and as a low cost, early maturing, nutritious, food crop. It can fit well in the cropping systems of those areas in Uganda where traditional food crops have been problematic, e.g. cassava which has suffered from African Cassava mosaic virus. On the 10th September, 1992 the Minister for Agriculture, Animal Industry and Fisheries launched a program to be known as popularization of the potato in the medium and low land altitudes

of Uganda. On this occasion which took place at Kako Secondary School in Masaka, Makerere University was invited to demonstrate the different planting techniques used for lowland potato. Makerere University will work in collaboration with the National potato program (NPP) to re-introduce and popularize the potato in the medium and lowland altitudes of Uganda. Mubende and Iganga have been identified as pilot districts for commercial potato production. Thus far, fifty five bags of potato have been distributed to growers. On farm trials of promising potato genotypes (Piratini, CIP 800947, Sangema, 391379.9, 381381.20, P5, LT9, CEW69) were conducted in the districts of Masaka, Mukono, Iganga, Mpigi, Mubende and Luwero (3-5 sites/district). On station research also continues at MUARIK and at Namulonge Research Station where the potential genotypes are being evaluated for tolerance to wilts.

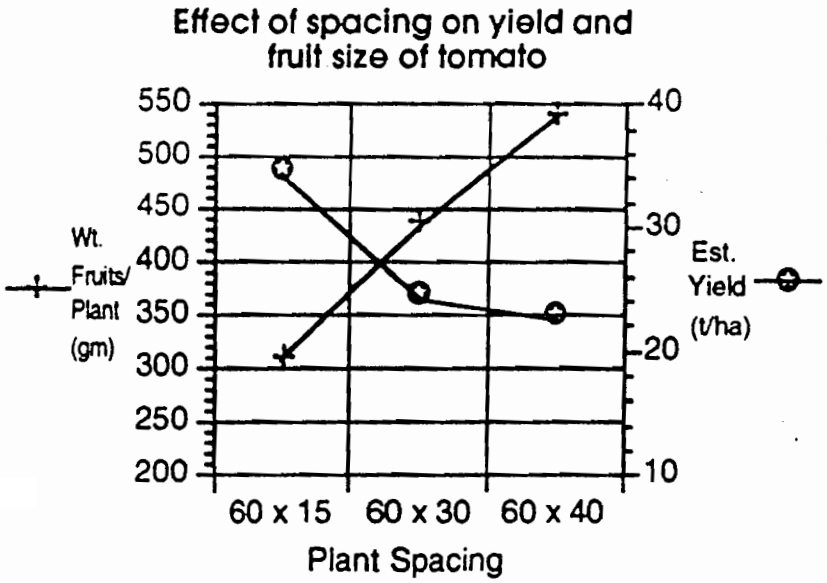
Experiment I: comparative performance of the genotypes Uganda Rutuku, Malirahinda, Victoria (381381.20), Kisoro (381379.9), 800947 CEW69, AVRDC, Sangema and a local variety (local red as a check.

Experiment II: Since one of the major problems of potato cultivation in the lowland tropics is seed degeneration, a second experiment was planted to compare the performance of new seed (from the high lands) against old seed (from previous season) in the lowlands of the potential genotypes.

Experiment III: Evaluation of potato germplasm for adoption in the lowland tropics. This experiment has all new germplasm from Kalengyere which was planted out in single rows and replicated three times.

Tomato improvement

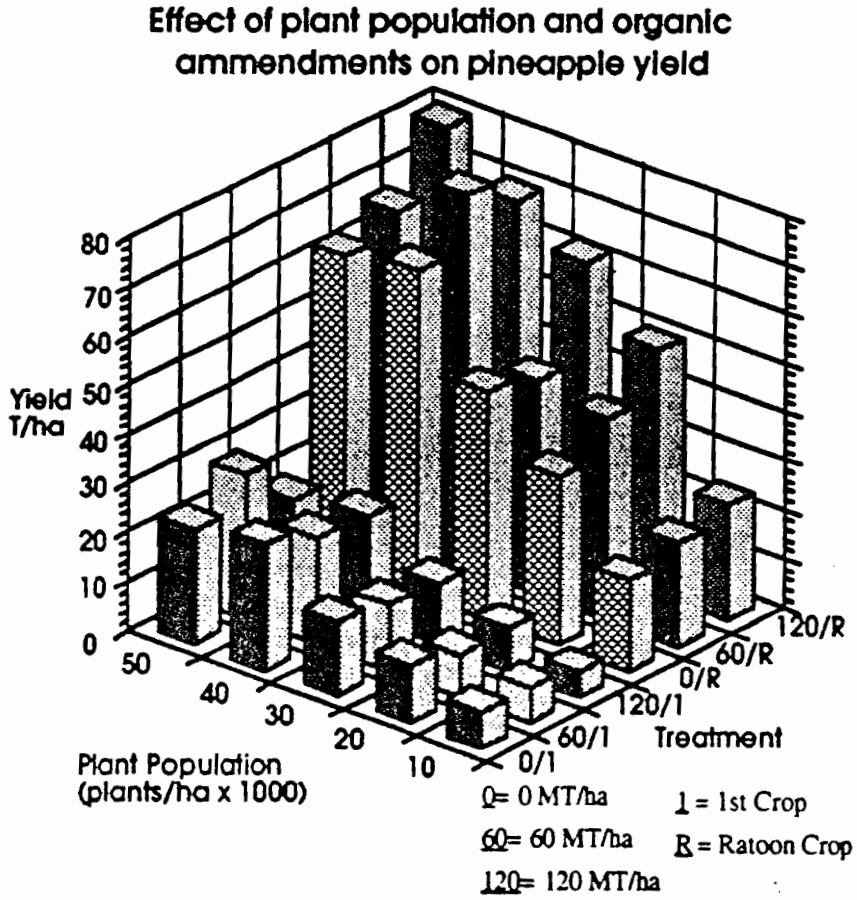
The tomato research program at MUARIK was initiated in 1987 and has been supported by MFAD for the past three years. The objective of the program is to develop high-yielding varieties which are well adapted to various ecological conditions of Uganda. Plant breeding, agronomy, pest management and economics of production and marketing have been conducted. Several promising cultivars have been identified based on variety evaluation trials at Kabanyolo, Ikulwe DFI and Mubuku(under irrigation). An experiment at Kabanyolo in 1989 shows that increased plant density has a negative effect on fruit size and number of fruits per plant; but a positive effect on yield due to a larger number of plants per unit area.



Fruit size is a major characteristic to be considered for marketing fresh market tomatoes. Therefore spatial arrangements which reduce fruit size below marketable size may not be desirable despite increased yields.

Pineapple Research

The interaction of plant population and the use of organic amendments such as coffee husks on pineapple yield and quality was researched. Use of organic amendments offsets the need for mineral fertilizers which are not readily available in Uganda.



As can be seen there is a positive interaction between plant population and addition of coffee husks up to around a plant population of 50,000 plants per hectare. Highest yields and largest response comes with the ratoon crop. Optimum levels of organic amendment was at 120t/ha but good response can be expected at lower levels especially on the ratoon crop which shows that there is a residual effect as the organic material starts to break down. This research is continuing.

Grain legumes in poultry feeds

The objective of this study was to investigate the nutritive value of velvet beans and jack beans for broilers and laying hens. Jack beans reduced growth, feed intake efficiency and increased mortality, no matter whether they were heated, soaked or fermented. Velvet beans can be used effectively as a protein source in diets for broiler and laying hens at levels up to and including 20% when heat treated and adequately supplemented with methionine.

Assessment of pathogen variability & recurrent selection programs for resistance to Maize Leaf Blight/Exserohilum Turcicum

The objectives of this project were to: (1) develop a recurrent selection program for control of maize leaf blight; (2) monitor the presence of new races of this pathogen; and (3) study physiological variability among biotypes of this pathogen from different parts of Uganda. The project was initiated in April 1992. It includes four MFAD-sponsored MSc. students from MU/FAF. Initial crosses have been made between susceptible and resistant lines. Double crosses and reciprocal crosses are now being conducted. Isolates of the leaf blight pathogen have been collected from seven locations in Uganda representing zones 1, 3 and 4. Variation in pathogenicity of the isolates is being tested on three maize cultivars.

Resistance of sweet potato to weevils and other pests

Field surveys have been conducted in most of the sweet potato production areas of Uganda. A new weevil species (Curcibionida) was found and samples sent to IIBC for identification. Data on insecticidal evaluation of sweet potato damage by the clearwing moth, the striped weevil and potato weevil from experiments at Kabanyolo and Ngetta DFI are currently being analyzed.

2. Agricultural Economics

Rate of return to agricultural research in Uganda: Maize & oilseeds

Rate of Return (ROR) analyses were conducted as one of seven case studies under the Agricultural Research Impact Assessment add-on to the Michigan State University "Food Security in Africa" cooperative agreement with USAID. Local currency resources were made available by MFAD for transportation, enumerator salaries and travel allowances. ROR were conducted for maize, soybean, sunflower, groundnut and sesame research. The primary conclusion is that the potential returns to agricultural research are excellent in Uganda despite the high costs of physical rehabilitation, training, extension and technical assistance.

Crop and Livestock Farming Systems

A multidisciplinary team from the FAF departments of Agricultural Economics, Soil Science, Crop Science, Animal Science and Agricultural Engineering and MAAIF extension has conducted research in conjunction with 20 farmers in Mpigi and Mukono districts. Objectives of this project were to: (1) identify major production constraints for crop-livestock farming systems; (2) conduct on-farm trials emphasizing integration of crops and livestock in the farming systems; (3) introduce animal traction to this part of Uganda; and (4) demonstrate profitability and sustainability of a fully integrated crop livestock farming system.

Thus far, the team has accomplished the following:

- On-farm crop trials yielded 30-60% increases in maize, soybean and sweet potato crops with low-input management including improved varieties, a combination of animal manures and 1/4 dose of are fertilizer, and animal traction for tillage and weeding.

- Three pair of oxen (one each at Luggo village in Mpigi, Mpigi DFI and Kabanyolo) were successfully trained in plowing, weeding and transportation. The animals trained include Ankole cattle which have not traditionally been used for animal traction. Four farmers near Namulonge have now had their oxen trained and over 80 farmers from Mpigi district have requested assistance in training of their oxen.

- Labor requirements for hand vs. oxen preparation of land has been discussed earlier in this report. Use of oxen reduce labor requirements by 800%. The present cost of a pair of animals, cost of training and all necessary implements is 1.42 million shillings compared to the cost of a 10 horse-power tractor and implements at 50 million shillings. Tractors are difficult to obtain in Uganda. Oxen and appropriate implements could be more readily available in Uganda.

Food Commodities: /FAPU-MFAD

Several studies on production trends, area, yields, consumption and marketing practices in relation to price trends have been conducted on staple crops such as beans, banana, soybean, maize, etc. Policy recommendation related to production incentives, marketing and export trade have evolved from these studies. These studies are summarized in a series of working papers prepared by the Agricultural Economics Department.

Significant findings from research conducted by the Food and Agricultural Policy Unit include (1) if provided proper incentives, Ugandan farmers are capable of increasing food production to ensure national food security and a surplus for the export market; (2) if marketing, transportation and storage problems are neglected, farmers may not respond to price incentives; (3) if producers and consumers have reliable and complete market information, their chances of being exploited by traders are reduced; and (4) improved government extension services are needed.

Export analysis and the Agricultural Aggregate

The Department, is currently attempting to model supply and demand relationships for Uganda traditional agricultural export commodities of Uganda. Aggregate and disaggregated commodity level approaches are being used along with econometric methodologies.

Curriculum Development and University Education

Teaching

The TA was instrumental in strengthening the Department for teaching economics and supervision for both undergraduate and postgraduate students. Subsequently the Department has been able to introduce new courses and to admit more BSc Agric. and BA Rural Economy final year students taking the Agricultural Economics option. The Department has also resuscitated the M.Sc. Agricultural Economics Program.

Teaching and Supervision for Undergraduates

Between September 1990 and March 1993, the T.A. taught an undergraduate course every term, for a total of seven course units. The T.A. has been entirely responsible for teaching the following courses :

RE 101 Microeconomic Theory

This is a required course for B.Sc. Agriculture, Forestry and Food Science first year students. It introduces students to the basic principles and theories of economics with emphasis on (i) understanding how the economy functions with particular reference to Uganda; (ii) understanding practical agricultural problems and interpretation of kinds of solutions suggested and/or based on economic principles and (iii) understanding market phenomena especially in Uganda.

RE 202 Principals of Farm Management

This is a required course for B.Sc. Agric. and B.A. Rural Economy second year students. The objectives are to (a) teach the principles and concepts of farm management (b) enable students to acquire the techniques/tools of decision making process and the capacity to solve farm planning and/or farm accounting/budgeting problems and (c) to equip students with needed skills to handle farm management problems with particular application to the Ugandan environment.

RE 306 and RE 404 Applied Farm Management

Objectives are to acquire theoretical knowledge and practical skills in (a) farm management decision making processes: and (b) farm planning procedures and budgeting techniques including the application of linear programming.

Teaching and supervision of Postgraduate students

The MFAD T.A. aided the Department in resuscitating the M.Sc. Agricultural Economics Program. The T.A. taught RE 504 Advanced Farm Management and Agri-Business. The T.A. taught postgraduate students theoretical knowledge and practical skills with emphasis on farm budgeting and planning techniques, farm business accounting, farm input and output management, farm business investment, farm product marketing and farm profit analysis, agribusiness development in Uganda, management strategies and analysis of important farm management problems and agricultural decision analysis. Two classes of M.Sc. students have been taught, 19 students in the 1991/92 and 17 students in 1992/93. Besides teaching, the T.A. supervised research projects for over 20 undergraduate

students, 15 postgraduate students and 4 Ph.D. candidates.

M.Sc. Curriculum Development

The T.A. revised the course for the masters degree in Agricultural Economics and contributed to the resuscitation of the postgraduate program after a short lull. The program has been re-organized that students have major course-work lasting one year, divided into four terms of 10 weeks each and a minor research project lasting six months.

Postgraduate students in Agricultural Economics are required to complete eight core courses and two electives. Due to shortage of qualified staff in the Department of Agricultural Economics, M.Sc. students from the Dept. of Agric. Economics are sharing lectures with the M.A. postgraduate students in the Dept. of Economics for the common core courses. The T.A. taught an Advanced Farm Management and Agri-Business course plus a series of seminar/workshops. He coordinated the postgraduate program. He also taught research methodology and advanced topics in farm management.

The marketing and policy TA taught or collaborated in the teaching of three courses at the graduate level: Advanced Micro and Macroeconomics and Structural Adjustment in Agriculture. He also taught two undergraduate courses: Introduction to Econometrics and Marketing and Price Analysis. He also supervised 9 MSc candidates and one PhD.

3. Agricultural Extension/Education

Research proposals were prepared before staff who were training in the U.S. returned with their degrees. They were funded by the MFAD project, using local currency. When staff were hired the TA worked with each of them to expand the proposal into the first three chapters of the research report. Data gathering instruments were developed, tested, and refined in close collaboration with the Ugandan researcher and the TA. Research titles, start dates, and completion dates are summarized below.

TITLE	INVESTI GATORS	START DATE	DATA COLLECTED	REPORT FINISHED
Problems Facing Women Extension Employees	M. Najjingo G. Denton	6/1/91	5/30/92	7/1/93
Follow-up of Graduates from FAF & Ag Colleges	F. Biryabaho G. Denton	8/1/91	10/1/92	7/1/93
Technology Adoption by Farmers Around MUARIK	J. Tibezinda G. Denton	11/1/91	8/1/92	7/1/93
Technology Adoption by Farmers Around KRI	G. Denton	11/1/92	5/1/93	7/30/93
Evaluation of New Four-Year Curriculum	A. Semana G. Denton	10/1/92	6/30/93	7/30/93
Student perceptions of Teaching & Learning	E. Mwanje G. Denton	10/1/92	7/15/93	7/30/93

Accomplishments:

Active research projects were undertaken by each member of staff with assistance provided by the TA. Individual skills in proposal writing, data collection instrument design and testing, data collection techniques, and report writing were improved. Each research project was original. Insights were provided for decision makers to revise the four-year FAF curriculum, strengthen outreach programs at MUARIK and KRI, and improve the working

conditions of women Extension Service employees. Details of research findings and recommendations are found in the individual research summaries and reports.

Impact:

All AEE academic staff members had the opportunity to conduct major research projects, thus improving their ability to conduct and report such research. Descriptive information was provided to decision-makers to strengthen various programs in their organizations.

Relevance of university-based research to local farming problems: The case of Makerere University Agricultural Research Institute

A case study of Makerere University Agricultural Research Institute, Kabanyolo, ascertained the nature of research done at the Institute and assess the Institute's impact on farming practices in surrounding areas. Most research programs were found to cover commodities and problems relevant to the Institute's surroundings and the country at large. However, only a few of the research programs yielded technologies that could be applied by farmers. Moreover, the few farmer-usable technologies available at the Institute were not widely adopted among the farmers studied. Most of the potential adopters were not aware that such technologies existed at the Institute. The Institute could increase the utility of its research to Ugandan farmers by conducting more adaptive research, strengthening its links with the agricultural research institutions outside the University, and establishing a formal program for reaching out to farmers and extension workers.

Two factors appeared to explain why only a few farmer-usable technologies had been generated at the Institute. First, some research programs had stopped before completion, because either the research scientists involved had left the Institute or the research funds had been depleted. Second, some research programs were basic in nature and therefore not expected to produce farmer-usable technologies in the short run.

All MUARIK employees interviewed reported having been exposed to various improved farming practices and technologies as a direct result of working at MUARIK. However, because of a shortage of land and capital, most of the employees had not used these practices on their own holdings. On the other hand, most of the respondents who did not work for MUARIK were not aware of the improved technologies available at MUARIK. Fifty percent had never been at MUARIK, 35% knew MUARIK as passers-by, 10% had toured MUARIK and 5% had worked for MUARIK in the past.

The survey respondents who identified MUARIK as a source of improved farming practices had obtained from MUARIK and used one or more of the following technologies: varieties of passion fruit, tomato and maize, piglets of Landrace and White Large pigs, and artificial insemination services. Farmers who used MUARIK technologies tended to belong to one or more of the following categories: (a) had toured MUARIK (b) worked or had worked at MUARIK, and (c) knew one or more of MUARIK employees.

Occupational status of agriculture graduates from Makerere University (1986-91)

The purpose of this study was to determine the effectiveness of the B.Sc. in Agriculture training programs offered by FAF, Makerere University as perceived by former students and their employers. Specific objectives of the study were:

1. To identify places of employment of graduates.
2. To describe and compare the perceptions of graduates and employers regarding:

(i) common skills and knowledge required for success at work;
(ii) level of competency for those skills and knowledge provided in the curriculum;
(iii) quality of instruction provided by institution: and
(iv) areas in which graduates need more training.

3. To provide recommendations to the institutions to improve curricula.

A purposeful sample of FAF graduates working in 26 districts in Central, Western and Eastern Uganda was carried out. Preliminary analysis of the responses provided by 88 graduates and 19 supervisors/employers showed that most graduates felt adequately trained in the general areas of animal and plant science. They felt somewhat inadequate in the specific areas of agricultural processing, agricultural economics, extension, crop protection, soil science, and agronomy.

When asked about the quality of instruction, using a scale from 1 (poor) to 4 (excellent), graduates rated theoretical instruction at 3.13 and practical instruction at 2.33. Sixty-three percent of the respondents indicated a need for additional training in extension, 43% in agronomy, 41% in crop protection, 35% in agricultural economics, and 25% in soil science. Percentage of respondents who felt that more practical training should be given in specific areas are:

32% - agronomy

27% - crop protection

20% - soil science

16% - extension

When asked what other areas should be included in the curriculum, 26% of the respondents mentioned computer training and 9%, research methodology.

Regarding the future direction FAF should take: 36% favored a primarily generalist curriculum with some specialist options; 23% were for a balanced generalist and specialist curriculum with some generalist requirements. Sixty-seven percent of the graduates felt that FAF should expand in-service training, 55% felt research should be improved, and 53% desired more up-to-date technical materials. Almost 90% of the graduates wanted more emphasis on practicals, 76% wanted stronger program in continuing education. Almost 40% of the graduates wanted improved extension linkages and more employment opportunities.

Research/Extension/FAF Linkage Programs

The TA was actively strengthened the linkages between MAAIF and MU/FAF. One way this was done was to work closely with the Commissioner for Agriculture and the Secretary for Research to strengthen in-service training programs for their subordinates. By cooperating with other funding agencies (CIMMYT, CIAT, FAO, etc.), AEE was included in over 50 of the staff development programs provided by the research and extension arms of MAAIF from 1989 to 1992. Subjects covered included program development, implementation, and evaluation; leadership/ management/ communication training; adult education principles; information processing; and proposal/report writing. Other activities included curriculum development, improved teaching methods/techniques/devices, teaching and learning principles; and research methodologies.

A series of fact-sheets and an MAAIF newsletter were published by the TA for MAAIF. Fact-sheets were developed by working with MAAIF researchers and editing the materials received for extension publications. Assistance was also provided to many MAAIF researchers and extension personnel to develop questionnaires and research reports. he assisted Farming Systems Support Program by providing specifications for the purchase of audio/visual and computer equipment. After this equipment was purchased, the TA assisted in setting up the desk-top publishing unit and maintaining and operating specific hardware and software components.

Working closely with the principal and head of the Extension Dept. of Bukalasa Agricultural College a guest lecturer program was started. MFAD supplied local currency and the TA started the program by providing leadership/ management training to the staff and students of the college. A schedule was then drawn-up, based upon student and staff needs, to provide transportation for guest lecturers both from governmental and non-governmental organizations. The TA provided on-going support to Bukalasa in several technical areas.

Accomplishments:

By the end of 1991, all national, regional, district, and county employees of the Ugandan Extension Service had an opportunity to attend a three to five day workshop on the proposed new organizational structure for the Ugandan Extension Service. FAO provided funding for the series of workshops. The TA and other staff in the AEE Dept. provided a multi-session training program that included program development and evaluation, leadership principles, and adult learning principles. Many other in-service programs were provided by the TA as outlined in the MFAD Quarterly Reports.

The TA assisted in the preparation of the many research reports, the first MAAIF Newsletter in 15 years and Extension fact-sheets in the following areas:

- Potato Production
- Bean Production
- Sunflower Production
- Cotton Production
- Cassava Utilization
- Ground-Nut Production
- Sweet Potato Production

Impact:

Only Extension staff with 20 or more years of experience had been adequately trained in management, program development, evaluation, and extension methods/techniques/ devices. Many had not had an opportunity to discuss extension techniques for many years. The in-service courses allowed them to discuss these principles within the context of the Ugandan situation, which improved their skills to meet organizational objectives. More recent employees were introduced to the principles of program development, communication, adult education, etc. This directly impacted on their ability to design and implement extension programs and teach adults.

Extension agents were given educational materials, which provided them technical information to disseminate to farmers and others providing farm services. Very little updated technical and process information was available in the Extension Service for the last 10 to 15 years.

Curriculum Development and University Education

Curriculum Development

A major emphasis of the TA was developing a detailed teaching curriculum. Fifteen new courses were developed for the undergraduate curriculum. In the past, only two extension/education courses were taught in the Agricultural Economics Department. They were very broad courses and only providing limited extension/education instruction to students. To develop the teaching curriculum a developmental process was established. First, course descriptions and objectives were written for each course. The objectives included both theoretical and practical concepts and activities. Before courses were taught the first time, course syllabi and draft unit and lesson plans were developed. The syllabus and objectives provided a guide for unit and lesson plan development. Major refinements of the draft lesson plans and teaching aids were made during the first two quarters the courses were taught. A final draft of the teaching curriculum was prepared after the second revision.

Detailed curriculum materials were needed because most of the staff were young in their academic career and had not taught before. Under the circumstances at the University, it was felt that all of the AEE staff should be able to teach any of the department's undergraduate courses. This allowed greater flexibility in course assignments, with regard to the staff development plan.

Accomplishments:

Course descriptions, objectives, and syllabi were developed for all of the courses. The second year courses had been taught twice and final teaching curriculum materials were developed for them. Third year courses had been taught once and draft materials were developed for them. MFAD technical assistance to the department stopped in October, 1992 before any of the fourth year courses were taught. Curriculum development would have been severely handicapped if it were not for the technical assistance provided to the department under the World Bank Agricultural Research and Training Project. Two out of the four department academic staff were in the U.S. and the two remaining had not taught any of the proposed fourth year courses before.

The table below provides a summary of the status of the development of the undergraduate teaching curriculum. EE 408 (Sociology/Psychology of Education) was not taught during the 1992-93 academic year because it was a course designed to train secondary school agricultural teachers. This option was not developed due to the lack of academic staff and a clear mandate to train secondary school agricultural teachers. Some discussion had taken place with the School of Education about a joint program to train agricultural teachers. They provide a one-year diploma in education to FAF graduates to prepare them for formal teaching in secondary schools.

Summary of undergraduate course development

Course Number	Course Title	Learning Objectives	Practical Objectives	Lesson Plans prepared	Teaching Aids prepared	No. Times Taught
EE 201	Introductory Ag Extension	YES	YES	YES	YES	2
EE 202	Rural Sociology	YES	YES	YES	YES	2
EE 301	Program Planning & Eval I	YES	YES	YES	YES	1
EE 302	Extension Methods I	YES	YES	YES	YES	1
EE 303	Visual Aids I	YES	YES	YES	YES	1
EE 304	Research Methods	YES	YES	YES	YES	1
EE 401	Program Planning & Eval II	YES	YES	YES	YES	0
EE 402	Agricultural Communication	YES	YES	YES	YES	0
EE 403	Agricultural Administration	YES	YES	YES	YES	0
EE 404	Curriculum Dev & Train Meth	YES	YES	YES	YES	0
EE 405	Extension Methods II	YES	YES	YES	YES	0
EE 406	Visual Aids II	YES	YES	YES	YES	0
EE 407	Adult Education	YES	YES	YES	YES	0
EE 408	Sociology/Psychology of Edu	YES	NO	NO	NO	0
EE 409	Social Research Methods	YES	YES	YES	YES	0

Impact:

All of the academic staff are able to teach any of the undergraduate courses. Assistant lecturers feel confident that they can master the concepts that they are asked to present to undergraduate students. A variety of teaching techniques and devices are used to present the lessons. This is very different from most of the courses taught at the FAF, which mainly use the lecture technique and the chalkboard.

Teaching Undergraduate Courses

The TA was actively involved in teaching undergraduate courses during his tenure with the project. He taught most of the second and third year courses first and then assisted Ugandan staff the second time they were taught.

Accomplishments:

Ugandan staff were trained to teach all of the second and third year AEE courses. Also, teaching materials and suggested teaching practices were prepared for all of second and third year courses and most of the fourth year courses.

Impact:

Adequate teaching materials were developed and staff trained to the necessary instruction and improvement of the second and third year courses. FAF students were better prepared to assume job roles that require technology dissemination and program development, implementation, and evaluation.

Practical Training

Practical training was incorporated into each of the undergraduate courses in the department. Students were required to practice many of the skills taught in those courses. For example, in the program planning courses, students were required to develop program

plans. Those plans included situation statements, program objectives (both long and short term), activities required to accomplish the objectives, resources required, and an evaluation plan. Another example of the practical training students receive during course instruction was provided in the Research Methods course. Research proposal preparation was discussed during course instruction and then each student was required to prepare a proposal for their special project. Each student's proposal was graded and suggestions provided for improvement before they collected data for their special projects.

Second-year practicals, at the Kabanyolo farm, were designed so that every second-year student gained skills in use of the method demonstration technique. AEE staff provided an overview of different extension methods and techniques and then demonstrated the method demonstration technique in detail. Students, working in small groups of four, or less, were required to present a method demonstration to their peers. Students not only gained experience presenting demonstrations, but also in designing and collecting the resources necessary for the presentation.

Accomplishments:

Students gain practical experiences in every AEE course they attend. Instructors were assisted in designing those experiences and preparing teaching aids to simulate actual situations. Second-year practicals were improved so that students are required to develop skills to implement actions, along with their cognitive abilities.

Impact:

The most common criticism of graduates of the FAF is that they can only talk about what to do. Many students were unable to implement change because of their lack of practical training. The emphasis on practical training improved students' ability to do, rather than just to know.

Advise Graduate Students

Two PhD and one MSc students were advised. The department did not have a post-graduate program, but graduate courses were taken from other options and departments and research was done in the area of technology generation and transfer.

In addition to graduate student advising, at least two and as many as five undergraduate students per year were assisted with their special projects. With the development of the AEE Research Methods course undergraduate students were better trained to conduct research. This is especially important because many of the BSc. graduates became agricultural research officers with the MAAIF and other ministries.

Accomplishments:

The MSc advisee completed his degree in early 1993. The PhD candidates have proposals accepted and one has begun his data collection. The TA was accepted as their advisor, because of the ARTP funding, which should allow him to be in Uganda until their degrees are completed.

Impact:

Ugandan students were able to enroll in a post-graduate degree program in Extension/Education at Makerere. In the past, this degree required enrollment in a foreign university.

4. Agricultural Engineering

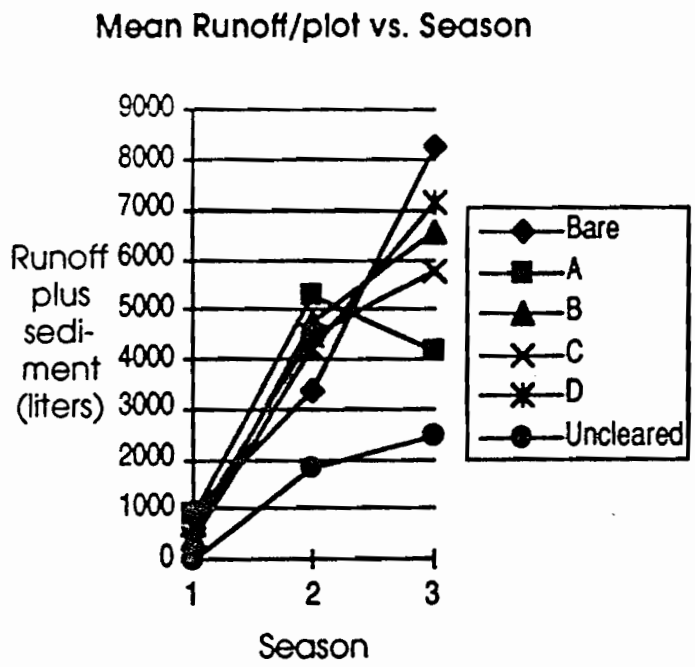
Soil Erosion

This project was undertaken in the 1989-1990 academic year. Its objectives changed considerably over the past four years. Initially, the project was designed to install runoff plots and measuring equipment which could be used in graduate level work, especially for Moses Tenywa and other graduate students, in the area of soil erosion. In addition, the plots were to be used as demonstration plots showing various types of equipment to undergraduate students. Under these objectives, runoff flumes, Coshocton measuring wheels and a site characterization were installed during the 1989-1990 academic year. During this time, however, a larger project with funding from IBSRAM (International Board for Soil Research and Management) came into effect which essentially took over the site and established its own objectives. The plots under this funding were established in September 1992. With this new project, the objectives of MFAD research were changed to (1) work with the IBSRAM project to monitor the water and sediment runoff from the plots, (2) working with graduate students on alternative sites in related work. The results for the first three seasons from the IBSRAM plots were presented at an IBSRAM conference in Kampala in May 1993.

The experiment involved six treatments as follows.

Name	Treatment	Replications
Bare	Fallow, which is tilled seasonally and left bare	2
A	Hoe tilled, but opened by slash and burn.	3
B	Hoe tilled, but opened by slash and burn and tractor	3
C	Hoe tilled, but opened by slashing only	3
D	Tractor tilled, but opened using bulldozer	3
Uncleared	Uncleared	1

Rainfall was measured by a rain gauge installed on the experimental site. General observations indicate that a total rainfall of approximately 15 mm is needed before any runoff would occur. Because of this, it often occurred that although rain fell it resulted in no runoff and sediment losses. Nine days of runoff were recorded during the first season while, 16 and 13 days of runoff were recorded during the second and third seasons respectively. The graph shows the variation in runoff over the three seasons from second season, 1991 through the second season, 1992. In each case the uncleared treatment was considerably lower than the 5 other treatments.



Development of climate and soil erosion parameters for the WEPP Model

The WEPP (Water Erosion Prediction Equation) is a highly advanced soil erosion computer model being developed by the USDA. This model is more theoretically based than any previous models. However, because of its newness, it needs more validation to enhance its usefulness. This research would put Makerere University near the forefront of developing the model parameters for tropical soils. When validated the model would assist greatly in assessing the soil erosion potential and long range sustainability of Ugandan soils. Objectives of this research are to: 1) study the variation of Ugandan rainfall intensities and patterns to assess their characteristics for the WEPP soil erosion prediction equation; 2) construct and/or compile the equipment necessary for a field test of soil erodibility characteristics for the WEPP model; and 3) test at least one soil type on the Kabanyolo farm.

The construction of the rainfall simulator was finalized in mid-January, 1993 and two soil types have been tested using the apparatus. One of the soil types is from Kabanyolo Research Institute while the second soil type is from the Buginyanya Coffee District Farm Institute. Analysis of the runoff data from the soil types has shown excellent agreement with the equations given in the WEPP model for the soil type at Buginyanya and differences for the soil type at Kabanyolo. Analysis of at least three more soil types was incorporated as part of Mr. Osindi's Master's Program. The results of this work were reported in detail in Mr. Osindi's thesis.

Student projects: surf, irrigation, drainage, etc.

During the 1990 academic year studies focused more on field work than laboratory studies.

- Kenneth Kintu studied the perception of farmers on the impact of soil erosion on their fields in Mpigi district.
- Byandala Godfrey studied the efficiency of a drainage canal at the Kibimba Rice Scheme.
- Wegulo Mephy studied the watering efficiency and drainage problems of a rice field at Kibimba Rice Scheme.
- Vuzzi Azza Vincent studied mechanical methods of controlling water hyacinth that clog irrigation inlets at the Kibimba Rice Scheme.
- Andrew Keith Mutengu studied the abandoned surface irrigation system in the western valley of MUARIK with a focus on renovating of the canal system for future rice studies.

During the 1991 academic year T. Nam analyzed a hydraulic ram pump. A report detailing the theory and potential of the pump was made. His results indicated that hydraulic ram pumps could be built from locally available materials to provide a good source of low cost water for rural areas of Uganda. His theory showed excellent agreement with his tested unit and could be used by local industry to design site specific pumps for various locations in Uganda.

During the 1992 academic year, Arthur Ntnengwe analyzed a bio mass burner. The bio mass burner burns common refuse material, such as maize cobs, to produce a clean, hot gas which can be used for various activities such as cooking and crop drying. His work focused on reducing the amount of energy input into the unit through the elimination of an external fan. His data compared well with the to the developed theory and should be readily publishable in a refereed journal. His work has also served as the initial study for the work of George Batte who is continuing this work at the Master's degree level.

During the 1993 academic year, studies have focused on the design, construction and testing of a low cost, fan driven solar collector suitable for crop drying by John M. Mageni and the design, construction and testing of a packaging materials testing device for the laboratory practicals of the Food Science Department by John K. Okwany. Both units are operative and are of potential use in Uganda.

Graduate Students

From September, 1990 to December, 1992, Bob Nakileza studied the soil loss levels from runoff plots in the Mount Elgon area near Mbale. His work involved the first set of soil erosion plots to be installed in Uganda, and provided the first measurements of actual soil loss due to erosion in Uganda. Needless to say his work has been of great interest to those interested in soil conservation work throughout Uganda. His results are presented in his Master's thesis which was submitted in December of 1992.

From July, 1991 to present, Peter Osindi has pursued his studies on the validation of the WEPP (Water Erosion Prediction Program) model for Uganda. This is a model of great potential to the prediction of soil erosion levels in Uganda and the design of appropriate soil conservation techniques. His work involved the construction of a rainfall simulator for studies in interrill erosion. This simulator is the first of its kind in Uganda and represents a significant contribution to the area of soil erosion research in Uganda. The simulator was also used by Moses Tenywa on his PhD studies while during January 1993. Mr. Osindi's work is not yet completed, but will receive additional funding from the Rockefeller Foundation until its completion around December, 1993. The results of his work will be presented in his Master's Thesis.

From July, 1991 to present, George Batte has pursued his Master's Degree studies on the development of a computer model to aid in the design and performance evaluation of a bio mass burner. Studies on the use of bio mass burners was started by Arthur Ntengwe in 1991. Bio mass burners show great promise in providing a high temperature, clean heat source for agricultural drying and processing in Uganda. To date, however, Mr. Batte has not shown the necessary initiative to see this study to its completion. He plans to continue his studies under the supervision of Dr. Rugumayo, as a part time student.

Since September, 1991, Joy Tukahirwa has pursued her PhD Degree studies on the validation of the WEPP model for steep sloped soils in Kabale, Uganda. This work is funded by the Rockefeller Foundation and my work has primarily been as a secondary supervisor. This program is currently near its half way point in duration with expected

completion in late 1994. Runoff plots have been installed on three slopes for monitoring. These plots represent a significant undertaking in Uganda for estimating the soil erosion levels in the Kabale District.

Evaluation of irrigated swampy soils of Uganda

Analysis of swamp soils at Kabanyolo and southern Uganda revealed that (1) they have low buffer capacity in surface and near surface horizons; (2) soil pH and exchangeable acidity is high and increases with cropping and drainage of the swamp. Research is continuing on evaluating rice production on these soils and monitoring soil chemical properties as a function of water management. Many of the swamp soils of Uganda are high in elemental sulfur. With oxidation induced by drainage this sulfur can form sulfuric acid at levels 100% toxic to all plant life. Proper water management is the key to agricultural utilization of soils in this landscape position.

Natural Convection Biomass Burner for Uganda

This study involves the development of a burner capable of producing high temperature air flows by burning typical agricultural refuse. Applications will be in the areas of crop drying, coffee roasting, brick kiln heating, and possibly home cooking. The design should be suitable for local manufacturing techniques and will fit well into the developing agribusiness sector of Uganda.

Objectives are to: (1) design an updraft gasifier based on natural convection principles as the driving force for the airflow in the unit.; (2) develop a computer model of the unit to model the heat and air flow characteristics of the unit.; (3) construct a bio-mass gasifier unit based on the design in objective 1.; and (4) collect heat and air flow data from the unit and compare them to the predicted flows from the computer model.

Initially the design and computer model will be developed at Makerere University. A prototype will then be built and tested at Kabanyolo.

During 1991-92, an initial prototype was designed, constructed and tested for natural convection airflow characteristics. This was done as a student project with Arthur Ntengwe. The results compared favorably with the theory developed. A full report of Mr. Ntengwe's findings are found in his senior design report submitted as part of his BSc. degree in Mechanical Engineering.

Demonstration of animal traction technology

This project seeks to develop (1) both the use and market for animal drawn equipment among local farmers and (2) the manufacturing capabilities of local manufacturers so as to increase the local production of animal drawn equipment.

Objectives are to : (1) develop promotional materials and workshops based on the previous animal drawn equipment research done at Makerere University.; (2) present these materials to at least 3 workshops of extension agents and farmers.; (3) construct 10 units each of the animal drawn seeders and Kabanyolo One Plow frame for use by extension agents.; (4) develop the manufacturing processes for the units mentioned in objective 3; and (5) provide a workshop with local manufacturers in order to promote the manufacturing process, and production of animal units.

Several animal drawn units previously designed and built at Kabanyolo during the 1970's were reconstructed and validated. These units were introduced to farmers in conjunction with the on-farm animal traction group of Kasisira, Ngambeki, and Simkins. Workshops for manufacturers were postponed to a later date.

Manufacture of rotary injection planters in Uganda

The rotary planter will allow the small scale farmer to seed his/her field at the rate of at least one hectare per day. The production of the units by local manufacturers will increase the quality of the local agribusiness sector of Uganda.

The rotary planter was designed by the International Institute for Tropical Agriculture (IITA). Plans were sent for, and the units built according to their specifications.

Objectives are to:(1) build and test prototypes of the rotary injection planter developed at IITA in Ugandan soils and with Ugandan seeds; (2) develop an extension program in conjunction with the Ministry of Agriculture to promote the use of the rotary injection planter throughout Uganda; (3) construct 15 units for demonstration use by extension agents at county fairs and meetings; (4) develop a publication describing, in a step by step manner, the construction process of a planter unit; and (5) develop a manufacturing short course for local manufacturers, through which manufacturers will learn how to build a rotary planter.

Objective four concerning the construction was completed with the final editing remaining before publication. Objective five concerning the short courses was abandoned.

Meteorological data tabulation

This project was undertaken in the 1991-1992 academic year. The objectives of the project were (1) to tabulate 30 years of meteorological data from Kabanyolo on computer, (2) to publish the data for the faculty library, and (3) to analyze the data for trends. Data were taken from the meteorological station at MUARIK. A computer was purchased and a safe room installed at the faculty on the main campus. The data has been logged and distributed to a number of visitors and faculty members in electronic form. Print out of the data and some elementary trends have been completed and final publication of the data (approximately 250 pages) is being finalized. A number of researchers have already requested and received electronic copies of the data.

Small scale irrigation on acid soils

This project was undertaken during the 1991-1992 academic year. The objective of this project was to monitor of the soil pH with the raising and lowering of water tables. Field observations indicate that if the water table can be controlled, swampy lands may be managed for long term usage. The project was initially begun with the expectation that the project would be taken over by Drs. Aniku and Uma. During the first year of the project Dr. Uma unfortunately died of a stroke. However, the work has been taken up by Dr. Aniku during its second year and continues strongly under his leadership. The project will continue into the future under Dr. Aniku's leadership. The initial findings of the project were presented by Dr. Aniku to the Soil Science Society of East Africa in November of 1991. These results involved the decline of soil pH with time after drainage of the swamp. His paper drew much interest from the Ministry of Environment. Work has continued this past season with the planting of rice and the monitoring of the soil pH and nutrients.

Curriculum Development and University Education

Teaching:

The teaching responsibilities of the Agricultural Engineering Department fall into four categories.

- Service courses taught to the Agricultural and Forestry students as part of the departments collaborative role within the Faculty of Agriculture and Forestry.
- Courses taught within the agricultural engineering undergraduate program.
- Courses taught in the Faculty of Technology as part of the department's collaborative relationship with the Faculty of Technology.
- Courses taught to the agricultural engineering graduate students.

The courses, their length of term and number of students taught are indicated in the table below. The MFAD TA for this department was given a consistent teaching load of one service course (Field Engineering) which was repeated each year. Additional courses were added with the development of a new undergraduate level Agricultural Engineering Program. This program began in 1990 with the students being taught in the Faculty of Technology during their first two years and then coming to the Department of Agricultural Engineering for their last two years. These students were first taught in 1993. The TA taught them for the entire year. Additional courses for the new graduate level Agricultural Engineering Program began in 1992. Aid in teaching a crop drying course and part of a packaging materials course was also given to the Food Science Department.

The number of students taught during the TAs tour was as follows: (1) General Agriculture and Forestry Students - 587, (2) Agricultural Engineering Undergraduate Students - 15, (3) Faculty of Technology Undergraduate Students (collaborative courses) - 113 and (4) Agricultural Engineering Graduate Students - 3; for a total of 718 students over four academic years.

Courses Taught during the four academic years 1989-93:

		Number of Students per year				
Course Title	No. Units/Term	89	90	91	92	93
Service Courses:						
Field Engineering	1 unit/1 term	109	115	137	114	112
Calculus	1 unit/1 term	115				
Surveying	1 unit/1 term					112
Crop Drying	0.5 unit/0.5 term					22
Packaging Materials(2 wks of a 5 wk course)	0.5 unit/0.5 term				15	22
Agricultural Engineering Undergraduate Program:						
Soil and Water Engineering	3 unit/3 term					15
Collaboration Courses with Faculty of Technology:						
Fluid Mechanics (Third Year)	3 unit/3 term			15	15	
Fluid Mechanics(first Year)	3 unit/3 term					83
Agricultural Engineering Graduate Program:						
Instrumentation and Similitude	one 16 week semester	3 students				
Soil Erosion and Sedimentology	one 16 week semester	2 students				
Advanced Hydrology	one 16 week semester	1 student				

Advising Students:

Supervisory activities during the past four academic years have been in two general categories: (1) undergraduate students and (2) graduate students. Supervision of undergraduates has revolved around the senior level design project that all students must complete during their fourth year. These projects involved a literature search, an experimental design, construction and testing of the experimental apparatus and write up of the results. The projects themselves were each done over a one year period with submission of a written report covering the literature, their activities and results. The following table lists all students supervised and their level of study.

Number of Students Advised during academic years 1989-93:

Student Name	Level	Year Supervised
Kenneth Kintu	Undergraduate	1990
Byandala Godfrey	Undergraduate	1990
Wegulo Mephy	Undergraduate	1990
Vuzzi Azza Vincent	Undergraduate	1990
Andrew Keith Mutengu	Undergraduate	1990
T. Nam	Undergraduate	1991
Bob Nakileza	Graduate (MSc)	1991
Arthur Ntnengwe	Undergraduate	1992
Bob Nakileza	Graduate (MSc)	1992
Peter Osindi	Graduate (MSc)	1992
George Batte	Graduate (MSc)	1992
Tukahirwa Joy	Graduate (PhD)	1992
Mageni John M.	Undergraduate	1993
Okwany John K.	Undergraduate	1993
Bob Nakileza	Graduate (MSc)	1993
Peter Osindi	Graduate (MSc)	1993
George Batte	Graduate (MSc)	1993
Tukahirwa Joy	Graduate (PhD)	1993

Curriculum Development:

During the period 1989-92, two new programs were developed within the Agricultural Engineering Department at Makerere University. Both programs are unique to Makerere and Uganda in that they are engineering based, i.e. firmly rooted in the engineering courses taught in the Faculty of Technology, rather than based on a general agriculture background. The first program is the undergraduate program, while the second program is a modification of the existing graduate program to reflect a higher level engineering background. Both of these programs are discussed in detail in the TAs terminal report.

The new undergraduate program in Agricultural Engineering is the first of its kind in Uganda, and received special acknowledgment by President Y. Museveni during his commencement exercise speech of 1990. The program itself is unique to the Faculty of Agriculture and Forestry in that it involves collaboration of teaching efforts in both the Faculty of Agriculture and Forestry and the Faculty of Technology. Each year 15 students are admitted to the four year program. During their first and second years the students take engineering courses in the Faculty of Technology with the other divisions of engineering such as Mechanical and Civil Engineering, and then during their third and fourth years the students move primarily to the Faculty of Agriculture and Forestry for specialized courses in Agricultural Engineering.

The graduate program in Agricultural Engineering is not a new program in the University catalogue. The program however had been dormant with no students for at least 15 years.

In revitalizing the program, an engineering background was emphasized so that in time the program would meld well with the new undergraduate program.

5. Soil Science

The direct use of locally available Tororo rock phosphate in Uganda

Although there are extensive deposits of rock phosphate in Uganda (over 230 million tons), phosphorus is one of the most limiting nutrients in Ugandan Soils. The factory which produced single super phosphate at Tororo broke down several years ago. A study by Bearden-Potter corporation valued the cost of a new plant to be over one hundred million US dollars. It is possible, therefore, that of the many soils and materials in Uganda, some can interact with rock phosphate to make it available to plants.

Objectives were to:(1) determine soil conditions under which phosphorus rock can be used directly under agronomically and economically acceptable conditions and, (2) investigate local materials which can make phosphorus available from Tororo phosphate rock.

The incubation studies clearly indicated that phosphate rock can be solubilized by combining it with organic matter. Sulfur also solubilized some phosphate rock but it was not as effective as organic matter. It was further found that agricultural lime did not lead to the availability of phosphorus from the rock. Field studies did not clearly confirm the above results since SSP had been used in Kabanyolo for several years.

Phosphate rock can be used directly in acid and swampy soils with ample soil moisture. Accordingly, further work on using phosphate rock was started at Kibimba rice company and at Lugazi Sugar Company. The relatively soft Busumbu phosphate rock is also being tried at Buginyanya where the soil has very little available P. Phosphate rock has also been included in banana and coffee research to determine its effects on biological nitrogen fixation

Biological Nitrogen Fixation[BNF]

Makerere University is operating a National Rhizobium Inoculant Production Facility that was set up by USAID using MFAD Project funds. The facility has been producing inoculants for grain, forage, tree and green manure legumes since June, 1990. Farmers and researchers have continually and increasingly purchased the inoculants for farm production. Research results on evaluation of responses of commonly grown legumes to Rhizobium inoculation are as follows:

- Yields of both climbing and erect (K20) bean varieties were not increased significantly by Rhizobium inoculation at both sites. Yield increments obtained due to inoculation, however, were economically viable for a farmer. At both sites the climbing beans when inoculated gave a yield increase ranging between 135 and 480 kg/ha which pays off all inoculation costs. The cost of inoculating a hectare of beans is Ushs.4800 (4 packets of inoculant).

- Soybean yield was significantly ($p \leq 0.05$) increased from 1670 to 2340 Kg/ha by inoculation with Rhizobium . Groundnuts grain yield increases (from 833 to 1246 Kg/ha) due to inoculation were not significant. However, this improvement on the crops performance by use of Rhizobium inoculants is economically viable.

- Nodulation of siratro and centrosema was not increased by inoculation. This could be due to high numbers of infective native rhizobia in the soil. Alfalfa nodulated only in inoculated plots which indicates lack of microsymbiant for the crop in Uganda's soils.

- Dry matter yield of leuceana, siratro and centrosema was not significantly affected by the use of inoculant. Yields of inoculated plants, however, were higher than those of uninoculated ones and almost equal to those of plants that received nitrogen at 80KgN/ha. This indicates less efficient symbiosis of native rhizobia and these legumes. Alfalfa yield was significantly ($p \leq 0.05$) increased by use of Rhizobium inoculants.

Management of Vertisols for Maize, Sunflower and Soybean Production

Soil profiles have been described and sampled from vertisols in the West Nile and northern Uganda. Chemical and physical analyses are to be conducted at MU/FAF. Mineralogy and micromorphological analyses will be conducted at OSU.

Fertility decline of recently cleared red soils under traditional production systems

Soil profiles have been sampled and described from several farmer fields in matooke production areas of Mukono. Intensive chemical and organic matter analyses are beginning in order to ascertain why banana yields have declined in Mukono district.

6. Food Science And Technology

Aflatoxin incidence in grains and roots & tubers

To date, this project has established that aflatoxins do exist in food grains, roots and tubers sold in markets around Kampala, although the incidence was higher in cassava flours. Storage conditions are an important factor in promoting already existing molds and allowing invasion of Aspergillus flavus and other molds in stored foods. Food grains, roots and tubers kept in open space were more affected than the others. Storage in gunny bags will decrease infestation slightly. Keeping food grains and roots in flower form for any length of time increases aflatoxin invasion and multiplication. Pounded groundnuts are more susceptible than unpounded, irrespective of storage conditions. Removing bran from maize grain reduces aflatoxin incidence but this is not nutritionally sound. Subsequent storage is more important.

7. Animal Science

Ruminant feed analysis and evaluation

This project is designed to (1) compile and document available information relating to nutrient composition of local feedstuffs for ruminants: (2) evaluate local feedstuffs in terms of nutrient composition, digestibility and animal performance: and (3) establish suitable and low - cost feeding systems based on locally available materials to promote sustainability. Data obtained so far demonstrate that certain forages such as Russian Comfrey, velvet bean, mung bean and browse species such as sesbania and leucaena have high potential as ruminant feedstuffs in terms of dry matter yields and chemical composition. Research will be continued in order to assess nutritive value of these materials in terms of animal acceptance and performance.

8. Forestry

MFAD provided supplemental support to the AFRENA/ICRAF regional agroforestry project in 1990 and 1991. Since that time USAID has provided this program with direct shilling support.

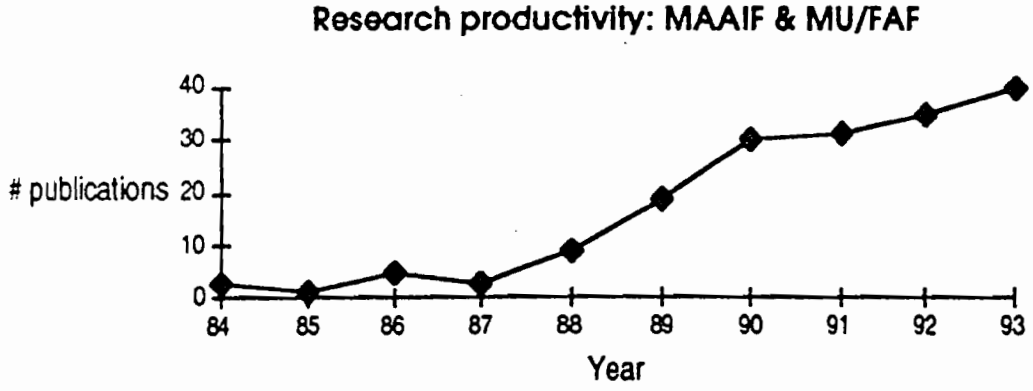
9. Support for returning US graduates

In addition to Dr. Adipala Ekwamu, three MU/FAF external degree returnees have initiated their research programs as follows:

- Dr. C. Ssekabembe, Crop Science, ***(Evaluation of agronomic factors related to high yield among maize varieties in Uganda.)***. will characterize Ugandan maize varieties with respect to agronomic factors that have been reported to be associated with high yields in other countries/regions. The primary agronomic focus will be on low-input strategies to maximize yields.
- Dr. D. Mutetikka, Animal Science, ***(A zero-grazing swine management system for small scale farming conditions in Uganda.)*** will begin to look at development of a comprehensive but practical management information package for use by small scale pig producers.
- Dr. J.S. Tenywa, Soil Science, ***(Influence of molybdenum and cobalt fertilization on symbiotic N-fixation in Ugandan soils.)*** Appropriate soil reaction as well as adequate supply of Mo and Co are imperative for successful occurrence of symbiotic N-fixation. There is little information on the Mo and Co status of Ugandan soils. This study will assess the relationship between soil pH and nitrogen fixation in four important soil groups of Uganda; establish whether Mo and/or Co are limiting factors; and check the need for supplemental Mo and/or Co fertilization to enhance N-fixation.

C. Research Productivity

The basic indicator of productivity for a scientist is to get his or her research efforts into print. Once the work has been accepted on a peer basis then the next step is to test the results under user conditions. Finally the recommendations generated from the research is communicated via extension bulletins, field days, popular articles, media presentations, etc. The graph shown here is derived from a partial list of research and extension publications produced over the life of MFAD(Appendix D) This is a definitive indicator that the project has had an impact on agricultural research productivity in Uganda.



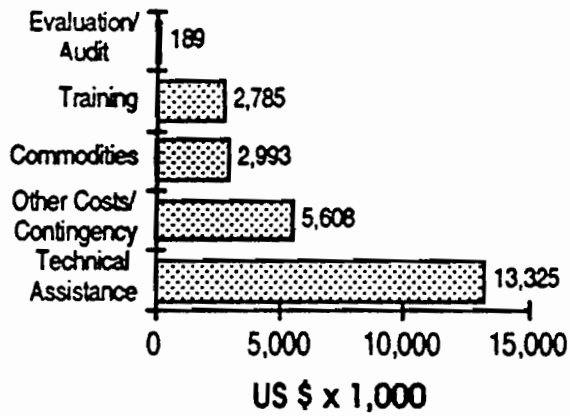
VII. Fiscal Management

A. Dollar Account

Total project grant assistance was 24.9 million dollars. Fifty-three percent of the grant funds were devoted to technical assistance; 23% to other costs; 12% to commodities; 11% to training and the remaining 1% to audits and evaluations. The Ohio State University prime contract was funded at 16.3 million dollars and the remaining 8.6 million dollars was programmed by the USAID mission. USAID - programmed funds were used for

- project management;
- commodity procurement, especially vehicles and household furnishings, residential generators and appliances;
- regional conferences and workshops.
- discretionary program support

Distribution of dollar grant funds



The Ohio State University dollar budget summary is shown in Appendix E. Contract funds were used for

- technical assistance (rehabilitation, research and university);
- participant training, and
- some commodity procurement (most of which was subcontracted to the Univ. of Minnesota and a Kenya PSA).

B. Ohio State University Contributions

During the MFAD Project—and more importantly, beyond the life of the project—Ohio State University has made a commitment to agricultural research and education in Uganda. This relationship has spanned four decades from the late sixties to the present. Graduates and colleagues of these past programs are playing key educational, research and administrative roles in the resurgence of agriculture in Uganda. A new generation of agricultural leadership is now coming to the forefront as a result of USAID funding and Ohio State's commitment under MFAD.

Over the past four years, Liaison Committees, composed of Faculty members from each agriculture department at Ohio State and Makerere University, have generated collaborative research projects designed to use non-MFAD funds to expand project-related research. As a gesture of support for on-going linkages between OSU and MU, the OSU Graduate School provided five fee and tuition waivers to MFAD-sponsored participant trainees. Other contributions have included book donations, program support activities, and faculty and graduate student exchanges. Utilizing program support funds, Ohio State's College of Agriculture faculty helped lay the foundation for new departments of Agricultural Extension Education and Food Science at Makerere University.

Summarized below and on the following pages is a detailed accounting of program inputs by OSU made directly to MU/FAF and MAAIF outside of the core grant funds from USAID and Government of Uganda counterpart funding.

1. Fellowships/ Fee and Tuition Waivers

A. Fellowships/Post Doctoral Support

Winifred Wafwoyo	1989-92	MU/FAF	Food Science	68,686
W. Odwongo	1989	MU/FAF	Animal Science	6,250
Jay Dorsey*	1990	OSU/FAF	Agric. Engineering	12,000
M. Latigo	1991	MU/FAF	Entomology	8,900
V. Kasenge	1993	MU/FAF	Agric. Economics	12,500
			Total Fellowships/Post Doctoral Support through Dec. 1991:	**$108,336**

** Mr. Dorsey taught courses at MU/FAF, conducted research and also worked with the soil physics group at Kawanda.*

B. Tuition Waivers

Name	Degree	Institution	*No. of fee waivers*	*Amount*
Amos Okiria	M.Sc.	MAAIF	5	$11,948
John Ssembatya	M.Sc.	MAAIF	2	4,512
Dennis Kyetere	Ph.D.	MAAIF	7	23,229
Johnson Hakiza	Ph.D.	MAAIF	9	25,835
		Subtotal MAAIF	23	$65,524
Margaret Najingo-Kau.	M.Sc.	MU/FAF	6	14,538
Adipala Ekwamu	Ph.D.	MU/FAF	12	31,190
Charles Ssekabembe	Ph.D.	MU/FAF	17	47,212
David Mutetikka	Ph.D.	MU/FAF	6	19,779
Ijoyi Fendru	Ph.D.	MU/FAF	14	43,024
John Tenywa	Ph.D.	MU/FAF	3	10,043
Joseph Kibalama	Ph.D.	MU/FAF	12	33,271
Moses Tenywa	Ph.D.	MU/FAF	7	23,229
		Subtotal MU/FAF	77	$222,286
		Total	**100**	**$287,810**

C. Rockefeller Foundation Exchanges

Epila-Otara	1989	MU/FAF	Forest Entomology
Patrick Rubaihayo	1989	MU/FAF	Crop Science
George Nasinyma	1989-91	MU	Veterinary Medicine
Felix Bareeba	1991-92	MU/FAF	Animal Science
Joy Tukahirwa	1992	MU	Geography

The Ohio State University Office of International Agricultural Programs provided program, communication and logistical support for each of these MU academic staff at no cost to the Rockefeller Foundation. Estimated staff time and other costs = $35,000.

Total A + B + C = $431,146

2. Makerere University/ OSU Liaison Committee

In 1989 the OSU Department Heads of Agronomy, Dairy Science, and Agricultural Engineering along with senior professors from the OSU departments of Agricultural Education and Forestry traveled to Uganda to assist the Faculty in developing the first draft

of the FAF Five Year Development Plan. Travel costs were covered by the MFAD Project and salaries of the consultants were covered by Ohio State.

OSU Contribution $26,120

From 1989 through 1993 OSU faculty in the Departments of Agronomy, Plant Pathology, Entomology, Forestry, Animal Science, Agricultural Economics, Agricultural Engineering, Agricultural Education and Food Science have served in an advisory capacity to MU/FAF academic staff and administration and the MFAD Technical Assistance Team at MU/FAF. OSU Faculty time has been contributed freely outside of normal academic advisory roles associated with participant training. This has included formal meetings of the Liaison Committee at OSU to review project activities, promotion of Project-related activities in individual departments, and individual consultations with visiting MU/FAF administrators and academic staff in addition to the technical assistance team and USAID administrators and project staff.

OSU Contribution(faculty/staff salaries) $289,425
Total Contribution to Liaison $315,545

3. OSU Faculty Travel to Uganda

During Phase II of MFAD, OSU has either fully or partially supported the travel and salary costs of thirteen faculty and administrators to provide assistance in areas in which needs were identified but were not programmed for funding under MFAD. These inputs are summarized below.

Name	Date	Assisted	Purpose	OSU $ Contribution
Poul Hansen	1988	MU/FAF	Develop plan for establishing Dept. of Food Science & Tech.	20,477
Neil Smeck	1988	FAF/MAAIF	Map & describe soils at MUARIK, Namulonge & Kawanda	7,815
Lowell Hedges	1988	FAF/MAAIF	Plan to develop Dept. of Ag Ed/Ext; artic of FAF and Ag Tech Colleges	13,542
Pablo Jourdan	1989	FAF	Horticultural research	8,405
Alan Lines	1989	FAF	Consult with academic staff of Ag Econ Dept.	8,702
Frank Calhoun	1989	FAF/MAAIF	Review MFAD proj. act. and support to FAF/MAAIF soils research	9,000
Richard Riedl	1990	FAF/MAAIF	Review plant pathology research & education	8,500
Robert Romig	1990	FAF	Forest products research	11,200
Robert Zimmerly	1990	FAF	Organization of practical experience exercises at MUARIK	8,100
Harold Willson	1991	FAF/MAAIF	Integrated pest management research and workshop	10,316
John Blaisdell	1991	FAF	Food Science curriculum development and analysis of food tech industry in Uganda	22,671
Frederick Hutchinson, Provost/OSU	1991	FAF/MAAIF	Review project activities and meet with FAF & MAAIF administrators	4,550
David O. Hansen, Assoc. Dean	1991	FAF/MAAIF	Review project activities and meet with FAF & MAAIF administrators	5,435
Luther Waters, Chair Hortic./ OSU	1993	FAF/MAAIF	Review horticulture industry in Uganda	3,256
D. O. Hansen, Assoc. Dean	1989-1993	FAF/MAAIF	MFAD Reviews salary cost share by OSU/IAP	25,931

Total OSU Contribution to Faculty travel to Uganda = $167,900

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4. MU/FAF & MAAIF Library Donations

OSU Agricultural Faculty members and OSU Libraries have contributed over **$85,000** worth of books and journals to the Faculty of Agriculture and Forestry and MAAIF agricultural library collections during Phase II of MFAD. Total contribution has only been limited by logistical and cost constraints including labor, administrative time for organizing and listing of contributions and shipping costs.

5. Makerere University Visitor Travel

OSU has picked up travel costs totaling **$6,953** for the MU Vice Chancellor, the Dean and the Department Head of Animal Science to visit the OSU campus for Liaison committee meetings and consultations with OSU faculty and administrators.

6. OSU Office Backstopping

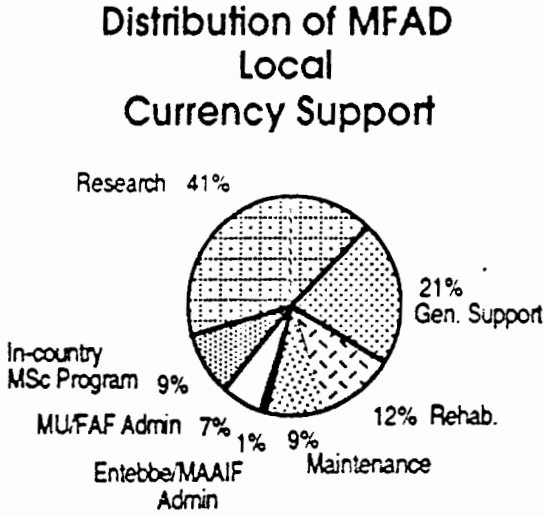
During Phase II of MFAD, Ohio State has picked up the costs of administrative backstopping by the Director of International Agricultural Programs, the IAP administrative assistant, and various other office staff who have contributed to the functioning of MFAD. OSU has also underwritten travel costs for the campus coordinator to Minnesota, Fort Valley and Washington, DC to handle MFAD affairs related to technical assistance, training and rehabilitation. Finally some campus office supplies and communication costs have been absorbed. The total documented OSU contribution in this area amounts to **$395,674**.

In summary, Ohio State University has contributed, through June, 1993, a total of **$1,402,218** in costs directly related to MFAD Project activities. The University normally charges a 45% overhead rate on all sponsored projects which utilize campus facilities and administrative infrastructure. If these costs were factored in, then the actual contribution through 1993 would be **$2,033,216** which exceeds by over $30,000 the two million dollar commitment made by Ohio State University at the initiation of MFAD Phase II.

C. Local Currency Account

Nearly 1.7 billion shillings were disbursed through the OSU Field Office to support MFAD activities between 1986 and 1993.

	Phase I	Phase II	Total
1 Project Support		348,585,092	348,585,092
2 Rehabilitation	138,601,824	56,287,148	194,888,972
3 Maintenance		150,044,852	150,044,852
4 Entebbe/MAAIF Administrative Support		14,663,000	14,663,000
5 MU/FAF Administrative Support		110,775,000	110,775,000
6 In-country MSc Program		155,820,000	155,820,000
7 Research Projects	3,653,332	691,158,605	694,811,937
	142,255,156	1,527,333,697	1,669,588,853



Management and disbursal of local currency funds has been an evolutionary process. The source of these shillings during Phase I and the early part of Phase II came from PL-480 generated funds. In 1989 the source was switched over to shillings generated by loan repayments to the Agricultural Non-traditional Export Promotion Project. (ANEPP). This was done for programmatic reasons because MFAD research would play an important role in nontraditional export crop production. The switch from PL-480 to ANEPP did not go smoothly in the beginning. Shilling flow was more erratic under ANEPP than under PL-480. Funds were released first on an ad hoc basis, then quarterly and finally in 1992 the MFAD budget was released for the complete fiscal year. In 1990 and 1991 there would be long delays in funds release which would affect programs as the research, maintenance and/or rehabilitation elements of the project would periodically grind to a halt.

In the beginning local currency was released to both the Ministry of Agriculture and to the Faculty of Agriculture and Forestry. These accounts were separately managed. The MFAD office would receive a separate release to cover project support activities such as TA housing maintenance, office expenses and TA vehicle operation. In early 1990 the MFAD office was given the responsibility, by USAID/Uganda, to merge all local currency into a single account. This effectively increased the work load by 500% of what was up until early 1990, simply the OSU contract office in Uganda. Also, up until that time all accounting at the OSU field office was accomplished using a printing calculator and hand ledgers. It was decided that local currency accounts must be computerized in order to handle this magnitude of fiscal management.

The MFAD administrative assistant, who had handled the books on part-time basis, became a full-time accountant. At the same time she had to learn the process of computerized accounting. She would also travel to the bank about three times a week to replenish the cash box. At the time, currency denominations were in 50 and 100 shilling notes. This practice was discontinued for security reasons, limited physical size of the cash box and realization that the accountant would have to spend all of her time at the bank. Once the new accounts were set up, two-month advances would be issued by check to the project leader.

Full recovery and smooth operation of the local currency management system did not occur until early 1991. The administrative assistant (a dependent spouse) then trained two local staff to take over her job in July 1992. This was accomplished satisfactorily. The mid-term evaluation team strongly recommended that the USAID office be provided with a professional project administrator, but project funds were not available for this. The MFAD Team Leader devoted a sizable percentage of his time to local currency management from mid-1990 to the end of the project.

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VIII. Project Accomplishments

A. Human resource and Institutional development

1. Inputs

- 65.3 person years of long term technical assistance were provided as follows:

	Total	Rehabilitation	Maintenance	Research/Education	Administration
MAAIF	32.3	10.0	1.0	14.2	7.1
MU/FAF	33.1	6.0	0.5	19.5	7.1

- Over 5.3 person years of short term technical assistance from diverse technical fields and organizations were provided through 92 individual visits to Uganda.

- Over 100 person-years of degree training at 11 different U.S. universities were provided to 38 national staff from MAAIF and MU/FAF.

- Over 60 person years of degree training at Makerere University were provided to 35 national staff from MAAIF and MU/FAF.

- Over 18.6 person years of external short term training were provided to 97 individuals. MAAIF accounted for 57% (10.6 person years) and MU/FAF accounted for 43% (8.0 person-years).

- Over 26 conferences and workshops were either totally or partially sponsored by MFAD between December 1986 and June 1993; an average 4 to 5 per year. Total attendees at them was at least 1,720.

2. Outputs

- The MU/FAF undergraduate curriculum was completely revised and the postgraduate program was restored. The Faculty Handbook was completely revised and a Five-Year Development Plan completed.

- By the end of 1991, all national, regional, district, and county employees of the Ugandan Extension Service had attended three to five day work-shops on the proposed new organizational structure for the Ugandan Extension Service. MFAD staff provided a multi-session training program that included program development and evaluation, leadership principles, and adult learning principles.

- At least 50 in-service programs covering research/extension linkage issues were provided by AEE staff of MU/FAF to over 3,000 MAAIF research and extension staff.

- Many research reports, the first MAAIF Newsletter in 15 years was produced, and Extension fact-sheets were prepared in the following areas:

    - Potato Production
    - Bean Production
    - Sunflower Production
    - Cotton Production
    - Cassava Utilization

- Ground-Nut Production
- Sweet Potato Production

B. Physical rehabilitation inputs

- Four primary units were physically rehabilitated during the life of MFAD:
  - Namulonge Agricultural Research Station (MAAIF);
  - Kawanda Research Station (MAAIF);
  - Makerere University Agricultural Research Institute at Kabanyolo; and
  - The Faculty of Agriculture and Forestry building on the Makerere University campus in Kampala.

- The electrical distribution, water/supply distribution and drain/waste systems were completed at all four locations . Farm buildings, administrative units, laboratories, warehouses, staff housing sheds, stores, clinics and workshops were rehabilitated between 1987 and the end of 1990.

- A maintenance program which phased out MFAD project input and phased in station input over three years was designed and implemented . The primary constraint to sustainability will be fiscal rather than lack of skills.

- Eighty-five vehicles were purchased for MFAD use between late 1984 and mid - 1993. Distribution was MAAIF-55%; MU/FAF-40% and USAID-5%. This facilitated at least 6,000,000 kilometers of travel to all regions of Uganda in order to achieve project objectives.

- Field and laboratory equipment worth $706,317 has been equally divided between MAAIF and MU/FAF. This equipment has enabled MU/FAF and MAAIF to increase their research, teaching and agricultural production capability several fold.

- At least $104,880 worth of office equipment was purchased and strategically distributed to both organizations. The large volume of professional papers, academic coursework materials, correspondence and reports can be directly attributed to the availability of this equipment.

C. Research outputs

- For passion fruit, T-bar trellis configuration is superior to either single or double T-bar for the Kawanda hybrid, but yields are so low for the local purple varieties that trellis type is of little importance.

- Fifteen adaptable forage legumes have been identified as being capable of integration into crop/livestock production systems. For example, Desmodium uncinatum was successfully oversown in a natural pasture and persisted for three years under grazing.

- Several promising, early maturing(70-75 days after planting) solanum potato genotypes with relative tolerance to Bacterial Wilt were identified.

- Increased plant density has a negative effect on tomato fruit size and number of fruits per plant; but a positive effect on yield due to a larger number of plants per unit area.

- There is a positive interaction between pineapple plant population and addition of coffee husks up to around a plant population of 50,000 plants per hectare.

- Velvet beans can be used effectively as a protein source in diets for broiler and laying hens at levels up to and including 20% when heat treated and adequately supplemented with methionine.

- A new sweet potato weevil species (Curcibionida) was discovered.

- Rate of Return analysis shows that potential returns to agricultural research in Uganda are excellent, even with its history of political instability. This holds true despite the high costs of physical rehabilitation, training, extension and technical assistance.

- Given incentives, Ugandan farmers are capable of increasing food production to ensure national food security and a surplus for the export market

- If marketing, transportation and storage problems are neglected, farmers may not respond to price incentives

- If producers and consumers have reliable and complete market information, their chances of being exploited by traders are reduced.

- Improved government extension services are needed.

- Most research programs at MUARIK were found to cover commodities and problems that bear on farming in the Institute's surroundings and the country at large. However, only a few of the research programs had yielded technologies that could be applied by farmers.

- MUARIK employees are exposed to various improved farming practices and technologies as a direct result of working at MUARIK. However, because of a shortage of land and capital, most of the employees had not used these practices on their own holdings.

- Sixty-seven percent of the MU/FAF graduates felt that in-service training should be expanded, 55% felt research should be improved, and 53% desired more up-to-date technical materials. Almost 90% of the graduates wanted a greater emphasis on practicals and 76% wanted a stronger program in continuing education.

- Runoff plots show that uncleared land had considerably lower erosion rates than the 5 other treatments, but sediment loss tends to stabilize with time regardless of cropping system.

- Hydraulic ram pumps can be built from locally available materials to provide a good source of low cost water for rural areas and local industry could design site-specific pumps for various locations in Uganda.

- Swamp soils at Kabanyolo and southern Uganda (1) have low buffer capacity in surface and near surface horizons; and (2) soil pH and exchangeable acidity is high and increases with cropping and drainage of the swamp.

- Over 30 years of meteorological data from Kabanyolo has been tabulated on computer and trend analysis has been initiated.

- Aflatoxins do exist in food grains, roots and tubers sold in markets around Kampala, although the incidence was higher in cassava flours.

- Storage conditions are an important factor either in promoting already existing molds or allowing invasion of Aspergillus flavus and other molds in stored foods. Food grains, roots and tubers kept in open space were more affected than others.

- Certain forages such as Russian Comfrey, velvet bean, mung bean and browse species such as sesbania and leucaena have high potential as ruminant feedstuffs in terms of dry matter yields and chemical composition.

- In 1991 the Namulonge Research Station released a new maize variety named Longe 1. This open pollinated variety was a product of cooperation between IITA and the national maize program. Longe 1 is resistant to maize streak, is approximately 1 meter shorter in stature than the local varieties, and matures 2 weeks earlier.

- On most farmers fields maize produced without use of fertilizers, on continuously cropped land, yields less than 1 ton per ha. In general 1Kg nitrogen per ha. will boost yields approximately 30Kg per ha when other production factors are not limiting.

- Without the benefit of applied nitrogen, yields will be restricted because of the low nitrogen levels of the soil.

- In June 1989 a new soybean variety was released by MAAIF. The soybean variety, known as Nam 1, is superior in yield to Kabanyolo 1 and possesses more resistance to lodging.

- For sunflower:
    - Two cycles of maternal recurrent selection were undertaken within the Australian variety Sunfola and the improved version was released in 1991 and named New Sunfola.
    - Hybrids are superior to open-pollinated varieties in seed yield and, compared to the best hybrid New Sunfola, is low in seed yield, but has an oil content that compares favorably
    - Hybrids withstand stress better than open-pollinated varieties
    - Hybrids are more uniform in maturity date than open-pollinated varieties
    - Bird damage is one of the greatest constraints to small-farmer sunflower production when open-pollinated varieties are used
    - One or more hybrids appear to have some bird resistance

- The national bean research program released three new varieties in 1991.

- In general TMS varieties of cassava from IITA were highest yielding and ranked the best in respect to the farmers taste and suitability in existing cropping systems.

- During the 1st rainy season of 1993, a total of 84,500 stems of improved cassava varieties from 30.5 ha of cassava planted at Namulonge research Institute were distributed to mosaic- infested regions of Uganda.

- Several varieties of Irish Potato were released in 1991 and 1992.

- Eleven upland rice varieties were evaluated and six are undergoing further evaluation at Namulonge, selected DFIs and on farmers' fields.

- Animal traction investigations at Namulonge and MUARIK have revealed the following:

- The use of oxen as a source of farm power is possible with most soils and crop conditions in Uganda
- Female animals can be utilized as draft animals. They are easier to train than males and can be utilized for milking as well.
- The use of a collar on trained oxen can result in increased power output when compared to yoke.
- A team of well-trained oxen can furnish power for the cultivation of 10 acres or more of row crops per season.
- Working oxen can be kept healthy with proper disease control and feeding, but must be well-fed if worked hard.
- The cost of purchasing a team of oxen is generally less than a 200 liter barrel of diesel fuel. The present cost of a pair of animals, cost of training and all necessary implements, is less than 5% of the cost of a 10 horse-power tractor and implements.
- The use of oxen for seed bed preparation and cultivation of maize reduces the person- hours of labor per acre by 800% (156 hours down to 20 hours).
- Not all oxen are suitable for training. There are genetic differences which can have a tremendous impact on how long the training will take.
- Four farmers near Namulonge have had their oxen trained and over 80 farmers from Mpigi district have requested assistance in training of their oxen.
- Use of oxen reduce labor requirements for primary and secondary tillage.

- A detailed soil survey of the Kalengyere Research Station was completed and published in late 1992.

D. Agricultural Production

- During the first 3 years of Phase II of the project (1988-1990) there were 517 on-farm maize trials, 523 soy bean trials and 408 sunflower trials conducted by extension agents in collaboration with farmers.

- During the years 1991-1993 there were 1400 maize, 1450 soybeans, and 759 sunflower demonstration trials managed by farmers.

- Yields of new crop varieties Longe 1 (Maize), Nam 1 (Soybean) and Sunfola (Sunflower) produced yields which were 25 to 60 percent higher than local varieties.

- The on-farm research program has trained over 90 extension workers and over 3500 farmers have participated in the program.

- The project has had a major impact on farm production in the participating districts. A large number of neighboring farmers have adopted new varieties and improved production practices. Participating farmers have used 60% of their land to produce improved crop varieties; and 1.2 % of the farming population in the 6 districts have adopted improved crop varieties.

- Participating farmers have increased their over all farm productivity by 31 percent; their farm income by 300 percent; and their farm size by 83.3 percent.

- Five participating farmers have won national awards in agricultural competition.

- The Uganda Seed Project is now producing the new varieties of maize (Longe 1), soybean (Nam 1) and sunflower (new Sunfola) for sale to farmers.

E. Measured against the Project Log Framework

Log frame target	Output Status
• Improved quality of education by training of 22 Ph.D., 14 M.Sc.(out of country) and 35 M.Sc. participants at Makerere University	Only 20 PhD degrees will be reached, one of which will finish with a joint degree between OSU & Makerere. One individual was unable to academically complete his degree at Univ. of Missouri. FAF Ag Econ Department was unable to supply a second candidate. To offset this shortfall 3 MSc degree candidates were substituted. A total of 16 external MSc degrees have been obtained. One candidate died on course and was not replaced. In summary, the total number of external degrees was surpassed by one (37 vs. 36) but PhDs were short 2 and MSc degrees surpassed the target by 3. The MSc target for Makerere was matched at 35 with a new intake of 20 additional participants in 1992/93.
• Joint research coordination systems established	Commodity research teams are completely organized in which both MAAIF & MU/FAF scientists are represented. These teams will be more technically complete once all of the MFAD participants complete their degree training.
• Establishment of a National Agricultural Research Organization	NARO has been implemented. The Director General has been appointed and is temporarily officed in Entebbe at MAAIF headquarters. Staff recruitment has been initiated.
• Research stations rehabilitated and re-equipped	Rehabilitation is 100% complete and re-equipping is 98% complete. Some lab equipment parts have yet to arrive for Kawanda.
• Research priorities established	This was a condition precedent to the establishment of NARO so it is 100% complete.
• Research/extension linkage strengthened; research/extension plan prepared & on-farm trials being conducted	At least 5,057 on-farm trials were conducted in six districts from 1988-93. Over 3,500 farmers have participated in the program. A total of 90 extension agents were trained in the program which was coordinated by 8 extension staff. In 1991 a national director was named from MU/FAF Ag Econ Dept. A handbook for management of on-farm trials was developed. At least 50 in-service programs for over 3,000 MAAIF research and extension staff covering research/extension linkage issues were provided by AEE staff of MU/FAF.
• Faculty of Agriculture rehabilitated and re-equipped	100% complete
• Accelerated Food Crops Production Strategy completed	Completed in 1990. In constant demand as a reference for agricultural project development and analysis.

IX. Appendices

A. Rehabilitation

A. 1. Facilities rehabilitated under the MFAD project:-

MUARIK

Ag Engineering Drafting Building	Carpenter Workshop
Mechanics Workshop	Plumbing Workshop
Feed Processing Building	Poultry Unit, Processing and Production
Dairy Unit/Calf Barn/Free Stall Barn	Sheep and Goat Unit
Farm Plot Fencing	Two Greenhouses
Seed Technology Laboratory	Lecture/Library Building
Potting Shed	Farm Equipment Building
Ag Engineering Workshop/Equipment Shed	Plant Breeding Laboratory
Harvesting Laboratory	Farm Office Building
Piggery Unit	Animal Science Building
Senior Staff Housing	MFAD Warehouse Building
Post Graduate Housing	Junior Staff Housing
Labor Line Housing	Water Supply/Distribution System
Electrical Distribution System	Drain/Waste System

Kawanda Research Station - MAAIF

Main Administration Building	Main Office/Laboratory Building
Library	Farm Office Building
Seed Store	Mechanics/Security Office
Lubricants Store	Farm Store
MFAD Warehouse	Botany Store
Carpentry Workshop	Mechanics Workshop
Entomology Facilities	Station Clinic
Physics Laboratory	Fertilizer Store
Banana Laboratory	Entomology Store
Entomology Mechanics Shop	Dryer Building
Chemical/Fertilizer Stores	Spray Race
Guest House	Senior Staff Housing
Junior Staff Housing	Guard Housing
Labor Line Housing	Water Supply/Distribution System
Electrical Distribution System	Drain/Waste System

Namulonge Research Station - MAAIF

Main Administration/Laboratory Building	Maize/Soybean Stores
Soils Laboratory Store	Soils Laboratory Greenhouse
Soybean Greenhouse	Botany Greenhouse
Pathology Greenhouse	Soil Drying Store
Spare Parts Shed	Fuel Stores
Main Farm Store	MFAD Warehouse/Dryer/Maize Shelling Building
Fertilizer Store	Open Storage Sheds
Machinery Storage Shed	Farm Office Building
Workshops/Garages Building	Old Ginnery Building
Senior Staff Housing (A)	Senior Staff Housing (AA)
Guest Houses	Junior Staff Housing (B)
Labor Line Housing (C)	Water Supply/Distribution Systems
Electrical Distribution System	Drain/Waste System

A. 2. Rehabilitation Phase II - Contracted by USAID

Project	Dates	Funds			
	Start-Finish	Obligated		Paid	
		US $	U.Shs	US $	U.Shs
Namulonge Research Station					
House # 3 (D & S)		9,050	614,620	7,248	614,620
House # 3 (Contr)	6'88 - 10/88	24,896	6,490,506		
Amendment	6'89 - 08/89	24,544	927,506	51,008	6,493,280
House # 4&5 (D&S)		18,780	1,724,919	14,624	1,724,719
House # 4&5 (Contr)	6'88 - 12/88	108,931	8,080,597	106,035	7,864,280
Sub - total		186,201	17,838,148	178,915	16,696,899
Kawanda Research Station					
Lab Bldg (D&S)		19,040		17,945	
Lab Bldg (D&S)	6/88- 12/88	86,109		74,540	
Residence for CIAT(D&S)			1,210,430		1,210,430
Residence for CIAT (Contr)	7/88 - 1/89		11,112,438		11,496,603
Host Rooms (D&S)		9,350	0	0	0
Host Rooms (Contr)	5/89 - 8/89	30,000	11,431,142	20,824	7,934,442
Seed Bldg (D&S)		0	205,000	0	180,000
Seed Bldg (Contr)	4/89 - 5/89	0	3,787,845	0	1,278,772
Burglar proof (Contr)		0	2,350,000	0	2,350,000
Sub - total		144,499	30,096,855	113,309	24,450,247
Total		**330,700**	**47,935,003**	**292,224**	**41,147,146**
Makerere University Faculty of Agriculture and Forestry (MU/FAF)					
Gen Repairs (D & S)	4/78 - 7/88	60,300	0	58,791	0
Gen Repairs (Contr)	2/88 - 2/89	261,599	0	259,400	0
Gen Repairs (D & S)	2/88 - 2/89	15,000	5,250,000	7,500	2,625,000
Gen Repairs (Contr)	2/88 - 2/89	145,641	24,453,164	135,100	25,540,870
Amendment	Nov-89	13,695	6,576,673		
Sub-total		496,235	36,279,837	460,791	28,165,870
Makerere Agricicultural Research Institute at Kabanyolo (MUARIK)					
5 New Houses (D & S)		36,300	4,093,800	29,040	3,275,034
5 New Houses (Contr)	8'88 - 6/89	362,974	32,562,420	-	-
Amendment	Nov-89	30,971	0	253,214	26,238,975
Sub-total		430,245	36,656,220	282,254	29,514,005
Total		926,480	72,936,057	743,045	57,679,885
Grand Total		1,257,180	120,871,060	1,035,269	98,827,031

Final cost figures for Women's Hostel at MUARIK unavailable.

Note: (D & S), abbreviation for Design and Supervision

A. 3. Rehabilitation Phase II - Contracted by MFAD

Kawanda Research Station

Project	Date	Contractor's Name	Amount U.Shs.
Electrical Renovation	Apr-89	D.M.K. Energy Service	1,848,000
Electrical Renovation	Nov-89	D.M. Kasajja	1,147,220
Roof Repairs	Oct-88	Island Gen. Services	815,000
Roof, House 5	Aug-88	Charles Kayiga	40,000
Gutters, Hse 1 - 10	Apr-89	Charles Kayiga	90,000
Plumb. House 5	Apr-89	Charles Kayiga	234,000
Pit Latrine (6)	Jan-88	Y. Bbosa	22,500
Plumb Servant Qtrs.	Nov-88	Masowe	20,000
Tree trim and Removal	Apr-89	Bosco Egesa	30,000
Repair House 5	Aug-89	Island Gen Services	77,500
Renovate House 5	May-89	Island Gen. Services	472,500
Servant Qtrs, Hse 5	Jun-89	Charles Kayiga	485,000
Aprons / 11 Houses	Feb-89	Charles Kayiga	300,000
Electrical	Nov-89	D.M.K. Energy Services	364,500
Submersible Pump	Oct-89	Turnwine Lawrence	400,000
		Total =	*6,346,220*

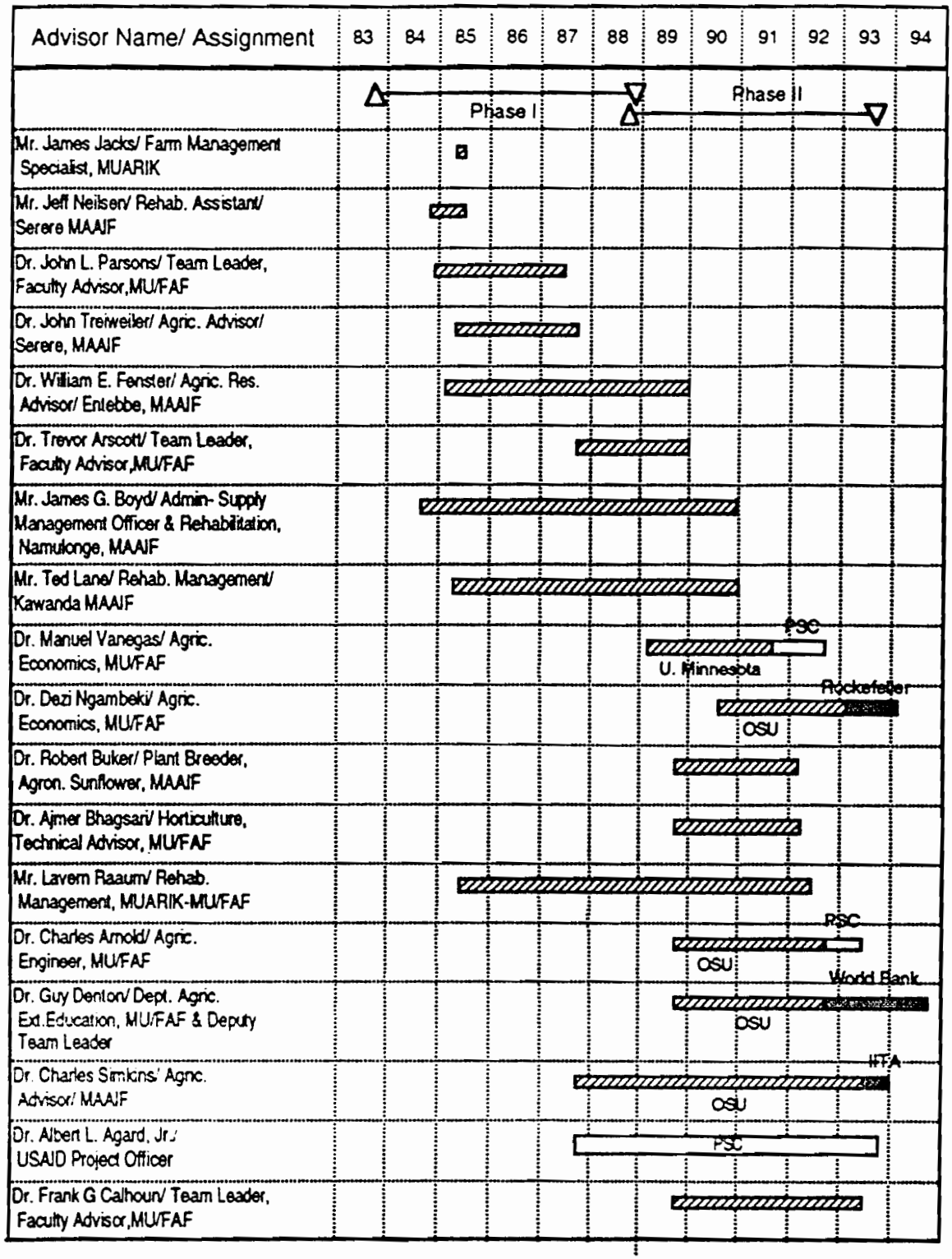
Makerere University Research Institute - Kabanyolo(MUARIK)

Renovation, various	Sep-88	Island Gen Services	46,000
Kabanyolo House	Apr-89	Island Gen. Services	267,500
Reconstruct Roads	Jun-89	Agro Indust. & Technical services	7,215,000
		Total =	*7,528,500*

Grand Total = 13,874,720

B. Technical Assistance

B.1. Long term technical assistance schedule under MFAD



B.2. Long term technical assistance provided under MFAD (in person years).

				Rehabilitation Phase		Maintenance Phase		Research Phase		Administration Phase	
Name	PY	MA AIF	MU/ FAF	I*	II**	I	II	I	II	I	II
J. Jacks	0.2	0.2		0.2							
J. Neilsen	0.7	0.7		0.7							
J. L. Parsons	2.6		2.6					1.7		0.9	
J.Treiweiler	2.4	2.4						2.4			
W. E. Fenster	4.9	4.9						3.5	1.3		
T. Arscott	2.3		2.3					0.6	0.6	0.6	0.6
J. G. Boyd	6.3	6.3		1.8	2.2					2.4	
T. Lane	5.7	5.7		3.5	2.2						
M. Vanegas	3.5		3.5						3.5		
D. Ngambeki	2.5		2.5						2.5		
R. Buker	2.5		2.5						2.5		
A. Bhagsari	2.5		2.5						2.5		
L. Raaum	7.0	1.0	6.0	3.2	2.3		1.5				
C. Arnold	3.7		3.7						3.7		
G. Denton	3.0	0.3	2.7						2.5		0.5
C. Simkins	5.8	5.8						1.0	4.8		
A. L. Agard, Jr.	5.9	2.9	3.0							1.1	4.8
F. G. Calhoun	3.9		3.9						0.5		3.4
Totals	65.3	30.1	35.1	9.3	6.7	0.0	1.5	9.2	24.4	4.9	9.3

* Phase I ** Phase II

B.3. Short Term Technical Assistance

#	Name	Affiliation	start	finish	days	AID funds	activity
1	W. Larson	Univ of Minn	12/10/86	12/17 86	7	7	Parti in Soil Sc Soc of E A. meeting
2	E Scmidt	Univ of Minn.	12/10/86	12/17.86	7	7	Parti. in Soil Sc Soc of E.A. meeting
3	F. P. Miller	Ohio State Univ.	1/15/87	1/22/87	7	7	Administrative, project review
4	FHutchinson	Ohio State Univ.	1/15/87	1/22/87	7	7	Administrative, project review
5	J. Kirkwood	Ft Valley St.Coll.	1/15/87	1/22/87	7	7	Administrative, project review
6	P Henderlong	Ohio State Univ.	2/8/87	2/23/87	15	15	Administrative, project assistance
7	Ron Brubaker	Ohio State Univ.	3/17/87	4/16/87	30	30	Laboratory/ Electronic Equip consult.
8	E.Sprague	Private consultant	7/18/87	8/15/87	28	28	Maize Development in Uganda
9	Carl N. Hittle	Private consultant	8/16/87	10/1/87	46	46	Soybean Development in Uganda
10	Gene Pilgrim	Private consultant	8/16/87	9/20/87	35	35	Extension program status & evaluation
11	D. Goss	SMSS/USDA	9/1/87	9/25/87	24	24	Soil survey of KRS, NRS & MUARIK
12	D. Yost	SMSS/USDA	9/1/87	9/25/87	24	24	Soil survey of KRS, NRS & MUARIK
13	N. Smeck	Ohio State Univ.	9/5/87	9/15/87	10	0	Soil survey of KRS, NRS & MUARIK
14	W. Gamble	ISNAR	9/15/87	10/15/87	30	30	MFAD evaluation
15	P Henderlong	Ohio State Univ.	12/10/87	12/20/87	10	10	UPANE conference
16	Poul Hansen	Ohio State Univ.	2/28/88	3/26/88	27	0	Establishment of Food Science Dept.
17	D. Yost	USDA/SCS	3/15/88	4/6/88	22	22	Characterize soils of Kachwekano DFI
18	Adam	USDA/SCS	3/15/88	4/6/88	22	22	Characterize soils of Kachwekano DFI
19	L. Hedges	Ohio State Univ.	4/9/88	4/27/88	18	0	Agric. Educ. Ext.
20	W. Rawls	Ft Valley St.Coll.	4/9/88	4/27/88	18	0	Agric. Educ. Ext.
21	O. Livingston	IFDC	5/15/88	6/1/88	17	17	Asess phosphate production potential
22	Allan Lines	Ohio State Univ.	6/28/88	7/14/88	16	16	Agric.Economics
23	Poul Hansen	Ohio State Univ.	9/8/88	9/25/88	17	0	Establishment of Food Science Dept.
24	Weingartner	INTSOY/ U. of Ill.	10/27/88	11/2/88	6	6	Soybean
25	H.D Tindall	Private consultant	11/9/88	11/16/88	7	7	Horticultural Assessment
26	W. Bishop	Private consultant	11/16/88	12/4/88	18	18	Five Yr Food Crops Research plan.
27	Arlo Tompson	Private consultant	11/21/88	12/4/88	13	13	Sunflower Breeding & production
28	Rattan Lal	Ohio State Univ.	12/4/88	12/15/88	11	0	1st All-Africa Soil Science Soc. Conf.
29	P.Jourdan	Ohio State Univ.	1/15/89	2/5/89	21	0	Horticultural research
30	David Hansen	Ohio State Univ.	2/15/89	2/24/89	9	4	Participate in Annual Review
31	F.Calhoun	Ohio State Univ.	2/17/89	2/27/89	10	0	Revi. soils research, Annual Review
32	Mark Erbaugh	OSU .Coordinator	2/17/89	2/25/89	8	8	Annual Review, assist participant prog.
33	Mark Erbaugh	OSU .Coordinator	4/3/89	4/15/89	12	12	Project administr.; participant death
34	E. Hartmans	Private consultant	4/9/89	6/13/89	65	65	Five Year Food Crop Research Plan
35	D. Welsch	Univ of Minn.	4/22/89	4/29/89	7	7	Administrative visit
36	Weingartner	INTSOY/ U. of Ill	5/21/89	6/2/89	12	12	Soybean Utilization
37	Ron Borton	Ohio State Univ.	6/16/89	7/4/89	18	0	Articulation MU & Agric. Tech Colleges
38	Gary Sheldon	Univ of Minn.	6/16/89	7/4/89	18	0	Articulation MU & Agric. Tech Colleges
39	Robert Hill	Utah State Univ.	7/4/89	7/31/89	27	27	Review of Irrigation Research facilities
40	Ron Brubaker	Ohio State Univ.	7/11/89	8/9/89	29	29	Laboratory/ Electronic Equip
41	Mac McCaslin	Ohio State Univ.	7/21/89	8/18/89	28	7	Participant adv. Ag.Ext.; FAF 5-yr Plan
42	R.Gustafson	Ohio State Univ.	8/10/89	8/22/89	12	0	5 yr dev.plan for MU/FAF, ag. engin.
43	Dave Zartman	Ohio State Univ.	8/10/89	8/22/89	12	0	5 yr dev.plan for MU/FAF, animal sci.
44	F.P. Miller	Ohio State Univ.	8/10/89	8/22/89	12	0	5 yr dev.plan for MU/FAF, agronomy
45	Bob Roth	Ohio State Univ.	9/7/89	9/12/89	5	0	5 yr dev.plan for MU/FAF, forestry
46	P. Singleton	U. of Haw.NiFTAL	10/22/89	11/10/89	19	19	Rhizobia research
47	Jay Dorsey	Ohio State Univ.	1/7/90	9/6/90	242	40	Research & teaching in Ag engin
48	L. Tweeten	Ohio State Univ.	1/14/90	2/23/90	40	40	Acc. Food Crop Production Strategy
49	Cesar Amorin	Private consultant	1/14/90	3/23/90	68	68	Acc. Food Crop Production Strategy

	Name	Affiliation	start	finish	days	AID funds	activity
50	D. Enksmoen	Private consultant	3/3/90	3/31/90	28	28	Maint and Renab. phase-out plan
51	R.Riedel	Ohio State Univ.	4/25/90	5/12/90	17	0	Plant protection
52	Philip Larsen	Univ. of Minn.	4/25/90	5/12/90	17	0	Plant protection
53	P. Singleton	U. of Haw.NiFTAL	5/15/90	6/1/90	17	16	Rhizobia research
54	D. Welsch	Univ. of Minn.	5/22/90	5/28/90	6	0	Administrative visit: UM 100%
55	J. Rourke	U. of Haw.NiFTAL	5/26/90	7/28/90	63	63	Install Rhizobium production facility
56	Robert Romig	OARDC/ Wooster	7/15/90	8/11/90	27	0	Forestry Research, forest products
57	Bob Ayling	USDA/ OICD	7/30/90	8/21/90	22	22	Mid Project Evaluation
58	Calvin Martin	Private consultant	7/30/90	8/21/90	22	22	Mid Project Evaluation
59	Ray Meyer	AID/S&T	7/30/90	8/21/90	22	22	Mid Project Evaluation
60	R. Hathcock	Univ. Tenn/Martin	9/14/90	12/18/90	95	0	Coursework & research in Weed Sci.
61	David Hansen	Ohio State Univ.	9/17/90	9/28/90	11	5	Semi-annual Project Review
62	D. Welsch	Univ. of Minn.	9/17/90	9/28/90	11	11	Semi-annual Project Review
63	J. Kirkwood	Ft.Valley St. Coll.	9/17/90	9/28/90	11	11	Semi-annual Project Review
64	Mark Erbaugh	OSU Coordinator	9/17/90	10/10/90	23	23	Semi-annual Proj. Rev., participants
65	G. Kunde	Private consultant	9/24/90	10/28/90	34	34	Financial Control Advisor
66	M. Johnson	Univ. of Minn.	9/26/90	10/3/90	7	0	Univ. Library; UM 100%
67	E. Wilson	Lincoln Univ.	9/26/90	10/3/90	7	0	Univ. Library; LU 100%
68	G. Zimmerly	Ohio St. Univ.	11/10/90	2/10/91	92	46	Curriculum & practicals at MUARIK
69	Mark Erbaugh	OSU .Coordinator	1/13/91	1/26/91	13	13	MFAD Annual Retreat; support activit.
70	John Blaisdell	Ohio St. Univ	1/23/91	4/17/91	84	17	Food Science curriculum development
71	Hal Wilson	Ohio State Univ.	4/5/91	4/19/91	14	0	Intergr. Pest Management Workshop
72	D. Welsch	Univ. of Minn.	4/20/91	4/23/91	3	3	Administrative visit
73	Calvin Martin	USAID	4/24/91	5/27/91	33	33	Kalengyere Ag. Research St..dev. plan
74	Patrick Lipps	Ohio State Univ.	6/12/91	6/19/91	7	0	PhD research, A.Ekwamu,Pl. Path
75	R.Frederiksen	Texas A&M Univ	6/20/91	7/1/91	11	0	PhD research, P. Esele, Pl.Pathology;
76	David Hansen	Ohio State Univ.	6/23/91	6/28/91	5	3	Administrative MFAD 50% OSU 50%
77	F. Hutchinson	OSU, VP & Prov.	6/23/91	6/26/91	3	0	Administrative; OSU 100%
78	B. Sundquist	Univ. Of Missouri	6/26/91	7/13/91	17	17	Capacity Bldg & Econometric Models
79	S. Thompson	Ohio St. Univ.	6/26/91	7/13/91	17	17	Capacity Bldg & Econometric Models
80	T. Carpenter	Ohio State Univ.	11/12/91	11/22/91	10	5	Field research of J. Kibalama
81	David Hansen	Ohio State Univ.	2/3/92	2/15/92	12	6	Participate in Annual Review & Retreat
82	Mark Erbaugh	OSU .Coordinator	2/3/92	2/20/92	17	17	Participate in Annual Review & Retreat
83	Calvin Martin	USAID	5/20/92	6/23/92	34	34	Research Sta. Org. and Management
84	Walter Wiles	La. St. Univ.	5/20/92	6/23/92	34	34	Research Sta. Org. and Management
85	W. J. French	Univ. Of Florida	5/20/92	6/23/92	34	34	Research Sta. Org. and Management
86	Wes Budke	Ohio State Univ.	10/21/92	11/7/92	17	8	Supervise field research of P. Padde
87	M.Erbaugh	OSU .Coordinator	2/17/93	5/20/93	92	0	Survey of farmer demand for research
88	D. Hansen	Ohio State Univ.	2/20/93	3/6/93	14	7	Administrative
89	L. Labao	Ohio State Univ.	2/20/93	3/6/93	14	7	Supervise field research of I. Fendru
90	L.Waters	Ohio State Univ.	3/16/93	3/21/93	5	0	View & asess hortic. pot. in Uganda
91	M. Morton	USDA	4/16/93	5/2/93	16	16	Develop success stories for MFAD
92	E. Jennings	Ohio State Univ.	6/15/93	6/30/93	15	10	Research foundation development

total days 1939 1157
person years 5.31 3.17
Total funded by AID = 60%

C. Training

C.1. External Degree Training Summary

	Name	Inst	Deg	Field of Study	Univ.	Departed	Returned	Comments/ Present Assignment
1	Ijoyi Fendru	MU	PhD	Rur Soc.	OSU	Dec-88	*	** ETR 12/93
2	L.Wabwire	MU	PhD	Ag Econ	Mo.	Aug-90	Mar-93	deceased
3	V. Kasenge	MU	PhD	Ag Econ	MU	Sep-90	Sep-91	Makerere PhD; coursework at OSU
4	J. Kibalama	MU	PhD	Ag. Eng	OSU	Dec-88	Jun-93	** teaching & research in Ag Engin Dept
5	M. Tenywa	MU	PhD	Soil Con	OSU	Sep-90	*	** ETR 12/93
6	J. S.Tenywa	MU	PhD	Soil Sci.	OSU	Sep-89	Apr-93	** teaching & research in Soil Sci. Dept
7	Mary Silver	MU	PhD	Soil Mic.	Fla	Aug-89	*	ETR 12/93
8	A. Ekwamu	MU	PhD	Pla.Path	OSU	Sep-88	Mar-92	** teaching & research in Crop Sci. Dept
9	R. Ssonko	MU	PhD	Hortic.	Fla	Sep-89	Jun-93	teaching & research in Crop Sci. Dept
10	Ssekabembe	MU	PhD	Crop Sc.	OSU	Aug-88	Dec-92	teaching & research in Crop Sci. Dept
11	D.Mutetika	MU	PhD	An. Sci.	OSU	Sep-89	Apr-93	teaching & research in Animal Sci. Dept
1	B. Matsiko	MU	MSc	Ed/Ext	Minn	Sep-88	Jun-90	** teaching & research in AgEd/Ext Dept
2	M. N.-Kasujja	MU	MSc	Ed/Ext	OSU	Sep-88	Apr-90	** pursuing PhD Minnesota/Rockefeller
3	J. Tibezinda	MU	MSc	Ed/Ext	Wisc	Sep-89	Jun-91	on PhD at OSU-World Bank/ARTP
4	G Ruhara	MU	MSc	Ed/Ext	WVa.	Aug-89	May-91	** transferred to MAAIF Extension
5	B. Kiiza	MU	MSc	Ag Econ	Minn	Sep-90	Apr-92	teaching & research in Ag Econ. Dept
6	G. Bahiigwa	MU	MSc	Ag Econ	Minn	Sep-90	Apr-92	teaching & research in Ag Econ. Dept
7	Sserunkuma	MU	MSc	Ag Econ	Minn	Sep-90	Apr-92	teaching & research in Ag Econ. Dept
1	B. Odongo	MA	PhD	Crop Sci	Purd	Sep-90	*	ETR 12/93
2	J. Imanywoha	MA	PhD	Crop Sci	Ut St.	Dec-89	Apr-93	rice/sunflower research at Namulonge
3	J.J. Hakiza	MA	PhD	Plant Br.	OSU	Jun-89	*	** ETR 12/93- Nat. Maize Prog.-Namul.
4	L. Serunjoji	MA	PhD	Plant Br.	OSU	Sep-89	Jun-93	Nat. Maize Research Program-Namul.
5	C.Butegwa	MA	PhD	Soil Sci.	Aub	Sep-90	*	ETR 12/93
6	D. Kyetere	MA	PhD	Crop Sci	OSU	Sep-90	*	ETR 12/93- Nat. Maize Prog.-Namul.
7	M. Magunda	MA	PhD	Soil Sci.	Minn	Sep-88	Jul-92	** soil physics research at Kawanda
8	P. Esele	MA	PhD	Pl.Path.	TAMU	Aug-88	Dec-91	** sorghum research; sta. director/Serere
9	G.Mukulu	MA	PhD	Entomol	OSU	Sep-89	Jun-93	either Namulonge or Kawanda
10	P. Padde	MA	PhD	Ag. /Ext	Aub	Sep-90	Jun-93	** National Extension Program/Entebbe
1	Drake Mubiru	MA	MSc	Soil Sci.	Ky	Sep-90	Dec-92	soil fertility research at Kawanda
2	P.K.-Jjemba	MA	MSc	Soil Sci.	Minn	Sep-88	Apr-91	soil micro/Kawanda; PhD under ARTP
3	O. Semalulu	MA	MSc	Soil Sci.	Ky	Jan-90	Jul-92	soil mgt research at Kawanda
4	G.Lukwago	MA	MSc	Ag Econ	Fla	Dec-89	May-92	FSSP in Mukono
5	Peter Mijumbi	MA	MSc	Ag Econ	Fla	Jan-89	May-91	On PhD at Florida; private fellowship
6	Mary Mugisa	MA	MSc	Ag Econ	OSU	Sep-89	Sep-91	Nati. Bean Research Program Kawanda
7	G.Opio	MA	MSc	Ag. Eng.	Minn	Sep-88	Aug-90	animal traction research at Soroti
8	Y. Obong	MA	MSc	Crop Sci	WVa.	Aug-89	Jul-91	groundnut research at Namulonge
9	J. Ssembatya	MA	MSc	Ag. /Ext	OSU	Aug-88	Apr-89	deceased
10	A. E.-Okiria	MA	MSc	Ag. /Ext	OSU	Sep-88	Dec-89	Principal of Arapai Agric. Tech. College

** will finish after PACD* *** Conducted research in Uganda*

C.2. List of external degree dissertations/theses

	Name	Degree	Thesis title
1	David Mutettika	Ph.D.	Some tropical forage leaf meals and their value in pig feeding
2	Joseph Kibalama	Ph.D.	Improvement of traction and maneuverability of a mono wheel drive tractor for a developing country
3	Valentine Kasenge	Ph.D.	Farm management information needs, availability and applicability for decision making in Ugandan practice.
4	Charles Ssekabembe	Ph.D.	Cutting or pruning management to reduce hedgerow root competition from leuceana alley cropped with maize.
5	Adipala Ekwamu	Ph.D.	Variation in field populations, disease development and yield losses associated with exserohilum turcicum in Uganda.
6	Mary Silver	Ph.D.	Trehalose: a possible determinant of competitiveness in rhizobium phaseoli.
7	Robinah Ssonko	Ph.D.	Calcium nutrition and bacterial wilt management in tomatoes.
8	John Stephen Tenywa	Ph.D.	Crop residue influence on exchangeable aluminum, potassium availability and seedling root growth in an oxisol.
9	Ijoyi Fendru	Ph.D.	Socioeconomic constraints to access to agricultural credit: a comparative study of women and men farmers in Uganda.
10	Moses Tenywa	Ph.D	Spatial and temporal variability in soil properties, runoff and erosion.
11	Dick Sserunkuma	M.Sc.	The role of roads, credit and political stability in agricultural development: a case of soybeans in Uganda.
12	Godfrey Bahiigwa B.	M.Sc.	The declining production trends for cotton in Uganda: a regional analysis and policy implication.
13	Biryabaho Matsiko F.	M.Sc.	Effectiveness of third party interviewers in identifying farmers needs for the purposes of extension program planning in Uganda.
14	Barnabas Kiiza	M.Sc.	The impact of the structual adjustment in Uganda: the case of agricultural supply response.
15	George Ruhara-Tweheyo	M.Sc.	Perceptions of extension supervisors and development committe chairmen regarding recent makerere agricultural graduates as extension agents in Uganda.
16	Jovan Tibenzinda	M.Sc.	The actors in Third World agricultural research- the Uganda case.
17	Margaret N. Kasujja	M.Sc.	An asessment of the technical and professional competency neeeded by extension personnel in the central region of Uganda.
18	Paul Padde	Ph.D.	An evaluation of the supervisory techniques of the extension supervisors as they relate to the job performance among the extension agents in the agricultural extension service in the eastern region of Uganda.

	Name	Degree	Thesis title
19	Gloria Mukulu	Ph.D.	Evaluation of various control methods for the banana weevil, cosmopolites sordidus : implications for integrated control of the pest in Uganda
20	Christopher Butegwa	Ph.D.	Laboratory and greenhouse studies to evaluate Uganda rock phosphate for direct application.
21	John J. Hakiza	Ph.D.	Variations in expression of exserohilum turcicum (pass) leonard & suggs symptoms due to the monogenic and polygenic resistance in corn (zea mays l)
22	Lastus Serunjogi	Ph.D.	Heritability, genotypic and phenotypic correlation studies for seed yield, protein and oil percent in populations of soybean with and without rhizobium inoculation.
23	Peter Esele	Ph.D.	The genetics of grain mold resistance in sorghum (sorghum bicolor l. Moench)
24	Matthias Magunda	Ph.D.	Influence of soil mineralogy and organic matter on soil strength and soil detachment.
25	Denis Kyetere	Ph.D.	Determination of the genetic basic of resistance to maize streak virus disease using molecular markers.
26	Benson Odongo	Ph.D.	Models relating the impact of a phytoseiid predatory mite, euseius fustis (acari: phytoseiidae) and environmental factors on cassava mite.
27	Justus Imanywoha	Ph.D.	Production and Indentification of Primary Trisomics in Diploid Agropyra Cristatum (L) Geartn.
28	Kayondo-Jjemba P.	M.Sc.	Effecient Nitrogen Fixation, P utilization and low P tolerance in common bean cultivars.
29	Drake Mubiru	M.Sc.	Mineralogical and P-sorption characteristics of some highly weathered soils in south central Kentucky.
30	Yuventino Obong	M.Sc.	Dynamics of growth of Red clover (Trifolium Pratense l.) And Kentucky Bluegrass (Poa Pratensis l.) In a native pasture.
31	Peter Mijumbi	M.Sc.	Economic analysis of maize production in two districts in Uganda.
32	George Lukwago	M.Sc.	Changes in the farming systems and farmers' decisions in Masaka District in Uganda.
33	Onesimus Semalulu	M.Sc.	Phosphorus and potassium calibration for postmine soils of western Kentucky.
34	Gaudesius Opio	M.Sc.	Design, manufacture and testing of agricultural implements/ machinery suited for use in developing countries.
35	Mary Mugisa	M.Sc.	Estimation of on farm enterprise costs of production and its policy implications with particular reference to Ohio.
36	Amos Edukut-Okiria	M.Sc.	Working under adversity: job satisfaction of agricultural teachers in Uganda.
37	George Ruhara	M.Sc.	Perceptions of regional and district agricultural officers, development committee chairmen and ext. agents regarding recent MU/FAF graduates as ext. agents in Uganda.

C.3. In-country MSc Students Sponsored by USAID/MFAD (1991 intake)

	Name	Institution	Field of Study	Supervisor(s)	Start	Finish
1	Akoyi Kevin	MAAIF	Agr Economics	Vanegas, Grisley	Jul-91	Apr-93
2	Kasenge V.*	MU/FAF	Agr Economics	Forster(OSU)	Jul-91	Apr-93
3	Khauka R.L.	MAAIF	Agr Economics	Shetty, Grisley	Jul-91	Apr-93
4	Kiwanuka V.	MAAIF	Agr Economics	Ngambeki	Jul-91	Apr-93
5	Mwanje E.	MU/FAF	Agr Economics	P. Ngategize, Denton	Jul-91	Apr-93
6	Nahwoga J.	MAAIF	Agr Economics	P. Ngategize	Jul-91	Apr-93
7	Nannyonga H.	MU/FAF	Agr Economics	Vanegas, Hyuha	Jul-91	Apr-93
8	Okiror M.M.	MAAIF	Agr Economics	Shetty, Vanegas	Jul-91	Apr-93
9	Ongom B.S.	MAAIF	Agr Economics	Ngambeki, Ddungu	Jul-91	Apr-93
10	Otim Samuel	MAAIF	Agr Economics	P. Ngategize	Jul-91	Apr-93
11	Sebunya G.	MAAIF	Agr Economics	Vanegas, Grisley	Jul-91	Apr-93
12	Senteza J.	MU/FAF	Agr Economics	Vanegas, Ngambeki	Jul-91	Apr-93
13	Tayebwa B.	MU/FAF	Agr Economics	Vanegas	Jul-91	Apr-93
14	Batte G.	MU/FAF	Agr Engineer.	Arnold, Rugumayo	Jul-91	Jun-93
15	Osinde P.	MU/FAF	Agr Engineer.	Arnold, Magunda	Jul-91	Jun-93
16	Kawongolo J.	MU/FAF	Agr Engineer.	Rugumayo	Jul-91	Dec-93
17	C.D. Waiswa	MU/FAF	Animal Science	Bareeba	Jul-91	Jun-93
18	Anyanga W.O.	MAAIF	Crop Sci/Brding	P. Rubahaiyo	Jul-91	Jun-93
19	Baguma Yona	MAAIF	Crop Sci/Agron	Osiru	Jul-91	Jun-93
20	Iceduna C.L.	MAAIF	Crop Sci/Entom	A. Ekwamu	Jul-91	Jun-93
21	Kalule Twaha	MAAIF	Crop Sci/Entom	Latigo, Okoth V.A.	Jul-91	Jun-93
22	Sekamatte B.	MAAIF	Crop Sci/Entom	Latigo, Okoth V.A.	Jul-91	Jun-93
23	Kanzikwera R.	MAAIF	Crop Sci/Agron	Osiru	Jul-91	Jun-93
24	Opio-Otim S.	MAAIF	Crop Sci/Path	Osiru, A. Ekwamu	Jul-91	Jun-93
25	Elobu Pius	MAAIF	Crop Sci/Path	Osiru, Zake	Jul-91	Jun-93
26	Takan O.J.P.	MAAIF	Crop Sci/Path	A. Ekwamu, Latigo	Jul-91	Jun-93
27	Mpairwe D.	MAAIF	Crop Sci/Past	Sabiiti, Mugerwa	Jul-91	Jun-93
28	Lusembo P.	MAAIF	Crop Science	Sabiiti, Mugerwa	Jul-91	Jun-93
29	Night G.	MU/FAF	Crop Science	Latigo	Jul-91	Jun-93
30	Ouma E.	MAAIF	Crop Science	Latigo, Okoth V.A.	Jul-91	Jun-93
31	Oonyo J.	MU/FAF	Crop Science	Latigo	Jul-91	Jun-93
32	Nyambiro-M.	MAAIF	Crop Sci/Entom		Jul-91	Jun-93
33	Muramira T.	MU/FAF	Agroforestry	Aluma, Marquart	Jul-91	Jun-93
34	Atukunda A.	MU/FAF	Agroforestry	Aluma, Sabiiti	Jul-91	Jun-93
35	Lubowa D.	MAAIF	Soil Science	Zake, Osiru	Jul-91	Jun-93

* PhD Candidate

C.4. Incountry MSc Thesis titles

	Name	Thesis Title
1.	Akoyi Kevin	Production Responsiveness of Cotton in Uganda.
2.	Khauka R.	An Econ. Analy. of Demand and Supply of Agric. Inputs at the Farm Level
3.	Mwanje E.	Supply Response and Technology Adoption of Uganda Maize Farmers Econometric Analysis and Policy Considerations.
4.	Nalwoga J.	Soybean Acreage Response: A National Econometric Fruit and Vegetable Marketing in the Economic Development of Uganda.
5.	Nannyonga H.	Impact of Donor Funding on the Supply Response of Sugar in Uganda.
6.	Otim S.	The Uganda Coffee Industry, The Impact of Sub-sector and Micro Economic Policies on Coffee supply, Returns and Exports.
7.	Okiror M. M.	Tobacco Supply Response for Arua Farmers.
8.	Ongom S. B.	Food Crop Production in Ugandan Agric. Policy.
9.	Ssenteza J.	Economic Analysis of Rice Industry in Uganda. Case of Kibimba Rice Co.
10.	Sebunya G.	The Income and Price elasticities of Home Consumption and Marketed Surplus of Beans: A Case Study of Masaka.
11.	Tamanyirwa V.	Impact of Government Policy on Agric. Development Programmes: A Case of Coffee Rehabilitation Programme in the Lake Crescent Zone.
12.	Tayebwa B.	An Economic Analysis of The Production of Maize in Uganda: A Case Study for Masindi District.
13.	Mpainwe D.	Evaluation of Gliricidia Sepium as a Fodder Tree for Ruminant Prod.
14.	Nyambiro Mugume	Effects of Spacing and Fertilizer (Organ. and Inorg.) on Mulbery Prodn.
15.	Opio-Otim S.	Investigation on Growth and Production of Grafted Vs Non-Grafted Passion Fruits Raised on Tree Lises.
16.	Atukunda A.	Silvipastoral Practices with specific Reference to Government sponsored Singo Ranching Scheme.
17.	Muramira T. E.	The Effects of Hand Tenure Systems on Land use and Natural Resource Conservation in Mpigi and Masindi Districts.
18.	Anyanga Walter O.	Genetic Studies of some Characters Correlated to Yield, their Inter-relationship and Heritability Estimates in Sesame (Sesamum inducum L.)
19.	Lusembo Peter	Agronomic Studies for Forage Legume Seed Production.
20.	Kawongolo J. B.	Dev' of Decorticator for Small/Medium Scale Fibre Crop Processing.
21.	Kanzikwera R. K.	The Effect of Seed Size and Plant Population on Marketing Yield of Potatoes (Solanum tuberosum L.) at High and Low Elevations in Uganda.
22.	Batte George	Development of a Gasifier Unit for use in Drying Agricultural Products.
23.	Baguma K. Yona	Dry Matter Production and Partitioning in Cassava (Manihoti esculenta crantz) Intercropped with Maize (Zea mays)
24.	Elobu Pius	Performance of Selected Potato (Solanum tuberosum) Genotypes in Relation to Plant Population and Nitrogen Levels in the Lowland Tropics.
25.	Takan John P.	Host Resistance, and The Effect of Plant Population and Residue Level on The Epidemiology of Northern Leaf Blight of Maize in Uganda.
26.	Ssekamate B. M.	Studies on the Pest Status and Control of the Cotton aphid, Aphis gossipii glover (Aphididae, Hem) in Ugandan.
27.	Iceduna C. L.	Selection for Resistance and Fungicidal Control of Scab of Cowpea (Sphaceloma sp.) in Uganda.
28.	Twaha M. Kalule	Investigations on the Pest status and control of Graminaecious stem borers of Maize in Uganda.
29.	Night Gertrude	Evaluation of Pest Status and The Resistance of Some Pigeonpea Cultivars to Major Pests in Uganda.
30.	Osinde Peter	Interill Erodibility of selected Uganda Soils based on the WEPP Model.
31.	Waiswa D.	Developing Low cost Rations For Feeding Growing Rabbits.
32.	Ouma Eric.	Pest Status and Resistance to Short-flies (Atherigona sp.) on Finger Millet (Eleusine coracana) in Uganda.
33.	Mbalule Moses	The Effect of Soyabean Population Density on Soil Nutrient Depletion (N P and K) and Sustainable Soil Productivity.
34.	Kasenge Valentine	Econ. Analy. and Spatial Organ. of Gain Seed Supply System in Uganda.

C.5. Training/External Short Term

Name & Title	Home Institute	Training Location	Training Emphasis	Date Depart.	Prog. Lgth (Wks)
Okello, J. SRO	MAAIF/ Serere R. S.	OSU	Agronomy, Exp Design	Jun-84	12
Mwaule, Y.W Director	MAAIF/ Serere R. S.	USDA OSU/ Wooster	Mgt. Of Exp Station Designing Field Exp.	Jul-84	14
Ddungu, J. Professor	MU/FAF Crop Science	Monterrey, Calif.	Handling of Veg. Crops	Jul-84	4
Nangoti, N SO	MAAIF/ Serere R. S.	OARDC, Wooster/OSU	Soil sampling and analysis and soil fertility	Apr-85	18
Zake, J., Chr. Soil Sci	MU/FAF Soil Science	IFDC & OSU	Dev. of Indigenous Phosphate Deposits Lab. and Lit. Review	May-85	14
Nyakooje, F. SAO	MAAIF/ Entebbe	New Mexico State Univ. & Western Illinois Univ.	Data Base Statistics; analytical systems for economic decision making; intensive training in use of personal computer	May-85	17
Mafulira, T.; Biometrician	MAAIF/ Serere R. S.	U. of Missouri & U. of Minnesota	USDA TC 110 - 17 Ag. Research Methodology & Intensive training in use of personal computer	May-85	14
Bareeba, F. Lecturer	MU/FAF Animal Science	Virginia Polytechnic Univ.(VPI)	Re-use of protein from waste materials in animal rations.	Jun-85	19
Acidria, M. SO	MAAIF/ Serere R. S.	Rutgers U. & OSU	Vegetable crop prod. and marketing; varietal testing USDA TC 130-11	Jun-85	12
Owera, S. Lecturer,	MU/FAF Crop Science	U. of Calif. (Riverside ; Davis)	Breeding disease resistance in edible beans	Jun-85	19
Ruyooka, D. Chr. Forestry	MU/FAF Forestry	Univ. of Arizona	Resource dev. of watershed lands, Forestry in arid environments, Mycological methodology.	Jun-85	22
Fendru, I. Lecturer	MU/FAF Ag Econ	Mich. State University	Survey research, Production economics	Jun-85	17
Magunda, M. SO	MAAIF/ Namulonge R.S	Colorado State Univ. & OSU	USDA TC 120-1 Irrigation problems and practice; Drainage problems./Agric. Res.	Jun-85	12
Mwega, V. SSO	MAAIF/ Serere R. S.	Auburn Univ. & Western Illinois Univ.	USDA TC 120-5 Soil testing & fertilizer management & Keys to Agric. Dev. at the local level.	Jun-85	13
Kiggundu, M., Director	MAAIF/ Kawanda R. S	George Mason U. & Texas A & M Univ.	Managment of Ag. Res. USDA TC 140-24 & Soils analysis	Jul-85	15
Dradu, E., Director	MAAIF/ Namulonge R.S	George Mason U. & Texas A & M Univ.	Managment of Ag. Res. USDA TC 140-24; Cotton production	Jul-85	13
Ziwa E Lecturer	MU/ FAF Ag Econ	OSU & U. of Wisconsin	Cooperative Development	Jul-85	9
Kasisira L. Lecturer	MU/ FAF Ag. Eng.	Univ. of Nebraska	Tractor testing and equipment design	Jul-85	20
J. Kibalama, Lecturer	MU/ FAF Ag. Eng.	Univ of Nebraska	Animal powered tillage	Jul-85	20

Okurut-Akol, H., SO	MAAIF/ Serere R. S.	Denver Wildlife Res. Sta. & Sandusky Wildlife Res Sta.	Bird pest control	Jul-85	14
Kamajje, D.	MAAIF/ Serere R. S.	OARDC; Wooster; Purdue Univ.	Bread baking technology & Food Tech	Jul-85	12
Msemakweli, L. Sr. Lecturer	MU FAF Ag Econ	Michigan State	Data collection, data management	Jun-86	11
Sakira, W. Acting Dir. of Res.	MAAIF/ Kawanda R. S	USDA; U. of Minnesota; OSU	Agric. Res. Stat. Mgmt; Weed research and spraying techniques	Jul-86	12
Epila-Otara, J. Lecturer	MU/ FAF Forestry	OSU	Wildlife management and Ecology, feeding habits of sap sucking insects.	Jul-86	11
Kintukwonka, A.; SSRO	MAAIF/ Namulonge R.S	USDA; U. of Minnesota; OSU	Mgmt. of Agric. Research; Soil testing; Soil fertility res.	Jul-86	12
Uma, I. Sr. Lecturer	MU/ FAF Soil Science	OSU	Soil and Water Conserv.	Aug-86	3.5
Kakusya, G. Lecturer	MU/ FAF Animal Science	Texas A & M	Reproductive endocrinology in the goat.	Aug-86	8
Kibirige-Sebunya,I, Sr. Res. Scientist	MAAIF/ Kawanda R. S	Florida State; Manhattan, KA	FSR techniques & Multiple cropping techniques	Aug-86	10
Bafokuzara, N. RO	MAAIF/ Kawanda R. S	USDA; OSU	Plant quarantine; Crop loss assess. & Plant pest mgmt. tech.	Aug-86	10
Akou, A. AO/ Ox Cult.	MAAIF/ Serere R. S.	Agric. Tech. Inst./ OSU; LSMOCO (Nev.)	Draft animal tech.; Draft animal machine design.	Sep-86	10
Odogola, W. Res./ Ag.Eng.	MAAIF/ Serere R. S.	Michigan State & U. of Minnesota	Solar drying and harvesting tech.	Sep-86	12
Ssendiwanyo, E. Soil Survey Officer/ Pedologist	MAAIF/ Kawanda R. S	OSU	Pedology & Soil survey	Sep-86	14
Munya-buntu, C. Lecturer	MU/ FAF Animal Science	U. of Georgia	Mineral and Vit. metabolism in ruminants.	Oct-86	6
Sabiiti, E. Lecturer	MU/ FAF Crop Science	OSU & U. of Florida	Pasture legumes; Research and Dev	Oct-86	10
Muduuli, D. Lecturer	MU/ FAF Soil Science	OSU	Food Science/ tech.	Oct-86	10
Tumuhairwe, J. Lecturer	MU/ FAF Soil Science	OSU	Soil survey and class Soil Mgmt. & Conserv.	Oct-86	10
Ekwamu, A Lecturer	MU/ FAF Crop Science	OSU & Texas A & M	Plant Pathology & Cereal Pathology	Jan-87	12
Banana, A. Lecturer	MU/ FAF Forestry	OSU	Sawmilling & Forest products.	Jan-87	8
Adupa, R. Lecturer	MU/ FAF Crop Science	OSU & U. of Wisconsin	Biometrics & Computer Use	Jan-87	8
Olaboro, G. Lecturer. Res.	MU/ FAF An. Science	OSU	Poultry management	Apr-87	8
Anyii, C. Agronomist	MAAIF/ Serere R. S.	OSU & CIAT	Pasture agronomy	Apr-87	12
Esele, J.P. Researcher	MAAIF/ Serere R. S.	OSU & U. of Minnesota	Plant Pathology	Apr-87	12

Rubaihayo, P. Lecturer, Res	MU/ FAF Crop Science	OSU & Illinois	Plant breeding	Apr-87	8
Byarunanga K. Sr. Lecturer & Acting Head	MU/ FAF Forestry	OSU	Soil fertility, Forestry, nursery mgt	Apr-87	6
Ameny, M. Lecturer	MU/ FAF Soil Science	OSU, U. of Wisconsin & CIAT	Biochemistry & Cassava	Apr-87	8
Ochwol, V. Lecturer,Res.	MU/ FAF Soil Science	OSU	Soil and water mgt.	Apr-87	9
Wabwire, L. Sr. Lecturer	MU/ FAF Ag Econ	OSU& USDA	Marketing	May-87	12
Namaganda, J. SO	MAAIF/ Kawanda R. S	OSU, USDA & U. of Florida	Pest management	May-87	12
Isabirye-Balaba, M.	MAAIF/ Mas. Seed Project	OSU & USDA	Seed improvement	May-87	12
Iputo, G. SAAO	MAAIF/ Serere R. S.	OSU & USDA	Seed improvement	May-87	12
Nabasirye, M. SO	MAAIF/ Kawanda R. S	OSU & USDA	Res. Methodology & Biometrics	May-87	12
Waibale, J.	MAAIF/ Entebbe	OSU, USDA & U. of Minnesota	Res. Admin.	Jun-87	8
Okello-Uma, I. Assoc. Prof.	MU/ FAF An. Science	OSU & USDA	Dairy Production & Res. Admin.	Jun-87	8
Kiwuwa, G. Prof.	MU/ FAF Animal Science	OSU & USDA	Dairy herd mgnt & Res. Admin.	Jun-87	12
Rubaihayo, E. Dir. KRS	MAAIF/ Kawanda R. S	OSU, USDA & U. of Minnesota	Maize breeding & Res. Admin.	Jun-87	12
Ojacor, F. Dep. Comm. Ag.	MAAIF/ Entebbe	OSU, USDA, & U. of Minnesota	Ag. Policy & Extension Admin.	Jun-87	12
Kavuma, J. SRO	MAAIF/ KRS	OSU, USDA & IFDC	Soil testing & Fertilizer mgnt.	Jun-87	14
Ssali, C. AO/ Soil Survey.	MAAIF/ Namalere R.S.	OSU & U. of Minnesota	Soil Taxonomy, Soil survey, land use	Jun-87	12
Koma-Alimu, F. RO	MAAIF/ Serere R. S.	OSU, USDA, & Purdue University	Soil testing and fertilizer mgnt.	Jun-87	12
Silver, M. Lecturer	MU/ FAF Soil Science	OSU	Soil microbiology, Nitrogen Fixation	Jun-87	12
Bua, A. Oil Crop Agron.	MAAIF/ Serere R. S.	U. of Minnesota	Oil seed crops	Jul-87	8
Mugerwa, J. Dean of Ag.	MU/ FAF Adm.	OSU	Admin. Curric. and Faculty Development	Aug-87	3
Okuni, A. SO, Ox Cult.	MAAIF/ SR.S.	OSU	Drafting and mechanics	Aug-87	8
Emeetai-Areke, T	MAAIF/ SR S	ICRISAT	Breeding pigeon pea,cowpea	Aug-87	12
Nyamwegyendaho, A Asst. Comm/ Trng	MAAIF/ Entebbe	OSU & U. of Minnesota	Training; Agric. & rural Dev.	Aug-87	12
Gombya-Sembajjwe, W. Lecturer	MU/ FAF Forestry	OSU	Forest econ., Forest resource dev.	Sep-87	12
Nanzin, S.	MAAIF/ EBS	IITA	Maize Res and Prod.	Oct-87	12
Adupa, Joyce PSC	MAAIF	Univ. of Wisconsin	USDA/TC 110-5 Agric. Ext Programs for Dev. Countries.	May-88	9
Odongo, J.C.W. PRO	MAAIF	USDA/TC 140-24	Management of Agric Res.	Jun-88	10
Ayo, Christopher SO/ Agronomist	MAAIF/ Kawanda R. S	USDA TC 1311	Vegetable Crop Prod. & Marketing	Jun-88	9

Mubiru, Ruth Biochem Technolist	MU/ FAF An. Science.	OSU	Basic Lab. techniques in animal Science	Jul-88	6
Muwonge, G.W Lab. Tech.	MU/ FAF Crop Science	OSU	Basic Lab. techniques in Crop Science.	Jul-88	6
Katwire David Technician	MU/ FAF Soil Science	OSU	Basic Lab techniques in Soil Science	Jul-88	6
Nemeya, Ponciano SO	MAAIF/ Kawanda R. S	Texas Tech Univ.	USDA/ TC 130-8 Integrated Pest Mngt	Jun-89	6
Lwanga, C. Lab. Tech.	MU/ FAF Crop Science	OSU	Crop science lab. techniques	Jun-89	8
L. Sekalye P. Tech.	MU/ FAF Forestry	OSU	Forestry Lab. techniques	Jun-89	8
Kaboggoza, J. Sr Lecturer	MU/ FAF Forestry	OSU	Forest Products	Jun-89	7
Ssenyimba, Joseph Lab.Tech.	MAAIF/ Kawanda R.S.	OSU	Basic Lab. techniques in Soil Science.	Jun-89	7
Luyiira, M.K. Lab.Tech.	MAAIF/ NRS	OSU	Basic Lab. techniques	Jun-89	7
Baliddawa, C. W. Lecturer/ Head	MU/ FAF Crop Science	OSU	Entomology-insect sampling data analysis.	Jul-89	7
Bakabweyaka G.	MOA/Agric. Officer	USDA/TC 130-11	Vegetable Crop Prod. & Rutgers Univ.	Jul-89	7
Hakiza G. RO/ Plant pathology	MAAIF/ Kawanda R. S	OSU	Plant disease clinic operation	Jun-90	8
Sentongo, D. S. Rev. Univ.Secretary	MU/ Adm.	OSU	Univ. Adm. Management	Jul-90	4
Onyango, B. Univ. Registrar.	MU/ Adm.	OSU	Univ. Adm. Management	Jul-90	4
Okot M. Senior Lecturer	MU/ FAF Animal Science	Small animal extension methods, processing	OSU; Land O' Lakes	Jul-90	6
Tushemereirwe W. RO Plant pathologist	MAAIF/ Kawanda R. S	OSU	Plant pathology research methods, statistical techniques	Jul-90	9
Rubaihayo E. Director	MAAIF/ Kawanda R. S	OSU	New techniques in research administration	Jul-90	8
Gumisiriza G. SRO/ Legume Breeder	MAAIF/ NRS	Soybean production and practices	OSU	Jul-90	5
Idembe M. SO/ Agronomist	MAAIF/ NRS	OSU & Fort Valley	Soybean production and practices	Jul-90	8
Omoding J. O. Y. Asst. Commissioner	MAAIF/ Entebbe	Univ. Of Wisconsin	Devt. and operation of Agric. Extension programs	Aug-90	8
Lubega D. Agric. Officer	MAAIF/ Entebbe	Univ. Of Wisconsin	Agric. extension program management coordination & preparation	Aug-90	9
Aluma J. R. W. Head	MU/ FAF Forestry	OSU	Forest management and teaching techniques	Aug-90	4
Lwanga E. Librarian	MAAIF/ KRS	OSU	Agric. Research library training	Aug-90	9
Najjingo Kasujja M. Lecturer	MU/ FAF Ag Ext Ed	Thesaloniki, Greece	Methods and management of practical agric. training	Jun-91	2
Mayanja C. Lab. Technician	MU/ FAF An. Sc.	OSU	Animal Sci. laboratory operations	Aug-91	4
Sentongo B. Lab. Tech.	MU/ FAF Soils	OSU	Soil Sci. laboratory operations	Aug-91	4

Total Person Weeks of Training = 967.5
Total Person Years of Training = 18.61

C.6. Training/ In-country Conferences & Workshops

Title	Date	Location	Purpose	# attending
Soil Science Society Of East Africa Conference	Dec-86	Kampala	bring together soil scientists to promote the study, research, and teaching of soil science and related subjects.	160
Makerere University Donors' Conference	Jul-87	Kampala International Conference Centre and Makerere University, Main Hall.	To find ways and means of assisting the University to overcome its present grave difficulties.	157
Soybean Research Workshop	Sep-87	Namulonge	Establish research strategy and guidelines for the National Soybean Research Program	25
Extension-Research Linkage Workshop	Sep-87	Mukono	Stengthen ties between research and extension and develop strategies for reinforcement	35
Uganda Pasture Network Workshop	Dec-87	Kampala	Regional conference to re-establish pasture research scientist linkages in East Africa and within Uganda	100
A Workshop On The Improvement Of The Effectiveness Of Agricultural Extension In Uganda	Sep-88	Mukono, DFI	To examine the failures of the agricultural extension as well as methods of improving its effectiveness.	53
On-Farm Research Workshop	Mar-89	Faculty of Agric and For, Makerere Univ., Kampala	To iron out policy, methodological and training issues pertaining to the execution of On-farm Research (OFR)	35
Farming Systems Research Workshop	Mar-89	MU/MAAIF	Establish guidelines and approaches to farming systems research in Uganda in collaboration with CIMMYT	45
Bean Research In Eastern Africa Workshop	Jun-89	Mukono	Status of bean research in Uganda and East Africa; future planning	30
Irrigation Research Techniques	Jul-89	Makerere University	To develop and recommend irrigation systems at Kawanda, Namulonge, Mubuku and Kabanyolo University Farm.	28
BNF Technology, UCCU, ACDI, MFAD Workshop	Oct-89	Kampala International Conference Center	Promote BNF technology and explore possibilities	40
Pedagogy. Curriculum Development And Evaluation Workshop	Jan-90	Bushenyi DFI	Agricultural training requirements and curriculum adjustments necessary to meet these needs	20
CIMMYT Farming Systems Data Analysis Workshop	Nov-90	Makerere	Methodologies for data analysis unique to farming systems research	45
Integrated Pest Management (IPM) Workshop	Apr-91	Mukono, DFI	To identify and review strategies of IPM technology development, implementation, and transfer applicable to pest management problems in agriculture.	31

Soil Science Society Of East Africa Conference	Dec-91	Colline Hotel, Mukono	Sustainable land productivity and environmental protection - a key to National Development	111
First National Workshop On Soybean Production And Utilization	Mar-92	Mukono D.F.I	Skills in processing and utilization of soybeans	25
Root Crops Symposium	Nov-92	Uganda International Conference Centre, Kampala	Root crop scientists from Africa to discuss research results and to determine root crop research priorities	125
Maize Planning Sessions	Dec-92	Namulonge	Exchange views and information about maize based cropping systems, identify crucial constraints to maize production, proposals that can address the problems	25
2nd Uganda Pasture Network Workshop	Dec-92	Fac. of Veterinary Medicine, Makerere University	Pasture and Feeding Systems for Sustaining Livestock Production and the Environment.	85
The First Multidisciplinary Academic Convention On Agrobased Manpower Development - 1993	Feb-93	Makerere University Agricultural Research Institute, Kabanyolo	A Concerted Effort in Transforming Uganda's Agricultural Systems	200
First Crop Science Conference For Eastern And Sourthern Africa	Jun-93	International Conference Centre, Kampala, Uganda	Sustaining Crop Production in Africa: Challenges to Science.	300
			Total Persons attending	**1,675**

D. Partial list of professional research publications generated under MFAD

MAKERERE UNIVERSITY

Adipala E., Ssango F. and Opulong H		Pathogen Variability and reactions of maize populations to Exserohilum Turcicum
Adipala E. Lipps P. E. and L. V. Madden		Reaction of Maize Cultivars from Uganda to Exserohilum turcicum
Adipala E., Lipps, P. and Madden L. V.	1991	Reaction of corn lines from Uganda to Exserohilum turcicum. (Abstr.) Phytopathology 81:1146
Adipala E. Lipps, P. E. and Madden L. V.	1993	Occurrence of Exserohilum turcicum on maize in Uganda. Plant Dis. 77:202-205
Ekwamu A. Lipps, E. and Pratt R. V.	1991	Reaction of maize lines from Uganda to Exserohilum turcicum. Phytopathology (in press)
Adipala E. Lipps. and Madden L. V.	1993	Effect of disease assessment method on predicting yield loss due to northern leaf blight on maize in Uganda. Submitted in 1992 to Phytopathology
Adipala E. Lipps. and Pratt R. V.	1993	Progress and spread of northern leaf blight of maize form inoculated foci. Submitted in 1993 to Phytopathology
Adipala E. Lipps. and Pratt R. V.	1993	Reaction of 150 OHS10 S_1 lines to Exserohilum turcicum races O an 1. Submitted in 1993 to Plant Dis.
Adipala E.	1989	Host range, Morphology, and Pathodenecity of the genus Pyricularia in Uganda. E. Afr. Agric. For J. 54 (3):101-105.
Adipala E.	1990	The optimal spray regime for the control of important diseases of finger millet in Uganda. E. Afr. Agric. For. J. 55 (3):87-93.
Adipala E. and Mugerwa J. S.	1992	Effect of Nitrogen, phosphorus, and potassium fertilization on the yield and chemical composition of Amaranthus hybridus subspecies hybridus. (Greenhead). E. Afr. Agric,. For. J. (in press)
Adipala E. and Mukiibi J. S.	1992	Determination of the optimal time to start and to stop spraying against important fungal diseases of finger millet in uganda. E. Afr. Agric. For. (in press)
Adipala E., Takan J.P. Mukalere Z. and Okoboi A.	1993	Effect of inter cropping maize with finger millet and Exserohilum turcicum and Physoderma maydis infections. E. Afr. Agric. For. J. (in press)
Adipala E. and Bua B.	1992	Effect of head blast severity on yield of finger millet. Paper presented during the 8th regional Workshop on sorghum and Millet Improvement of Eastern Africa, 30 October - 5 November 1992, Wad Medani, Sudan.
Ogenga-Latigo M. W. and Adipala E.	1992	Studies on Pests and Diseases of Grain legumes, Maize and sweet potato in Uganda. Crop Protection Section Research Bulletin No. 1 Faculty of Agriculture and Forestry, Makerere University, Kampala 53pp
Adipala E.	1993	Comparison of the logistic, Gompertz, and exponential models for depicting increase in number of northern leaf blight lesions on maize. Submitted in 1992 to Innovation and Discovery.
Adipala E. And Kiyingi D. S.	1993	Effect of planting date and plant population on severity of angular leaf spot and rust of beans. (Phaseolus vulgaris L.). Submitted in 1993 to E. Afr. Agric. For. J.
Adipala E. Mukalere Z. Takan J. P.	1993	Evaluation of cowpea lines for resistance to yellow blister disease and rust. Submitted in 1993 to E. Afr. J. of Sciences.
Adipala E. Okoboi C. A. Sekabembe C. K.	1990	Intercropping. Part 1: Foliar disease and yield of finger millet (Eleusine coracana L.) under monocropping and intercropping systems. submitted to Innovation and Discovery.
Adipala E. Okoboi C.A. Sekabembe C. K. Ogenga Latigo	1993	Intercropping. Part 2: Effect of finger millet on the yield and disease of pigeon peas, Phaselous beans, and sorghum. Submitted in 1991 to Innovation and Discovery.
Mukalere Z. G., Takan J. P. Okoboi C. A. & Adipala E.	1993	Preliminary evaluation of cowpea lines for resistance to Sphaceloma sp. Submitted in 1993 to E. Afr. Agric. For. J.
Adipala E. and Takan J. P.	1993	Effect of time of placement of infested maize residue on progress of northern leaf blight. To be submitted in June to Afr. Crop Sci. J.
Bua. B. Adipala E. and Ogenga-Latigo	1993	Quantification of the relationship between blast severity and yield of finger millet. To be submitted in March 1993 to Field Crop Research.
Edema J. Adipala E and Ogenga Latigo M.W.	1993	An evaluation of different fungicide treatments for the control of Synchtrium dolichi and Uromyces phaseoli diseases of cowpeas. To be submitted in March 1993 to Field Crop Research.
Iceduna C. Adipala E. and Ogenga Latigo	1993	Field reaction of 80 cowpea lines to natural inoculum of Sphaceloma sp. To be submitted in March 1993 to Journal of Agric. Research, Camb.
Iceduna C. Adipala E. and Ogenga-Latigo M. W.	1993	Effect of different chemical treatments on severity of scab disease of cowpeas. To be submitted in June 1993 to Int. Journal of Pest Management.
Takan J. P. and Adipala E. and Ogenga-Latigo	1993	Evaluation of the reaction of parent, BC_1 and BC_2 maize populations to Exserohilum turcicum. To be submitted in March 1993 to Journal of Agric. Research, Camb.
Takan J. P. Adipala E. and Ogenga Latigo M. W.	1993	Effect of maize population on progress and spread of northern leaf blight. To be submitted in March 1993 to Afr. Crop Sci. J.
Takan J. p. Adipala E. and Ogenga-Latigo M.W.	1993	Effect of infested maize residue level on epidemics of northern leaf blight. To be submitted in March 1993 to Afr. Crop Sci. J.

P. Lusembo E. N. Sabiiti and J. S Mugerwa		The Status of forage seed production in Uganda Abstract.
Mpairwe D. Sabiiti E. N. and Mugerwa J. S.		Potential of Legume shrubs and tree fodder as animal feedstuff
E N. Sabiiti and J. S. Mugerwa		Agronomic Evaluation of forage legumes for improving native pasture systems in Uganda
E. N. Sabiiti, J. S. Mugerwa and F. Bareeba		Pastures in sustaining soil fertility and crop production
E. N. Sabiiti and J. S. Mugerwa		Potential Browse species as feed for small ruminant production in Uganda
E. N. Sabiiti		Feeds and Feeding on a Zero-grazing unit in Uganda
E. N. Sabiiti, J. S. Mugerwa and F. B. Bareeba	1989	Forage legume germplsam evaluatiion in crop livestock farming systems in Uganda. Paper pubished in the The Pastures Netweork for Eastern and Southern Africa (PANESA) newsletter. Ed. B. H. Dzowela. No. 11 December 1989 pp 7 - 11.
E. N. Sabiiti and J. S. Mugerwa		Forage research and development for livestock production in Uganda
G. Olaboro, M. W. Okot, J. S. Mugerwa and J. D. Latshaw		Studies with Broiler chicks on growth depressing factor(s) in velvet beans (Stizolobium deeringianum).
G. Olaboro	1990	Performance of Broiler chicks fed diets containing cottonseed cake. E. Afr. Agric. for J. (1990) 55 4) 171 - 177
G. Olaboro, M. W. Okot, J. S. Mugerwa and J. D. Latshaw		Performance of Broiler chicks fed heat treated velvet beans. (Stizolobium deeringianum)
G. Olaboro, M. W. Okot, and J. S. Mugerwa		Amino Acit, Mineral, Tryspin inhibitor and proximate analyses of velvet beans
Kiiza Barnabas	1992	An Economitric Analysis of the Dynamics of the Beans Economy 92-1 Department of Agriculaural Economics.
Kiiza Barnabas	1993	Export Analysis and the Ugandan Economy FAPU working paper No. 93-1 (Forthcoming)
Kiiza Barnabaset al	1992	The Marketing of beans in Uganda. FAPU research Paper No. 4 Unpublished Report, 1992. Department of Agricultural Economics, Makerere University.
Kiiza Barnabaset al	1991	Summary of FAPU Outlook Staff Report No. 1-91
Kiiza Barnabaset al December, FAPU Report No.	1989	Data availability, Constraints and Utilisation. December, FAPU Report No. 1 1989
Rubaihayo P. R.	1988	The Makerere Totmato Improvement Program. Paper presented at Lusaka meeting on Utilisation of Mutagenesis in Crop Plants
Paper presented at the First National Plant Genetic Resources Workshop: Conservation and Utilisation.	1992	Performance of laocal and exotic germplasm of tomatoes (Lycopersicon esculentum Mill) in Uganda. Paper presented at the First National Plant genetic Resources Workshop: Conservationa and Utilisation. Mukono District Farm Institute Kampala Uganda. 9th -11th November, 1992
Rubaihayo. P. R.	1991	Makerre Univeristy Tomato Improvement Program. 1st Research Bulletin 1987 - 1990
Singh A. K. Rusoke, D. G. Latigo M. W. O. Mukuru. S. Z and S. Appa Rao	1992	Collecting legume germplasm in Uganda. FAO/IBPGR Plant Genetic Reseoruces Newsletter, 88/89:72-73
Singh A. K. Rusoke, D. G. Latigo M. W. O. Mukuru. S. Z and S. Appa Rao	1990	The current status of cowpea (Vigna unguiculata L. Walp): Production, Research and Utlisation in Uganda Paper presented at 1st National Conference on Food and Agriculture. Dec. 10th - 15 th 1990
Rusoke D. G. and Rubaihayo P. R.	1990	The status of the Grain Legumes Genetic Resources at Makerere University Agricultural Research Institute Kabanyolo 10th - 15th Dec. 1990
Rusoke D. G. and P. R. Rubaihayo	1992	Evaluation of Cowpea (Vigna unguiculata L. Walp) and Pigeonpea (Cajanus cajan Mill sp.) varieties in Uganda. Paper presented at 1st National Plant Genetic Resources Workshop: Conservation and Utilization. Mukono District Farm Institute. 9 - 11th November 1992
Rubaihayo P. R.	1991	Characterisation of Grain Legumes Germplasm at Kabanyolo. Faculty of Agriculture and Forestry, Annual Research Bulletin. Makerere University, Kampala Uganda
Odwongo W. O., Bareeba F. B. and Mugerwa J. S.	1987	Feed analysis and Evaluation In research Report Makerere Univeristy, Faculty of Agriulcure & Forestry Pg. 50
Odwongo W. O., Bareeba F. B. and Mugerwa J. S.	1988	Feed analysis and Evaluation - Evaluation of some forages - Research Bulletin, MUARIK, Makerere Univeristy pg. 38.
Odwongo W. O. Bareeba F. B. and Mugerwa J. S.	1988	The potential of comfrey (Symphytum of officinale) as animal feed feedstuff in uganda. In proc. of theFirst Uganda pasture Network Workshop, Makerere University, Kampala. 235pp.
Odwongo W. O. Bareeba F. B. and Mugerwa J. S.	1988	Evalatuion of Russian comfrey as an animal feedstuff in uganda - Paper presented at Animal Production Society of kenya Regional Conference, Nairobi, Kenya.
Bareeba F. B. and Mugerwa J. S.	1988	Use of research results to formulate a feeding strategy for livestokc during the dry seasons in ugnda. In proc. PANESA/ARNB joint workshop in Malawi. ILCA, Addis Ababa, Ethiopia.

Bareeba F. Kato H. and Mugerwa J. S.	1989	Poultry litter-treated maize silage for growing cattle. J. Anim. Sci. 67 suppl. 1 (Abstr. 1195)
Bareeba F. Odwongo W. and Mugerwa J. S.	1989	The performance of Sesbania species in Uganda - PANESA in Kisumu Paper presented at PANESA workshop on Sesbania. Kisumu, Kenya.
Bareeba F. B. Odwongo W. and Mugerwa J. S.	1990	The potential of green gram and velvet beas as forage legumes in Uganda - 1st National Scientific conference on Food and Agriculture Conference on Food and Agriculture. Kampala Uganda.
Barreba F. B. Odwongo. W. and Mugerwa J. S.	1992	The potential of Russian comfrey as an animal feed stuff in Uganda. In Stares. J. E. S., Said, A. N> and Ketegele, J. A. (eds). 1992. The complementanly of feed reseources for animal production in Africa. Proc. of the joint feed resources networks workshop, Gaborone, Botswana. AFRNET. ILCA, Addis Ababa, Ethiopia. 430pp.
Barreba F. B. Lusembo, P. and Mugerwa J. S.	1992	Introduction and Screening of Sestbania germplasm in the sub-humid zone of Uganda -AFRNET workshop on Sesbania, Nairobi, Kenuya
Bareeba F. and McClure K. E.	1992	Effect of ensiling corn stover with alfalfa or urea on intake and idegestibility by growing lambs. J. Anim. Sci. 70: Suppl. 1 (Abstr. 188).
Bareeba F. and McClure K. E.	1992	Changes in the chemical composition of lower and upper leaves of corn plants with advancing maturiety. J. Anim. Sci. 70: Suppl. 1 Abstr. 310)
F. B. Bareeba., E. N. Sabiiti, P. Lusembo and J. S. Mugerwa		Introduction and screening of Sesbania Germplasm in the sub-humid zone (Kabanyolo Farm) of Uganda .
J. R. F. Aniku, C. Arnold and I. O. Uma		Buffering capacity of Wetland soils in Southern Uganda
J. Aniku, C. Arnold and I. O. Uma		Extractable Cations, Acidity and pH trends in a reclaimed Histosol from Southern Uganda
Manuel Vanegas and Agnes Akwang	1992	An Economic Analysis of Milk Production costs and pricing in Uganda. Working paper #92-4
D. S. Ngambeki and M. Vanegas	1990	Baseline Survey of Farm Production in Uganda
Buchanayandi, T. Tweeten L., Cesar Amorin, Sam Zziwa, Edward Nsubuga	1990	Accelerated Food Crop Production Strategy, April 1990, Kampala Ug.
D. S. Muduuli, Okello-Uma, P. M. T. Hansen	1988	Establishment of a Department of Food Science and Technolgoy at Makerere Unviersity.
	1989	Food and Agricultural Policy Unit Data Availability, Constraints and Utilization in Uganda. Econometric Modelling and Policy Analyiss of the Bean Industry in Uganda. December 1989
Ssekabembe C.K. and Henderlong, P. R.	1991	Some aspects of competition for environmental resources in alley cropping. In Peter Williams (ed.). Agroforestry in North America. Proceedings of the First conference on agroforestry in North America. 13 - 16 August, 1989. University of Guelph, Guelph, Ontario, Canada. P. 56 - 69.
Ssekabembe C.K. and Henderlong P.R.	1991	Below-ground interactions in alley cropping: appraisal of first-year observations on maize grown in black locust (Robinia pseudoacacia L.) alleys. In H.E. "Gene" Garrett. Proceedings of the second conference on agroforestry in North America. 18-21 August, 1991. Springfield, Missouri. pg 58-73.
Charles Nkwiine		Biological nitrogen fixation in Uganda for enhancement of Soybean production.
C. Nkwiine and Zake Y.K.		Soybean response to N2 application to a ferrallistic soil as a guide to its rhizobium inoculation requirements. S.S.S.E.A 8th An. Gen. meeting Proc. 148-156
D. S. Ngambeki		Soybean production constraints in Uganda.
G. Olaboro		Utilization of Soybeans in livestock production.
Florence I. Muranga		Incorporation of Soybean into local diets.

MINISTRY OF AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES

The ministry of Agriculture and the USAID/MFAD Project	1989	1989 Research report on maize, soybean and sunflower field trials pp 1 - 29
Maize Program	1989	1989 Annual Report
Maize Research 1990 Namulonge Research Station	1989	Annual report pp 29 - 75
Kalule, T. M.	1993	Investigations on the pest status and control of graminaecious stem-bores of maize in Uganda. MSx. research project sponsored by USAID/MFAD. (On-going)
Biginwa G.	1990	Evaluation of maize materials against nortern corn leaf blight using artificial inoculation methods. Paper presented at the first natioal Scientific conference on food and agricuire, International Conferedce Centre, Kampala Ec. 10 - 14 (in press)
Biginwa G., Kyetere T. D., Baguma. D., Okoth V. A. O., Kalule, T. M. , Rubaihayo E. and Simkins C.	1990	The current staus of maize breeding research in Uganda. Paper presented at the first National Scientific Conference on Food and Agriculture, International Conference, Kampala, Uganda. Dec. 10 - 14 (press)

Okoth V. A. O., Bigirwa G. and Baguma D.	1990	Survey of maize diseases and insect pests in major maize growing districts of Uganda. Paper presented at the first National Scientific Conference on Food and Agriculture. International Conference, Kampala, Uganda. Dec. 10 - 14 (press
Bigirwa G	1992	An overview of maize research program activities in Uganda. Present and future. Paper presented during the first maize research program planning session at Namulonge Research Station, Dec. 10 - 11
Baguma D.	1990	The screening of herbicide for weed control in maize production in some major areas of Uganda. Paper presented at the first National Scientific Conference on Food and Agriculture, International Conference. Kampala, Uganda. Dec. 10 - 14 (press
Baguma D.	1992	The problem of adopting a herbicide technolgoy in the peasant farming. The experience with Stomp 500E. Paper presented during the workshop for Distrect Agricultural Officers on the development of the horticultural industry in Uganda at Mukono D. F. I. Sept. 17-21
Baguma S.D.	1992	The impact of on-farm research on Government, Donors and other agencies in establishing agricultrual development priorities: The Uganda experience. Paper presented during atdchnical net workshop on the impact of on-farm research, Harare, Zimbabwe, June 23 - 26 (in press)
Baguma S. D.	1992	An overview of the farmers constriants in Uganda. paper presented during the first national maize research program planning session at Namulonge Research Station, Dec. 10 - 11. 1992
Esele, J. P.E.	1984	"Sorghum and Millets Imprvovent in Uganda" procedings of the second Regional Workshop of Sorghum and Millets Improvement in Eastern Africa. 12 - 19 May, 1983, Rubona, Rwanda
Esele J. P. E.	1984	"Sorghum Research at Serere, Uganda." Proceedings of Crop Improvement in Eastern Afrcia: A regional Workshop on Research Objectives and On-farm Testing. 22 - 26 July, 1983, Nairobi Kenya
Esele J. P. E.	1984	Sorghum and Finger Millet Diseases in Uganda. Proceedings of the Tenth International congress of Plant Protection. 19-23 November, 1983, Brighton, Sussex U.K.
Esele J. P. E.	1986	An overview of Sorghum Disess in Uganda. Proceedings of the Fourth Regional Workshop of Sorghum and Millets Improvements in Eastern Africa. 22 - 26th July, 1985, Soroti, Uganda
Esele J. P. E. and O'Bwangamoi.	1986	Pest control in Uganda. Proceeedings fo African Regional Pest Mangement R & D Network (PESTNET). 4- 9 October 1985 Nairobi Kenya
Esesle J. P. E.	1987	Crop Protection Aspects of Sorghum in Ugada. Proceedings of theFifth Regional Work,shop of Sorghum and Millets Improvement in Eastern Africa. 5 - 12 July, 1986, Bujumbura Burundi.
Esele, J. P. E.	1986	The Production of Finger millet in Ugada. Proceedings of the International workshop on Small Millets. 29 Sept. - 3 Oct 1986 Bangalore Karmataka, India.
Esele J. P. E.	1986	Processing and Utilization of Finger Millet in Uganda. Proceedings of the International Workshoop on Small Millets 29 Sept - 3 Oct 1986, Bangalore, Kasrmataka, India.
Makumbi - Zake, and Esele J. P. E.	1985	The status of Sorhgum and Millets Improvement in Ugand.a Proceedings of the Third Regional Workshop of Sorghum and Milets Improvemet in East Africa. 12 - 17 July 1984, Morogoro Tanzania
Maxted, N. Esele J. P. E. and Khizza, B.W.	1986	Collection of Sorghum and millets GErmplasm in Ugada. FAO/IBPGR Newsletter No. 66, October 1985.
Esele J. P. E.	1987	Sorghum Seed Production in Uganda Seed Production Workshop September 1987 Nairobi Kenya.
Esele J. P. E.	1989	The current status of Sorghum and zmillets Research in Uganda. Proceedings of thesixth Regioanl workshop of Sorghum and Millets Improvenet= In Eastern Africa. 20 -29 July 1988 Mogadishu Somalia
Esele J. P. E.	1988	Sorghum Disease in Uganda. Proceedings of the Second International Workshoop on Sorghum Disease 7 - 11 march 1988, Harare Zimbabwe.
Hulluka M. and Esele J. P. E.	1988	Sorghum Disease in East Africa Proceedings of the Second Interantional workshop on Sorghum Diseass 7 - 11 March 1988 Harare Zimbabwe.
Esele J. P. Fredicksen R. A. and Miller F. R.	1990	The Genetics of Grain Mold Resistance in Sorghum. INTSORMIL Annual Report, 1990.
Esele J. P.	1990	The Strategy for the Control of Sorghum Diseases in Uganda. Proceedings of the First National Scientific Conference in Food and Agriculture 10 - 15 October, 1990, Kampala, Uganda.
Esele, J. P.	1991	The Current Status of Research on Finger Millet Blast Disease (Piriculana Grisea) at Serere Research Station, Uganda. Proceedings of the Second International Small Millets Workshop, 5 - 11 April, 1991, Bulawayo, Zimbabwe.
A. F. Kintukwonka	1988	Land Evaluation for Rainfed Agriculture in Uganda. Paper presented at Seventy meeting of the East and Southern African sub-committee for Soil Correlation and Land Evaluation, FAO, Rome, 1988
A. F. Kintukwonka	1991	Computer Assisted system for processing soil data and for quantified land evaluation. Paper presented to the ninty meeting of the Eastern andSouthern Arica sub-committee for soil correlation and land evaluation in Lilongwe, Malawi from 25th Nov - 2nd December 1991
Tukamuhabwa P.		Establishing and Integrated Soybean Industry in Uganda: Prospects and Challenges

Eriabu Sendiwanyo	1993	Soil Survey of Kalengyere Research Station, kabale Distnct
Eriabu Sendiwanyo	1993	Soil Survey of Promotion of Gram Legume Project Farm Mubuku, Kasese, Uganda
Patrick Jjemba and Peter H. Grahan		Efficient N Fixation, P Utilization and LOw P Tolerance in Phaseolus vulgaris, L. Cultivars
M. S. Musaana, A. F. Opio, Dr. I. K. Kibinge Sebunya		Application of interorgnasm genetics to mutation breeding for disease resistance: The Role of Breeders Pathologists and Physiologists.
A. F. Opio and S. M. Musaana		The National beans program operates as influenced by the Agricultural policy.
M. S. Musaana and F. Opio	1991	Optimum bean production in uganda with Reference to soil climatological requirements and most suitable varieties for market needs Seminar on Export of Dried Beans July 3 1991.
T. Sengooba and B. S. Male-Kayiwa	1990	Progress in Studies of Phoma Blight of Common Bean in Eastern Africa. Workshop on bean research in E. Africa, Nairobi 1990.
T. Sengooba	1990	Comparison of Disease Development in Beans in Pure Stand and Maize Intercrop. Annual Report of the Bean Improvement Cooperative 1990.
J. Kisakye and M. Ugen-Adrogu		Bean Yield loss assessemnt Trials in Uganda. Workshop on bean research in East Africa.
C. S. Wortmann and M. Ugen-Adrogu	1990	The development of a Maize climbing bean intercropping system for Central Uganda. Workshop on bean research in East Africa Nairobi 1990
J. Kisakye and M. Ugen-Adrogu	1990	On-farm bean cultivar Evaluation trials in Uganda. Workshop on bean research in East Africa, Nairobi 1990.
S. M. Musaana and A. F. Opio		Regional Collaborative Research Project on common bacterial blight, Xanthomonas campetris pv. phaseoli Smith) Dye, of Common Bean (Phaseolus vulgaris L.)
B. S. Male-Kayiwa and M. S. Musaana	1990	Yield stability of common bean in uganda. Workshop on bean research in E. Africa Nairobi 1990.
M. N. Silim	1990	Districbution Patterns of the Bean Bruchids Zabrotes subfasciatus Boheman and Acanthoscelides obtectus (Say) (Bruchidae: Coleoptera) in Uganda. Workshop on bean reseach in East Africa Nairobi 1990.
E. Kikoba	1990	Exploratory Survey of the effects of bean cropping systems on weed composition and predominant weed species. Workhop on bean research in East Africa Nairobi 1990.
S. A. P. Owera	1990	Analysis of Serotypes and strains of bean common mosaic virus (BCMV) in countries within CIAT's regional programme on beans in Eastern Africa. Workshop on Beans research in east Africa Nairobi 1990.
Imanyoha J. B.		Cytological analysis of progenies os autrotriploid (2n = 21) and hypertriploid (2n = 22) and comparison of these progenies. (Paper in preparation)
Imanyoha J. B.		Meiotic Behavior of the autrotriploid and hypertriploid Agropyron Cristattum (L) Geartin (Paper in preparation).
Mwanga R. O. M., Zamora, O. B.	1989	Physiological response of sweet potato (1 pomoea batatsas (L) Lam) to varying levels of shade. In M. N. Alvarez and S. K. Hahn (Eds). Root Crops in low input Agriculature. Proc. 3rd Eastern and Southern Africa Regional Workshop on Root and Tuber Crops, 7th 11th Dec. 1987 p. 188 - 212.
Mwanga R. O. M., Zamora O. B.	1990	Path analysis and correlation studies in sweet potato grown under coconut palms. In Proc. 8th symp. Int. Soc. Trop. Root crops R. H. Howeler (ed). Bangkok, Thailand, 1988 p. 530 (Abstract).
Ocitti p' Obwoya, C. N., Emokol W. E..	1989	Optimum number of view cuttings for optimum tuber yield in Sweet Potato (1 pomea batatas). In: M. N. Alvares and S. K. Hahn (Eds). Root Crops in Low input Agriculture. Proc. 3rd Eastern and Southern African Regional Workshop on Root and tuber crops 7th - 11th Dec. 1987. p. 213 - 218.
Ocitti p'Obwoya, C.		The effect of seed bed preparation on tuber yield and quality of sweet potato and the economic implications.
Mwanga R. O. M., Ocitti p'Obwoya, C. Otim-Nape, W. Odongo		Sweet Potato Improvement in Uganda.
Mwanga R. O. M., Zamora O. B.	1990	Biochemical responses of sweet potato (1 pomea batatas) (L. Lam) to varying levels of shade. Paper presented at the National Scientific conference in Agriculture 10th - 14th Dec. 1990.
Ocitti p;Obwoya		Factors limiting Sweet Potato Production and Utilization in Uganda
Bashaasha, B., Mwanga R. O.	1990	Sweet Potato: A source of income for low-income rural families in Uganda. Paper presented at the first National Scientific Conference in Agriculture 10th - 14th Dec. 1990
Tukamuhabwa P.	1993	How to grow Soybean in uganda.
Tukamuhabwa P. Ebong C.	1992	Soybean production and utilization in Uganda. Paper presented at the first workshop on soybean production and utilization held at Mukono District Farm Institute on 2nd - 6th March 1992.
	1990	Soybean Research 1990 in Namulonge Research Station Annual Report p. 7 - 24
	1991	Soybean Research 1991 in the Namulonge Research Station Annual Report p. 156 - 165
	1990	Groundnut research 1990 in Namulonge Research Annual Report p. 25 - 28
	1991	Groundnut Research 1991 in Namulonge Research Station Annual Report p. 93- 102
	1990	Sunflower Research 1990 in namulonge Research Station Annual Report p. 79 - 102
	1991	Sunflower Research 1991 in Namulonge Research Station Annual Report p. 166 - 193

Semalulu, O, and R. I. Barnhisel	1991	The response of prime farmland corn to P and K fertilization. Agronomy abstracts. ASA, CSSA, SSSA. Paper presented at the 1991 American Society of Agronomy meetings, Denver, Colorado U.S.A.
Semalulu, O. and R. I. Barnhisel	1992	Phosphorus availability as affect by top soil and sub soil properties. Paper presented at the 1992 National Symposium on Prime farm land reclamation, St. Louis, Missouri. U. S. A.
Semalulu O, and R. I Barnhisel	1992	Corn response and associated soil test changes following P and K fertilization of Prime farmland poster paper presented at the 1992 National meetings of the American Society for surface mining and reclamation. Duluth Minnesota. June 14th - 18th.
Moses Mbalule Idembe		The use of Basagran and focus to control weeds in Soybean.
A.F. Apio		*Pests of Soyabeans
Imelda Lwanga		Soybean processing at household level/recipes.
Helen Eyedu		Utilizing Soybean at household level/Soybean recipes.
Daniel Nsubuga - Kikoyo		Soybean marketing

E. Commodities

E1.MFAD Vehicles

	Description	Tag No.	Yr. Arr.	Cost	Agcy	Location	Comments
1	MITSU.PAJERO	UA0585	1985	$9,750	MAAIF	ENTEBBE	FAIR
2	MITSU.PAJERO	UA0586	1985	$9,750	MAAIF	NAMULONGE	USED FOR SPARES
3	MITSU.PAJERO	UA0594	1985	$9,750	MAAIF	NAMULONGE	GOOD
4	FORD PICKUP	UA0414	1985	$7,700	MAAIF	SERERE	USED AS SPARES
5	MITSU.PAJERO	UA0573	1985	$11,250	MAAIF	SERERE	STOLEN
6	FORD PICKUP	UA0597	1985	$7,700	MAAIF	SERERE	LOOTED
7	FORD PICKUP	UA0598	1985	$7,700	MAAIF	SERERE	TO BE REHAB.
8	FORD 10 TN TRUCK	UA0568	1985	$28,500	MAAIF	SERERE	STOLEN 1986
9	MITSU.M/BUS	UA0617	1986	$12,280	MAAIF	ENTEBBE	USED FOR SPARES
10	MITSU.SEDAN	UA0616	1986	$12,280	MAAIF	KAWANDA	OFF THE ROAD
11	2 SUZUKI M/CYCL		1987	$3,000	MAAIF	ENTEBBE	POOR
12	MITSU.M/BUS	UA0672	1987	$13,500	MAAIF	KAWANDA	OFF THE ROAD
13	MITSU.PICKUP	UA0706	1987	$13,500	MAAIF	KAWANDA	FAIR-MAINTENANCE
14	SUZUKI M/CYCLE		1987	$1,500	MAAIF	KAWANDA	POOR
15	MITSU.PICKUP	UA0714	1987	$13,500	MAAIF	NAMULONGE	FAIR-RESEARCH
16	MITSU.PICKUP	UA0724	1987	$13,500	MAAIF	NAMULONGE	FAIR-RESEARCH
17	MITSU.PAJERO	UA0838	1988	$15,500	MAAIF	KAWANDA	TOTALED
18	MITSU.PAJERO	UA0959	1989	$17,325	MAAIF	EMTEBBE	GOOD-COMM.AGRIC
19	MITSU.PAJERO	UA0927	1989	$17,325	MAAIF	ENTEBBE	SEC.FOR RES.
20	MITSU.PICKUP	UA0960	1989	$13,625	MAAIF	ENTEBBE	GOOD-SEC FOR RES
21	MITSU.PICKUP	UA0961	1989	$13,625	MAAIF	KALENGYRE	GOOD-DIRECTOR
22	MITSU.PICKUP	UA0930	1989	$13,625	MAAIF	KAWANDA	STOLEN MAY 1990
23	HONDA M/CYCLE	UA0877	1989	$2,291	MAAIF	KAWANDA	FAIR
24	MITSU.PAJERO	UA0958	1989	$17,325	MAAIF	MFAD OFFICE	GOOD-TEAM LEADER
25	MITSU.PICKUP	UA0924	1989	$13,500	MAAIF	NAMULONGE	GOOD-MAINTENANCE
26	MITSU.PICKUP	UA0925	1989	$13,500	MAAIF	NAMULONGE	GOOD-SOYBEAN
27	MITSU.3TN TP.	UA0926	1989	$21,125	MAAIF	NAMULONGE	GOOD-UTILITY
28	MITSU.PICKUP	UA0928	1989	$13,625	MAAIF	NAMULONGE	GOOD-MAIZE
29	MITSU.PICKUP	UA0929	1989	$13,625	MAAIF	NAMULONGE	GOOD-GROUNDNUTS
30	MITSU.PAJERO	UA0943	1989	$17,325	MAAIF	NAMULONGE	GOOD-SIMKINS
31	MITSU.PAJERO	UA0947	1989	$17,325	MAAIF	NAMULONGE	WRECKED-DIRECTOR
32	HONDA M/CYCLE	UA0876	1989	$2,291	MAAIF	NAMULONGE	GOOD
33	HONDA M/CYCLE	UA1384	1991	$2,017	MAAIF	KASESE	GOOD-ON FARM RES
34	HONDA M/CYCLE	UA1381	1991	$2,017	MAAIF	LUWERO	GOOD-ON FARM RES
35	HONDA M/CYCLE	UA1382	1991	$2,017	MAAIF	MASINDI	GOOD-ON FARM RES
36	HONDA M/CYCLE	UA1383	1991	$2,017	MAAIF	MBALE	GOOD-ON FARM RES
37	HONDA M/CYCLE	UA1385	1991	$2,017	MAAIF	MUBENDE	GOOD-ON FARM RES
38	MITSU.PICKUP	UA1314	1991	$16,022	MAAIF	NAMULONGE	GOOD-OFR
39	MITSU.PAJERO	UA1315	1991	$21,565	MAAIF	SERERE	GOOD-DIRECTOR
40	MITSU.M/BUS	UA1409	1992	$13,321	MAAIF	ENTEBBE	NEW-STAFF TRANSP
41	NAVISTAR TRUCK	UA1593	1992	$36,760	MAAIF	KALENGYRE	CIP
42	MITSU.M/BUS	UA1410	1992	$13,321	MAAIF	KAWANDA	NEW-STAFF TRANSP
43	ISUZU/NPR575BUS	UA1617	1993	$19,683	MAAIF	ENTEBBE	NARO STAFF
44	MITSU.LANCER	UA1623	1993	$15,000	MAAIF	ENTEBBE	NARO DG
45	MITSUB.L300 BUS	UA1622	1993	$15,000	MAAIF	ENTEBBE	NARO STAFF
46	MITSUBISHI DCAB	UA1621	1993	$15,251	MAAIF	KABANYOLO	CIP
47	NAVISTAR TRUCK		1993	$42,027	MAAIF	NAMULONGE	RESEARCH SUPPORT

MAAIF SUBTOTAL ***$616,152***

	Description	Tag No.	Yr. Arr.	Cost	Agcy	Location	Comments
48	FORD PICKUP	UXX275	1984	$7,700	MU/FAF	KABONYOLO	NOT SERVICEABLE
49	FORD PICKUP	UE0624	1984	$7,700	MU/FAF	KABONYOLO	GOOD
50	FORD PICKUP	UXX376	1984	$7,700	MU/FAF	KABONYOLO	SOLD IN PARTS
51	FORD PICKUP	UXX377	1984	$7,700	MU/FAF	KABONYOLO	STOLEN 1986
52	SUZUKI JEEP	UE0739	1985	$6,500	MU/FAF	AG ECON	FAIR
53	MITSU.PAJERO	UE0743	1985	$11,250	MU/FAF	ANIMAL SCI	NOT RUNNING
54	MITSU.PAJERO	UE0745	1985	$9,750	MU/FAF	CROP SCI	GOOD-HORTICULTURE
55	SUZUKI JEEP	UE0723	1985	$6,500	MU/FAF	FORESTRY	FAIR
56	FORD CARGO	UE0625	1985	$28,500	MU/FAF	KABANYOLO	NEEDS ENG.OVERH
57	MITSU.PAJERO	UXY102	1985	$9,750	MU/FAF	MAKERERE	STOLEN JUNE '86
58	MITSU.3TN TR	UE0877	1986	$10,250	MU/FAF	MAKERERE	GOOD-UTILITY
59	MITSU.PICKUP	UE0510	1987	$13,625	MU/FAF	KABANYOLO	NEEDS OVERHAUL
60	MITSUBSHI VAN	UE0515	1987	$14,200	MU/FAF	KABANYOLO	GOOD-STAFF TRANSP
61	2 SUZUKI M/CYCL		1987	$3,000	MU/FAF	KABANYOLO	POOR
62	LEYLAND BUS	UE0623	1987	$45,000	MU/FAF	MAKERERE	GOOD-STUDENT TRAN
63	MITSU.M/BUS	UE0524	1987	$14,200	MU/FAF	MAKERERE	FAIR-STAFF TRANSP
64	MITSU.PICKUP	UE0519	1987	$13,200	MU/FAF	SOIL SCI	FAIR
65	MITSU.LANCER	UE0529	1988	$17,000	MU/FAF	MAKERERE	GOOD-ASSOC.DEAN
66	MITSU.LANCER	UE0611	1989	$14,000	MU/FAF	AG ECON	GOOD-NGAMBEKI
67	MITSU.LANCER	UE0610	1989	$14,000	MU/FAF	AG ENGIN	GOOD-ARNOLD
68	MITSU.LANCER	UE0609	1989	$14,000	MU/FAF	FOOD SCI	GOOD
69	MITSU.PICKUP	UE0591	1989	$14,000	MU/FAF	KABANYOLO	GOOD-FARM MGR
70	HONDA M/CYCLE	UE0438	1989	$2,291	MU/FAF	KABANYOLO	GOOD
71	MITSU.PICKUP	UE0612	1989	$13,200	MU/FAF	KABANYOLO	GOOD-FARM MGR
72	MITSU.PAJERO	UE0608	1989	$17,325	MU/FAF	MAKERERE	GOOD-DEAN
73	NISSAN MINIBUS	UE0613	1989	$9,000	MU/FAF	MAKERERE	GOOD
74	DAIHATSU ROCKY	UE0719	1989	$18,500	MU/FAF	MFAD OFFICE	GOOD
75	MITSU.LANCER	UE0592	1989	$14,000	MU/FAF	MFAD OFFICE	GOOD-GENERAL
76	MITSU.PAJERO	UE0716	1990	$20,820	MU/FAF	AG EXT ED	GOOD
77	HONDA M/CYCLE	UE0855	1991	$2,017	MU/FAF	KABANYOLO	GOOD-ON FARM RES
78	MITSU.ROSA BUS	UE0731	1991	$29,890	MU/FAF	MAKERERE	GOOD-STUDENT TRAN
79	MITSU.M/BUS	UE0860	1992	$13,321	MU/FAF	MAKERERE	NEW-STAFF TRANSP
80	MITSU.M/BUS	UE0861	1992	$13,321	MU/FAF	MAKERERE	NEW-STAFF TRANSP
	MU/FAF SUBTOTAL			***$443,210***			
81	MITSU.7TN TR.	CD0249U	1985	$22,000	USAID	WAREHOUSE	GOOD
82	MITSU D/VAN	UA0671	1987	$13,500	USAID	WAREHOUSE	GOOD-ON LOAN
83	MITSU.PAJERO	UE0622	1989	$17,325	USAID	NAKASERO	GOOD-AGARD
	USAID SUBTOTAL			***$52,825***			
	GRAND TOTAL			***$1,112,187***			

F. OSU Fiscal Report/Expenditure of USAID funds

	Expenditures to date (3/31/93)	Estimated expenditures from 4/1/93-6/30/93	Total
Salaries	$2,276,016	$51,640	$2,327,656
Fringe Benefits	$416,357	$12,910	$429,267
Consultants	$118,303	$28,739	$147,042
Travel & Transportation	$973,005	$30,000	$1,003,005
Allowances	$431,182	$15,098	$446,280
Expendable Supplies	$217,217		$217,217
Nonexpendable Equipment	$99,393		$99,393
Subcontracts			
Experience Incorporated	$2,841,754	$17,500	$2,859,254
Univ. of Minnesota	$1,709,718		$1,709,718
Winrock	$223,093		$223,093
Export Trading	$306,595		$306,595
Utah State Univ.	$15,984		$15,984
Fort Valley State College	$293,456		$293,456
Subtotal/subcontracts	$5,390,600		$5,408,100
Participant Training	$3,021,454	$134,294	$3,155,748
Other Direct Costs	$408,630	$8,197	$416,827
Indirect Costs	$2,551,154	$103,869	$2,655,023
Total	**$15,903,311**	**$402,247**	**$16,305,558**

G. List of MFAD Reports

1 An Assessment of Sunflower Production Potential and a Research Plan for Uganda - Arlo Thompson, 1988
2 An Economic Analysis of Milk Production Costs and Pricing in Uganda. By Manuel Vanegas and Agnes Akwang - Working paper #92-4.
3 Annex of ARIS reports. Agricultural research Manpower in Uganda ISNAR. November 1990.
4 Baseline Survey of Farm Production in Uganda. By Manuel Vanegas and Dezi Ngambeki - Staff Working paper #3-91.
5 Concepts for the Development of The Food Industry of Uganda - By: Dr. John Blaisdell.
6 Critical Issues in On-Farm Research in Uganda. Proceedings of Workshop held in the Faculty of Agriculture and Forestry, Makerere University, 29 31 March, 1989.
7 Curriculum Development for the Department of Food Science and Technology Makerere University Faculty of Agriculture and Forestry. By: John L. Blaisdell; September 1991.
8 Data Availability, Constraints and Utilization in Uganda Report No. 1, Econometric Modeling and Policy Analysis of the Bean Industry in Uganda. Food and Agricultural Policy Unit (MFAD), December 1989.
9 Development Plan for Kalengyere Agriculture Research Station. By Calvin Martin - May 23, 1991.
10 Uganda Root Crops Programme Technical Report No. 1, 1988.Ebwanatereka: Uganda's Better Cassava Variety/
11 Establishment of a Department of Food Science and Technology at Makerere University. D. S. Muduuli, I. Okello-Uma, P. M. T. Hansen, February - March 1988.
12 Establishment of a National Agricultural Research Organization (NARO) August 1988.ISNAR/MFAD
13 Faculty Handbook - 1989. Makerere University Faculty of Agriculture
14 Feasibility of Establishing Socio-Economic Research Capability Within the Ugandan Ministry of Agriculture, Animal Industry and Fisheries. By: Burt Sundquist, Stanley R. Thompsom, Bernand Bashaasha, Dezi Ngambeki; October 1991.
15 First Annual MFAD Retreat: Jinja - Uganda November 27-29, 1989.
16 Five Year Food Crops Research Plan 1989 - 1994 Vol 1, E. Hartmans, June 1989
17 Food and Agricultural Policy Unit Data Availability, Constraints and Utilization In Uganda. Econometric Modeling and Policy Analysis of the Bean Industry in Uganda. By: Manuel Vanegas, Godfrey Bahiigwa, David Mwesigwa, Stephen Lwasa; December 1989.
18 Groundnut Program - Brief for USAID Evaluation Team 1990.
19 Improving the Effectiveness of Extension Services in Uganda. By: A.R. Semana, J.M.A. Opio-Odongo, S. Zziwa; September 1988.
20 Integrated Pest Management Technology Development and Transfer. By Harold Wilson. By: Harold R. Wilson; January 1991.
21 ISNAR Consultant Report to Working Group 9A. Agricultural Research Manpower in Uganda. Larry Zuidema November 1990
22 Kawanda Research Station - National Bean Program Annual Report 1988.
23 Maintenance Program and Rehabilitation Phase-Out Plan MFAD (617-0103), March 5 - 28, 1990
24 Major Land Resource Areas of Uganda, SCS/SMSS, July 1990. David Yost, Hari Eswaran
25 Makerere University Faculty of Agriculture and Forestry, Five-Year Development Plan. 1991

26 Management Plan for Kawanda, Namulonge, And Kabanyolo Research Institutes. Calvin Martin, Walter Wiles, William French - June 23 1992
27 MFAD Project - Annual Food Crops Research Plan for Uganda, 1988
28 MFAD Quarterly Reports : 9/89-3/93
29 MFAD Rehabilitation Report: Present Status, Projections for LOP and Phase II October 10, 1987.
30 Mid-Term Evaluation Phase II MFAD Project - July - August 24, 1990.
31 Ministry of Agriculture and MFAD Project, 1988: Research Report on Maize, Soybean and Sunflower Field Trials.
32 Namulonge Research Station - Annual Report 1990.
33 National Bean Programme - Kawanda Research Station/Annual Report 1987.
34 National Bean Programme Annual Report 1988.
35 National Potato Research and Development in Uganda (Project Proposal) October 1987.
36 Phosphate Fertilizer and Agricultural Limestone Production and Distribution Feasibility Study in Uganda, Phase I, O. W. Livingstone, IFDC, May 1988.
37 Plan for Maize Research and Seed Production in Uganda - 1987 Ernest W. Sprague.
38 Progress Report: July 1985-June 1986/Uganda Root Crops Programme February 1987, Serere Agric. Res. Station.
39 Progress Report: July 1986 - December 1988/Uganda Root Crops Programme Serere Agric Res. Station, November 1988.
40 Project Evaluation (617-0103): MFAD November 1987.
41 Prospects for roots and tubers in the food security of Uganda. By Manuel Vanegas and Bernard Bashaasha; March 1991.
42 Report by Short-term Consultant on Horticultural Crops, H. D. Tindill, November 1988.
43 Report of the College/University Articulation Task Force, May 1990.
44 Report of the Donors' Conference held 6 July - 10 July 1987 Kampala UICC and Makerere University Main Hall.
45 Republic of Uganda: Establishment of a National Agricultural Research Organization (NARO) ISNAR, August 1988.
46 Research Extension Specialist Team (REST) Concept. By: Gene Pilgram. An assessment of the Present Extension situation in Uganda - October 1987.
47 Review of Irrigation Research Facilities, OSU/MFAD/USAID/UGANDA, September 1989, Robert W. Hill - Utah State University.
48 Revised USAID/MFAD Rehabilitation Report - May 1989.
49 Soil Science Society of East Africa (SSSEA) 8th Annual General Meeting 15-19 December, 1986; Kampala Uganda.
50 Soybean Development in Uganda - Carl N. Hittle - October 1987.
51 Soybean Production and Utilization in Uganda. P. Tukamuhabwa and C. Ebong (Editors). Proceedings of the first workshop on soybean Production and Utilization held at Mukono District Farm Institute.
52 Strengthening of Agricultural Research In Uganda - Uganda Agricultural Task Force Agricultural Research Group B 4. March 31, 1987.
53 Sustainable Soil Productivity in Uganda. By: J.Y.K. Zake; June 1990.
54 The Dynamics of the Banana Industry in Uganda. By Dick Serunkuuma, William Ekere and Charles Tumwebaze - Working Paper #92-8.
55 The Effects of unstable production on prices and consumption of legumes in Uganda. By Dick Sserunkuuma, William Ekere and Charles Tumwebaze -Working Paper #93-1.

56 The Status of Agricultural Extension Education in Uganda and the Establishment of an Agricultural Extension Education Department at Makerere University, Faculty of Agriculture and Forestry, Makerere University/MFAD, April 1988.
57 Training Plan for the Manpower for Agriculture Development Project 1988 to 1993 - Including updated version for 1989.
58 Trip Report - Rwanda and Uganda Projects September 28, 1990. By: Peggy Johnson, Assistant Director St. Paul Campus, University of Minnesota.
59 Uganda Accelerated Food Crop Production Strategy MOA/MFAD, Kampala April 1990.
60 Vehicle Plan - Phase II/MFAD Project.

H. MFAD Filing System

DIRECTORY	FILES	CONTENTS
1. BUDGET/FISCAL		OSU Budget and expenditures under MFAD project
	1.1. Imprest Account (U.S. Dollars)	Bank statements, correspondence, deposits, bank reconciliations
	1.2. Local Currency (Ug. Shillings)	Request for local currency from USAID, Financial Quarterly reports
	1.2.1. MFAD Office Support	Information on Local currency requests
	1.2.2. MU/FAF	Information on Local Currency requests
	1.2.3. MOA	Information on Local Currency requests
	1.2.4. Receipts for Current Month	Detailed Vouchers with receipts attached.
	1.2.4.1. Barclay's Bank Correspondence	Correspondence in terms daily transactions.
	1.2.4.2. MFAD Correspondence	
	1.3. OSURF Fiscal Reports	Quarterly reports
2. CONTRACT DOCUMENTS	2.1. Project Paper	
	2.2. PIO/T Ammendments	Contract services, budgets, statement of work. (Extensions, revisions and additional incremental funding)
	2.3. Project Implementation Letters/Reports	Reports on project impact assessment
3. CORRESPONDENCE	3.1. USAID	
	3.1.1. Incoming	Correspondence from AID (1983 - 1993)
	3.1.2. Outgoing	Correspondence sent to AID (1983 -1993)
	3.2. OSU	
	3.2.1. Incoming	Correspondence from OSU - budget matters, contracts, personnel and participant information (1983 -1993)
	3.2.2. Outgoing	Correspondence sent to OSU -budget matters, contracts, personnel data and participant information(1983 - 1993)
	3.3. MINNESOTA	
	3.3.1. Incoming	Correspondence from Minnesota budget matters, contracts, personnel data and participants(1983 - 1991)
	3.2.2. Outgoing	Correspondence sent to Minnesota budget matters, contracts, personnel data and participants(1983 - 1991)
	3.4. EXPERIENCE INCORPORATED	
	3.4.1. Incoming	Correspondence from AMENDMENTS -budget matters, contracts, personnel data(1983 - 1991)
	3.4.2. Outgoing	Correspondence sent to AMENDMENTS - budget matters, contracts, personnel data(1983 -1991)
	3.5. SCIENCE & TECHNOLOGY	
	3.5.1. Incoming	Correspondence from S & T

	3.5.2. Outgoing	Correspondence sent to S & T
	3.6. MAAIF	
	3.6.1. Incoming	Correspondence from the Ministry -Local currency matters, research, Technical assistants, participants, commodities memorandums & information etc.
	3.6.2. Outgoing	Correspondence sent to Ministry -local currency matters, research, technical assistants, participants, commodities memorandums & information etc.
	3.7. MU/FAF	
	3.7.1. Incoming	Correspondence from the Ministry -local currecny matters, research, technical assistants, participants, commodities, information & memorandums.
	3.7.2. Outgoing	Correspondence from the Ministry -local currency matters, research, technical assistants, participants, commodities, information & memorandums.
	3.8. OTHER	Memorandums & letters from other liaising organizations, government ministries and educational establishments.
4. COVENANTS	4.1. MU/FAF Five Year Development Plan	Aspects for each of the eight academic departments of Faculty -academic staff resources, planned extensions, research activities, technical assistance requirements and physical infrastructure requirements.
	4.2. Articulation Study	Project coordination activities
	4.3. Food Crop Production Strategy	Focus on the role of the public sector in accelerating farm productivity gains.
	4.4. Five Year Crops Research Plan	Goals for increasing food production for self sufficiency and to increase and diversify agricultural exports.
5. INVENTORY	5.1. FIELD EQUIPMENT	
	5.1.1. Farm operation	Inventories on farm equipment, receiving reports and memos
	5.1.2. Research	Inventories on research equipment, and memos
	5.1.3. Rehabilitation/Construction	Inventories and memos
	5.2. LABORATORY EQUIPMENT	
	5.2.1. MU/FAF	Inventories and receiving reports
	5.2.2. MUARIK	Inventories and receiving reports
	5.2.3. Namulonge	Inventories and receiving reports
	5.2.4. Kawanda	Inventories and receiving reports
	5.3. OFFICE EQUIPMENT	
	5.3.1. Computers	Inventories, service & repair record and memos
	5.3.1.1. CPUs/Monitors	Inventories, service & repair record and memos

	5.3.1.2. Printers	Inventories, service & repair record and memos
	5.3.2. Photocopiers	Inventories, service & repair record and memos
	5.3.3. Typewriters	Inventories and memos
	5.3.4. Other (Fax, binding machines, calculators, etc.)	Inventories and memos
	5.3.5. Office Supplies Issued	Supplies to the Dean's office and faculty departments
	5.4. RADIOS	Inventories, memos and repair record
	5.5. RESIDENCES	Household maintenance & repair; utilities
	5.5.1. Furniture	Inventories and memos
	5.5.2. Generators	Inventories and memos
	5.5.3. Hospitality Kits	Inventories and memos
	5.5.4. Utilities	Electricity, Water and Telephone services for residences and the MFAD office
	5.5.5 Mbuya Flats	Inventories, maintenance & rental payments
	5.6. TEACHING EQUIPMENT	
	5.6.1. Slide projectors	Inventories and memos
	5.6.2. Overhead projection	Inventories and memos
	5.6.3. Other	Miscellaneous Inventories
	5.7. VEHICLES	
	5.7.1. Office	Inventories, Maintenance & service records and procurement
	5.7.2. TAs/Field	Inventories, Maintenance & service records
	5.7.3. MU/FAF	Inventories, Maintenance & service records
	5.7.4. MOA	Inventories, Maintenance & service records
	5.7.5. USAID	Vehicle regulations, general communication
	5.7.6. Monthly Non-Official Use	Record on non official mileage and payment (accounts receivable)
6. LIAISON COMMITTEE		
7. PERSONNEL	7.1. TECHNICAL ASSISTANTS (LONG TERM)	
	7.1.1. Arnold	Agricultural Engineering -Personal Data, reports terms of reference & contract documents
	7.1.2. Bhagsari	Horticulture - Personal Data, reports, terms of reference & contract documents
	7.1.3. Boyd	Rehabilitation Advisor - Personal data, reports, terms of reference & contract documents
	7.1.4. Buker	Personal data reports, terms of reference & contract documents

7.1.5. Calhoun	Team Leader/Soil Agronomy -Personal data, reports, terms of reference & contract documents
7.1.6. Denton	Agricultural Research & Extension - Personal data, reports, terms of reference & contract documents
7.1.7. Fenster	Personal data reports, terms of reference & contract documents
7.1.8. Lane	Rehabilitation Advisor - Personal data, reports, terms of reference & contract documents
7.1.9. Ngambeki	Agricultural Economics - Personal data, reports, terms of reference & contract documents
7.1.10. Raaum	Rehabilitation/Maintenance Advisor - Personal data, reports, terms of residence & contract documents
7.1.11. Simkins	Crop Production Advisor - Personal data, reports, terms of reference & contract documents
7.1.12. Vanegas	Agricultural Economics - Personal data reports, terms of reference & contract documents
7.1.13. Others	
7.1.13.1. Visiting Research Fellows	Jay Dorsey Internship with MFAD Project - Agricultural Engineering
7.1.13.2. Visiting Professors	Dr. Robert Romig - Forestry, Dr. Bob Hathcock - Crop Science, Dr. John Blaisdell - Food Science and Technology
7.1.13.3. MFAD Team Leave Record	Annual Leave & Home Leave data
7.2. SHORT TERM CONSULTANTS	Technical assistance from various consultants for monthly periods. (a list is already included)
7.2.1. Per Diem Record	Rates as delegated from USAID
7.2.2. Newcomer Packet	
7.3. OFFICE	MFAD Support staff
7.3.1. Accountant	Personnel for cash disbursements and reimbursements
7.3.2. Drivers	Personnel for transportation etc.
7.3.3. Project Logistics Supervisor	Asst. Personnel for general office administration, procurement etc
7.3.4. Project Manager	Personnel for general office administration, procurement etc
7.3.5. Secretary	Personnel for general facilitation of work in the office -communication, correspondence, reception etc.
7.3.6. Other	Personnel for short term periods.
7.3.7. Job Applications	Applications for various positions advertised by MFAD
7.3.8. Forms	Forms used by Technical Assistants, Participant trainees.
7.3.8.1. Absence From Regular Duty	Blank forms

7.3.8.2. Annual Leave/ Monthly/ Hourly Salary	Blank forms
7.3.8.3. Application to Sell Property	Blank forms
7.3.8.4. Belgian Visa Forms	Blank forms
7.3.8.5. Consulting Agreement	For Non-OSU employees
7.3.8.6. Daily Work Record	Blank forms
7.3.8.7. Departing Post Clearance Sheet	Blank forms
7.3.8.8. Driving License Forms	Blank forms
7.3.8.9. Food Order Forms	Blank forms
7.3.8.10. Foreign Project Expense Voucher	Blank forms
7.3.8.11. French Visa Forms	Blank forms
7.3.8.12. German Visa Forms	Blank forms
7.3.8.13. GSO	
7.3.8.14. Incentive Pay Program	Blank forms
7.3.8.15. Inventory	Blank forms
7.3.8.16. IRS Extension	Blank forms
7.3.8.17. Kenya Visa & Declaration Form	Blank forms
7.3.8.18. Non Official Mileage	Blank forms
7.3.8.19. Passport Application USA	Blank forms
7.3.8.20. Procurement List	Blank forms
7.3.8.21. Project Forms	Blank forms
7.3.8.22. Quarterly Bank Reconciliation	Blank forms
7.3.8.23. Receipts	Blanks
7.3.8.24. Receiving/Inspection Report	Blanks
7.3.8.25. Store	Blanks
7.3.8.26. Tanzania Visa Form	Blanks
7.3.8.27. Telephone Record	Blanks
7.3.8.28. Travel Requests	Blanks
7.3.8.29. Travel Voucher	Blanks
7.3.8.30. Travel Expenses	Blanks
7.3.8.31. Uganda Visa Application	Blanks
7.3.8.32. Vehicle Inspection forms	Blanks

	7.3.8.33. Mission Notices & Info	Miscellaneous notices and information from American Embassy
8. PROCUREMENT	PROCUREMENT	Project implementation orders/Commodities (PIO/C) receiving reports from different contractors and sub-contractors.
	8.1. MINNESOTA	Project Implementation orders and Commodities information and receiving reports
	8.2. NAIROBI PSA	Project Implementation orders and Commodities information and receiving reports.
	8.2.1. Export Trading	Project Implementation orders and Commodities information and receiving reports
	8.2.2. Kenya Export Services	Project Implementation orders and Commodities information and receiving reports.
	8.3. LOCAL	Project Implementation orders and Commodities information and receiving reports.
	8.4. USAID	Project Implementation orders and Commodities information and receiving reports.
	8.4.1. Furniture	Project Implementation orders and Commodities information and receiving reports.
	8.4.2. Generators	Project Implementation orders and Commodities information and receiving reports.
	8.4.3. Vehicles	Project Implementation orders and Commodities information and receiving reports.
	8.4.4. Other	
	8.5. VENDOR BIDS	
9. REHABILITATION		
	9.1. MU/FAF	Progress reports & communication from research stations
	9.2. MUARIK	Progress reports & communication from research stations
	9.3. Kawanda	Communication about rehabilitation and maintenance
	9.4. Namulonge	Communication about rehabilitation and maintenance
	9.5. Maintenance/Phase-Out Plan	
10. REPORTS/REVIEWS/ WORK PLANS/TEAM MEETINGS		
	10.1. Annual Plan of Work	Both long term and short term assistance activities with MFAD project.
	10.1.1. Agendas	Agendas for MFAD meetings
	10.1.2. Minutes	Minutes for MFAD meetings
	10.2. Annual Research progress review	Review of MFAD supported research

10.3. Annual/Semiannual/Quarterly Reports	Activities of Technical Assistance in research, teaching, rehabilitation/maintenance
10.4. Annual/Semiannual/Quarterly Reviews	Review of MFAD project activities
10.4.1. Agendas	Agendas for MFAD reviews
10.4.2. Minutes	Minutes for MFAD reviews
10.5. Consultant Reports	
10.6. RETREATS	Jinja, Mbarara, Mweya and Lake Victoria Retreats.
10.6.1. Agendas	Agendas for the above retreats
10.6.2. Minutes	Minutes for the above retreats
10.7. TEAM MEETINGS	Meetings held by USAID, MFAD and GOU representatives on frequent basis.
10.7.1. Agenda	
10.7.2. Minutes	
10.8. VEHICLE PLAN	

11. RESEARCH

11.1. MAAIF	MFAD funded Research through its local currency budget.
11.1.1. On-Farm Trials	Research Proposals &Progress Reports
11.1.2. Sunflower	Research proposals & Progress Reports
11.1.3. Maize	Research proposals & Progress Reports
11.1.4. Soybeans	Research proposals & Progress Reports
11.1.5. Irish Potato	Research Proposals & Progress Reports
11.1.6. Other	Research proposals & Progress
11.2. MU/FAF	
11.2.1. Agricultural Economics	Correspondence in and out in relation to MFAD
11.2.2. Agricultural Engineering	Correspondence in and out in relation to MFAD
11.2.3. Forestry	Correspondence in and out in relation to MFAD
11.2.4. Animal Science	Correspondence in and out in relation to MFAD
11.2.5. Food Science & Technology	Correspondence in and out in relation to MFAD
11.2.6. Soil Science	Correspondence in and out in relation to MFAD
11.2.7. Crop Science	Correspondence in and out in relation to MFAD
11.2.7.1. Horticulture	Correspondence in and out in relation to MFAD
11.2.8. Agriculture Extension Education	Correspondence in and out in relation to MFAD
11.2.8.1. Research Extension Linkages	Between government bodies and other establishments
11.3. FAF/MOA Linkages	In terms of training and research
11.4. S&T Collaboration	Correspondence and collaboration in Science & technologies establishment activities

	11.4.1. NifTAL	Involves BNF technologies for international activities specifically with Soil Science Dept. in FAF
	11.4.2. INTSOY	Soybean research
	11.4.3. TSMM	Soils research
	11.4.4. IBSNAT	Soils research
	11.4.5. SMSS	Soils research
12. TECHNICAL ASSISTANCE		
	12.1. Long Term	(This is covered under personnel -#7.1)
	12.2. Short Term	(This is covered under personnel -#7.2)
13. TRAINING		
	13.1. Annual Training Plan	
	13.1.1. Nominees for External Degree Training	Nominees from the Ministry and Faculty
	13.1.2. Nominees for External NonDegree Training	Nominees from both the Ministry and Faculty
	13.1.3. Allowances	Information for participants
	13.1.4. Certificate of Eligibility USA	Blanks
	13.1.5. Conditions of Training	Blanks to fill for participant trainees.
	13.1.6. Exchange Visitor Status	Blanks to fill for participant trainees.
	13.1.7. GRE & TOEFL	Results for nominees for training and training participants plus general information
	13.1.8. Medical History/EXAM/ Insurance	Blanks for participant trainees.
	13.1.9. Participant Training Notices	Blanks for participant trainees
	13.1.10. PIO/P Forms	Blanks for participant trainees.
	13.1.11. Participant Biographical Data	For participant trainees.
	13.1.12. Predeparture Form	For participant trainees
	13.1.13. Project Implementation Request	Blank forms
	13.2. DEGREE	Both external and incountry
	13.2.1. External	Participants trainees in the U.S. - miscellaneous information on progress, financial, research, personal data etc.
	13.2.2. InCountry	Participant trainees at the Fac. of Agric. and Forestry. Masters program - allowances, financial matters and progress reports.
	13.3. NONDEGREE	Short term participants (details within the report)
	13.3.1. External	Participants trained in U.S.A. but other countries are also involved. miscellaneous information e.g. Filled in medical, PIO/P etc.
	13.3.2. Internal	USDA courses held within Uganda.

	13.3.2.1. Artisan/Rehabilitation	(Empty)
	13.3.2.2. Extension InService/MOA	(Empty)
	13.3.2.3. Workshops/Conferences	Various Workshops carried out with the funding of MFAD in relation to project research goals. (details in report)
	13.3.2.4. Other	
14. TRAVEL		
	14.1. InCountry	Travel requests for TAs and travel approvals
	14.2. International	Travel request for TAs and travel approvals.