SEED MULTIPLICATION PROJECT

621-0092

REVIEW

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I. Background

A. Authorization and Funding

The Seed Multiplication Project was approved in 1970 for a ten-year LOP authorization of $1,923,000.

The project goal was:

> To assist Tanzania to achieve self-sufficiency in the food-crops sub-sector.

The purpose of the project was:

> To assist Tanzania in developing a system which can produce the quantities of improved/high quality food crop seeds to satisfy national demand.

In June 1973 Amendment No. 2 changed project outputs from two foundation and five certified seed farms to four foundation seed farms: one for each major ecological zone of the country. Amendment No. 2 also increased LOP funding by $1,597,000 from $1,923,000 to $3,520,000. The bulk of this increase, $1,258,000, was for additional contract and short-term consultant services. Amendment No. 3 in April 1973 changed the mix of technical assistance without changing funding levels.

The project was again amended in January 1979 to add $2,484,000 funding for a new LOP authorization of $6,004,000. These funds provided additional technical assistance, training and commodities for Dabaga, the fourth farm. In August 1979 a programmatic adjustment was made to increase the authorization level by $325,000 to $6,329,000, which had been obligated according to financial management records.

In June 1980 Amendment No. 6 extended the project completion date to December 31, 1981 and added $525,000 for $6,854,000 life of project funding.

I. (continued)

B. The System and its Components

The ultimate objective in producing high quality food crop seeds--in sufficient quantity to satisfy the national demand--is to provide the Tanzanian farmer with high quality seed in order to increase his production.

The system starts with the development of improved seed. The general flow of improved seed from its beginning to its end use, which takes place over a three-year period, is depicted in the chart, Appendix A.

Briefly, seed is developed at the Government research farms or received from outside sources and tested at the research farms. When Research feels it has a proven improved line suitable for Tanzania it presents a formal report, backed by statistics, to the National Seed Committee at its Annual Meeting.

If the National Seed Committee accepts the report favorably and determines that the new line would be useful for Tanzania, it reclassifies the line from research seed to breeder seed and approves its release as breeder seed to the Foundation Seed Farms, to be multiplied under stringent, controlled conditions to maintain seed purity. This multiplied seed is then known as foundation seed and is taken by TanSeed for further multiplication on the farms of contract growers, where it is also produced under controlled conditions and becomes known as certified seed.

Certified seed, if all production regulations have been satisfied, goes from the contract grower to TanSeed processing plants, where it is treated, bagged and stored for distribution to the Tanzanian farmer for his production, consumption and sales.

I. B. (continued)

In 1975 the Seed Regulation Act set up a Seed Certification Program, creating the Tanzania Official Seed Certification Authority (TOSCA) as the official Certification Agency for Tanzania. TOSCA functions through its National Seed Testing Laboratory, to which are assigned TOSCA's headquarters staff and Field Inspectors, as well as the laboratory staff. TOSCA should monitor the field and post-harvest operations for seed quality control but, due to the shortage of qualified staff and lack of financial means, is unable to fully perform these duties. As a result, the burden of the field monitoring has fallen upon TanSeed, which is itself responsible for the quality of the field operations and should not be the agency to officially monitor these operations.

TanSeed (Tanzania Seed Company, Ltd.), a parastatal and an offspring of TanWattle (see VI, Recommendation 10) was organized to provide the link between the foundation seed farms and the Tanzanian farmer, having the legal responsibility of making certified seed available to the farmer. To do this TanSeed receives the foundation seed from the foundation seed farms and multiplies it by contract with farmers, agricultural companies and the foundation seed farms themselves, maintaining supervisory control. This takes place during the second year in the line of production. At harvest time TanSeed receives the seed from the contract growers and processes and stores it ready for sale. In the third year TanSeed sells it to the farmer.

I. (continued)

C. USAID/T's Contribution to the System

USAID/T's primary contribution in developing the system has been to create and develop the foundation seed farms (see III). This assistance has taken three forms:

(i) Technical assistance to the farms

Through the services of its contractor, Experience Incorporated, U.S. technicians served as Farm Managers and Agro Mechanics to co-manage and operate the farms while training Tanzanians. They constituted the nucleus of each farm, starting with Tanzanians with no experience in seed farm production, little or no experience with farm machinery and little or no technical education.

(ii) Training Tanzanian staff

Forty-seven Tanzanians were sent to the U.S. for degrees in Agronomy, Agronomy Extension, Agricultural Engineering, Seed Analysis and Entomology; or for training in Agro Mechanics, Seed Improvement or Plant Science. In addition, two were sent to CIMMYT in Mexico for training in Crop Research; and one to IITA, Ibadan, for Legume Production. Of these 50 participant trainees, 19 earned B.S. degrees and two earned M.S. degrees. See Appendix B, "Complete List of Participant Trainees."

Those participant trainees who returned to the farms on completing their degree work or training, were given positions as counterparts to the U.S. technicians and received training on the job by the technicians for eventual takeover.

I. C. (continued)

(iii) Physical Assets

USAID/T has provided most of the machinery, spare parts and equipment for the farms and has contributed significantly to their infrastructure.

In addition, USAID/T is responsible for the establishment of the Spare Parts Center, which supports the farms, having set up the inventory control procedures and organized the Center with U.S. technical assistance (an Inventory Control Specialist) and stocked it with spare parts. (The Spare Parts Center is discussed in II.B. and the second paragraph of II.C.).

Another contribution, vital to the system, was the National Seed Testing Laboratory, built with an Agri Sector Loan and equipped under the project, with technical assistance for the Laboratory (see IV.B.).

USAID/T stimulated and helped to develop the links in the system, starting with Research as developer of the breeder seed, and ending with TanSeed as the outlet for the certified seed.

II. Project Linkage to Ministry of Agriculture:

Seed Multiplication Project Office, Ministry of Agriculture

A. Support and Control

The Seed Multiplication Project Office is the control center for the foundation seed farms, the National Seed Testing Laboratory and the Spare Parts Center.

Its function is to provide direction for the foundation seed farms and support in the way of personnel, development support, and procurement of supplies.

Participant trainees: The control center identified candidates for participant training and assigned participants, on completion of their training, to the farms as counterparts to the U.S. Farm Managers and Agro Mechanics. Only 43% of the degree participants and 41% of the non-degree participants are now in the project. There should have been participant trainees to serve and be trained by U.S. technicians as Assistant Farm Managers; others as Field Agronomists to supervise the production of crops on the farms and to assist in crop planning; and still others to serve as additional Agro Mechanics and to receive on-the-job training on the specific machinery and equipment used on the farms. Most of those who did not return are being utilized in other LanGov jobs for which their training has also qualified them. However, their value to the nation has not been maximized as it would have been in the project, for which they were specifically trained. The farms could have matured more quickly, and operations carried out more efficiently had they been assigned as planned; and there would have been a cadre of specially educated and job-trained personnel to provide for attrition on the farms and even for expansion of the farms in the future. The project has not reaped even half of the benefit of its substantial

II. A. (continued)

investment in participant training. The loss in on-the-job training is an irretrievable loss to the nation of scarce human resources.

TanGov has in this respect failed the farms, the project, and the nation.

The control center allocates money to the farms for operation and capital development according to the Ministry's budgetary allowances, with the income from the farms going into a revolving fund under the control of the center for reallocation. It is responsible for procuring supplies requested by the farms.

B. Spare Parts Center

The Spare Parts Center, located at Vingunguti, was planned in 1975 but only developed during the past year. It maintains records and control cards, which were set up by a U.S. technician serving as Inventory Control Specialist. A returned U.S. degree participant trainee was assigned to manage this Center, but he did not take advantage of the on-the-job training by working together with the U.S. technician, as planned by the contractor and USAID/T. How well the records are maintained will determine how effective the Spare Parts Center is.

C. The Foundation Seed Farms as a Parastatal Organization

In the early stages this office was a much needed, active control center: direction was essential because the work of the farms had to be organized to fit the project design. An arm of the Ministry of Agriculture, it worked hand in hand with USAID/T as the farms were developing. At the present stage most of the operational decisions are made

II. C. (continued)

on the respective farms, and management decisions coming from the control center are minimal.

The infrastructure has been completed except for the erection of Dabaga's primary seed-handling, drying and storage structures and installation of equipment (which have arrived in the country and cleared customs). Requirements for spare parts, formerly a grave problem, are now well in hand, with enough parts on hand in the country to last the farms for 2-3 years or more. The farms carry inventories of fast-moving spare part items, and the Spare Parts Center carries a broad selection of slower-moving spare parts, as well as a backup of the former. In addition, the Spare Parts Center has records of spare parts on all farms so that a part can be transferred from one which has no immediate need for it, to another farm.

The greatest support need the farms now have is assistance in the procurement of recurrent inputs, such as fuel and farm chemicals (which support in recent years has been inadequate for maximum production).

Msimba and Arusha Foundation Seed Farms have reached a state of maturity whereby they do not require the supervicion and guidance of the control center, and they should be separated from the Ministry of Agriculture and organized under a form of Seed Industry Parastatal. (Dabaga Farm is not yet ready for this transition but could reach this stage in a year's time with good management.)

Conversely, the Ministry should be relieved of the burden of the oversight and support function in this mature situation.

III. A. Msimba Farm

1. Physical Factors

This farm is located about 275 kms. west of Dar es Salaam on a latitude of 6°50" south of the equator. Elevation is 1,600 ft. with a temperature range between 20°C to 30°C (68°F to 86°F) and an average rainfall of 30-40 in. during the growing season.

Soils: It has a total of 6,500 acres, of which 47% is Class I and Class II land, which is suitable for intensive cultivation, but the portion classified as Class II has a high water table (1 mtr. to 1/2 mtr. below the surface) during the growing season, which restricts its land use and productivity. Forty percent is Class III land and 13% is Class IV. These latter two land groups are less well suited for cropping because of the moderate-to-severe erosion hazard when the land is cultivated.

The soils on this farm have quite a high degree of natural fertility. However, plants are responsive to applications of nitrogen and phosphorous fertilizers.

Machinery and Spare Parts: In mid-1979, the farms being in critical need of machinery and spare parts, an inventory was taken of that on hand, a determination made as to the specific needs of each farm, and orders for machinery and spare parts were placed. An emergency situation then arose as a result of a prolonged strike against International Harvester Company (the principal supplier) in the first half of 1980 and, following the strike, the complete lack of support from AAPC, the purchasing agent selected by USAID/T in 1978 for the Seed Multiplication Project. Due to AAPC's failure to act, exacerbated by its inadequate response to follow-ups, a total of 99 cables and telexes were sent just to follow up on one PIO/C.

Following is a list of the machinery on that PIO/C, which was delayed.

1. Msimba

   a. One hydraulic floor crane
   b. One tire changer
   c. One 3-pt. hitch 8' blade
   d. One 1086 I.H.C. tractor
   e. One 13-1/2' offset heavy duty disc harrow
   f. One 13 ton G.V.W. International straight truck
   g. One 5 bottom semi-mount moldboard plow
   h. Two 2 row pull type corn pickers

2. Arusha

   a. One 1086 I.H.C. tractor
   b. One 13 ton G.V.W. International straight truck
   c. One 3-pt. hitch 7' blade
   d. One 12 ton gravity wagon and running gear
   e. One 12 ton running gear
   f. One 400 cyclo planter
   g. One 17-2/3' tandem disc harrow
   h. One 18' soil mulcher
   i. One 600 gal. trailer-mounted fuel tank
   j. One 600 gal. trailer-mounted water tank
   k. Two 5 bottom semi-mounted moldboard plows
   l. One 2 row 3 point hitch corn planter

3. Dabaga

   a. Three 5 bottom semi-mounted moldboard plows
   b. Two 1086 I.H.C. tractors
   c. Two 13-1/2' offset disc harrows
   d. Two 12 ton wagon running gears
   e. Two 8 ton gravity wagon boxes
   f. One 715 combine with grain header and 2 row cornhead
   g. One 13 ton G.V.W. International straight truck
   h. One 18' tandem disc harrow
   i. One 5 ton fertilizer sprader
   j. One I.H.C. front end tractor loader
   k. One 300 gal. crop field sprayer
   l. One 3-pt. hitch 7' blade
   m. One 6-row cyclo planter
   n. One 2-row 3 pt. hitch corn planter
   o. One 42' flight elevator
   p. One 16' grain elevator
   q. One 53' grain 6" auger
   r. One 21' grain 6" auger
   s. Two 2-row pull-type corn pickers
   t. Two 12' tine-toothed harrows
   u. One flail field shredder
   v. One corn sheller/cleaner
   w. Three 6000 bu. metal storage bins equipped with standard drying floor, fans, motors, vents, etc.
   y. One 6000 bu. metal drying bin with combination biogas or diesel fired furnace.

III. A. 1. (continued)

The machinery on the list for Msimba Farm and Dabaga Farm is basically replacement machinery. The machinery and spare parts for these two farms are already in place, each of them having a full line of farm machinery. In fact, now that spare parts are readily available for immediate repair, one could say that they are overmechanized by U.S. standards. Full service and future spare part needs cannot always be readily available, which necessitates excess machinery for backup. Machines will be aging with use, and as time progresses, increased repair and spare parts will be needed.

Equipment (the grain-handling and -processing equipment): This is adequate and adapted for the various functions required for foundation seed produced on Msimba Farm. It does not completely follow the original plans for the farm because of the building for maize-drying and that for seed-processing and -storage not having been completed by the contractor engaged for that construction. This failure to complete the buildings has resulted in non-utilization of part of the equipment, which was especially designed for use in the seed-processing and -storage building, but has in no way hampered the operations on the farm.

Buildings: Fortunately, much of the infrastructure present on Msimba Farm at the time of its conversion in 1971 from a sisal estate to a foundation seed farm was able to be used immediately. Some modifications were made to existing buildings, and some new buildings were added.

While the maize-drying building (which is in process of being equipped with forced air) and a diesel-fired furnace heating system were being built, temporary old-fashioned wire/expanded metal pole cribs were constructed to dry

III. A. 1. (continued)

and store ear maize from the first crop. This continues to be a satisfactory procedure. Increased production from expanded acreage was accommodated by additional cribs, and the maize-drying building has never been used.

Construction of the maize-drying building resulted from poor judgment in planning. It was not needed and, if completed, will never be used, except in cases of emergency, for the following reasons:

(i) Higher energy costs which would result from the use of electricity and diesel fuel have been eliminated through use of the old-fashioned natural air-drying crib and

(ii) The design of the building would make the movement of maize, both in and out, extremely difficult and burdensome.

Water

Adequate and dependable domestic water is available from a system of the former sisal estate. The source is a spring-fed stream which is dammed up to form a pool from which a pump sucks the water and forces it to a supply cistern high above all gravity-fed outlets or valves.

Roads

The approximately 80 km. road leading to the farm in either direction from the DSM-Iringa paved road is occasionally impassable during some of the rainy season. This may occasionally be a constraint since it is very important to be able to move supplies into the farm during the rainy season, which is also the crop-growing season.

III. A. 2. Management and Staffing

The last U.S. farm management technicians left the farm two years ago and the U.S. Agro Mechanic left one year ago. Since then the farm has been independently managed and fully staffed by Tanzanians. Mr. Lujuo is an excellent all-round manager who has responded well to the guidance of U.S. technicians. He is technically trained as an agronomist, with a degree from Purdue University. He is a manager and prime mover of people, so the job gets done properly on a timely basis. He is fully aware of and on top of daily operations. The cooperation he gets from the local authorities is excellent. He knows his farm, knows his crops and is getting optimum production from the farm, given the limitations of drainage and available rainfall.

The Agro Mechanic on this farm received nine months of training at Western Illinois University (along with 12 other Agro Mechanics from Tanzania). He does a good job for the most part but requires help with very difficult problems.

Bwana Shamba's, tractor drivers and other key personnel work well under the farm's management. Farm labor availability does not seem to be a problem. Two, three or four hundred laborers can be put to work on short notice when required for weeding or harvesting.

3. Planning

Year-to-year planning is the responsibility of the Farm Manager, with the approval of the Ministry of Agriculture. In most cases the responsibility is totally delegated to the Farm Manager.

The major factor in the annual crop plan is the TanSeed demand for the various foundation seed crops and certified seed commonly grown on

III. A. 3. (continued)

contract with TanSeed on the farm. The remainder of the crop plan involves the production of the basic milling grains, which fits into the crop plan for field isolation.

Of primary concern is avoidance of field contamination of the respective varieties. One method is to create adequate barriers between fields of different varieties of the same crop which might be pollinating at the same time. Another method is to stagger planting of unlike crop varieties by time periods. Mr. Lujuo has his planting plan fully organized.

B. Arusha Farm

1. Physical Factors

The farm is located in the northern part of Tanzania about 7 miles north of the Regional Headquarters town of Arusha. It lies along the major road between Arusha and Nairobi, Kenya. Elevation ranges from 4,800' to 5,300' on the southwestern slopes of Mt. Meru, which influences both moisture (32" of erratic rainfall per year, with more precipitation on the southern portion than on the northern end) and temperature (20°C-16.5°C) on the farm. It lies in the bimodal rainfall part of Tanzania, but only one crop per year is planted for lack of adequate moisture.

Soils: The soils are of recent volcanic ash origin, which are inherently fertile and potentially highly productive. They are erosive and do not have good water-holding capacity except for the alluvial areas in the lower positions, where water-holding capacity is excellent.

III. B. (continued)

It is essential, therefore, that water be available at the right time, either naturally or by irrigation, to assure a good crop. Manganese is definitely deficient and must be applied for both wheat and corn, but especially for wheat. Nitrogen and phosphate are present, but plants do respond to medium applications of these elements.

Machinery: Please refer to the machinery section on Msimba Farm under III.A.1. The machinery situation at Arusha is similar, but there is a difference with respect to the training of tractor drivers and machine operators in machine usage discipline. Bwana Shamba's, although supervisors of field operations, are not trained as drivers or machine operators. Not being knowledgeable in machine operations, they cannot be held responsible for proper tractor/machine care in field operations. The mechanics are in the field with the equipment, but they only maintain and repair; and have no authority over or responsibility for tractor and machine operations. The fact that at Msimba the Farm Manager and the Agro Mechanic spend considerable time in the field must account for the difference that exists between the farm machinery downtime at Arusha and that at Msimba.

There have been many failures in the IH trucks, but many of these can be traced to rough handling and driving.

Equipment: The same type of grain-handling and -processing equipment was planned for this farm as that at Msimba. The difference, however, is that at Arusha the two buildings for grain-handling and -processing were completed, and the equipment is in operation.

III. B. 1. (continued)

Buildings: Natural drying in Arusha is not so complete as it is in Msimba, and occasional artificial assistance is necessary to assure proper drying of the seed maize. The system is ancient in design and construction and will always be burdensome and awkward to use. This is an ear corn system, in which the moisture of the cob, as well as the kernel, is dried, requiring more energy and twice the space to hold the undried crop as for grain drying only.

Some modifications could be made to the outside crib-ventilating doors of the drying building to allow a slower flow at discharge in order to prevent an avalanche of ear corn bursting forward onto the attendant and onto the ground when the door is opened.

Misplacing of the main elevator stack in the center of the grain-processing building necessitated making an extension into the roof so that the stack could reach its necessary height for proper gravity discharge to the bins. The bins were not elevated enough in the plans and construction to allow the proposed gravity flow into the processing equipment. Therefore, the central processing unit was moved to one side so that at least half of the bins could discharge by gravity flow. The other half still requires additional augers/conveyors to become usable.

Materials are now on site for the construction of a chemicals and fertilizer storage building. Also, more machinery cover is being built. With the addition of these structures the farm will have a basic set of good buildings.

III. B. 1. (continued)

Unfortunately, due to misuse of machinery space--not the lack of a machinery storage building--most of the machinery is standing out in the weather when not in use and, as a result, is unduly depreciating. Many of the farm's crops are being stored in the machine storage area which should be transferred to TanSeed or, in the case of milling grain, to the National Milling Corporation.

There is good housing, office and lab space, as well as tools storage, spare parts storage, and workshop for repair of machinery and equipment. The compound is enclosed with high cyclone fencing to keep out unauthorized persons. This is essential because the farm is located on a major highway and is in a rather densely populated area.

Water: In the past the domestic water supply has not been dependable; however, a newly drilled well has alleviated this problem.

Irrigation: Because of a limited water source (a relatively small stream), the great water demands which would come with irrigation, and the dense population needs, river water rights could not be obtained. Attempts were made in 1978 to drill deep wells for crop irrigation purposes, but the wells failed for lack of water. Recently four irrigation boreholes were drilled by the Regional Engineer to test capacity. One borehole was tested at 10,000 gallons/hr., another at 9,000 gallons/hr., the third at only 3,000 gallons/hr. (the fourth unknown at the time of this writing). A 10,000 gallons/hr. bore can fully irrigate 20 acres or supplement 40-50 acres. The 3,000 gallons/hr. yield is too low for irrigation, but is being used for the domestic water supply. Irrigation

III. B. 1. (continued)

pipe and sprinklers are on hand supposedly to irrigate 200 acres. There is, in any case, enough such equipment to irrigate the land that the probable water supply will furnish. Before pumps are purchased, it will be necessary to again test the water capability of these bore holes during the dry season to substantiate their capacity. This work is currently being pursued.

Roads: The major road between Arusha and Nairobi, which is a very good road, borders this farm on the east. The intra-farm roads are adequate to service the field layout and are in good condition. A problem occurs with cattle herds being transferred daily on these roads. A border of sisal is being planted to reduce the incidence of cattle entering the fields.

2. Management and Staffing

The Farm Manager, Charles Mmari, received his B.S. in Extension Agronomy from Mississippi State University in 1977. He took over full management responsibilities of Arusha Farm in 1978 and for the most part is doing a good job. He is quite knowledgeable in the crops being grown. His weakest point is probably lack of full understanding of the farm's mechanization. As a result, he has reverted to much costly hand labor in many of the farm's operations involving weeding, harvesting and fertilizing.

Problems in hand labor arise when there are other community demands competing at the same time, such as coffee-picking, weeding, roguing, fertilizing. Also, Mr. Mmari in his efforts to get optimum production from the labor inputs, has spent many sessions in the labor union courts

III. B. 2. (continued)

settling labor disputes. Arusha is a difficult community from the standpoint of people asserting themselves and Mr. Mmari, because of his age, does not receive senior citizenship respect when dealing with labor problems. Under the circumstances he does remarkably well.

The Agro Mechanic situation is quite good, but there is some difficulty caused by one of the primary mechanics (an older man and a carryover from Com. Works) who is not so knowledgeable and asserts himself against management, apparently from stubbornness, not following instructions or prescribed rules. The other primary Agro Mechanic, Thomas Mwasongole, is better trained, more capable and more cooperative, and is a real asset to the farm.

The problem of tractor drivers and machine operators was discussed previously in the Machinery Section.

Because of numerous other job possibilities in the Arusha area for skilled and semi-skilled personnel and because of the low wage scale (see VI, Recommendation 17) paid by the Government, only the less skilled/semi-skilled workers are attracted to the Arusha Seed Farm; then as they improve their skills they move to better-paying jobs, and it is nearly impossible to hold a man on a job long enough for him to become fully trained and thus job-effective. This is a problem on the other farms also but probably is more serious on this farm.

3. Planning

Planning, as previously stated in III.A.3, is the responsibility of each individual Farm Manager working with the Ministry of Agriculture.

III. B. 3. (continued)

TanSeed meets with the Farm Manager well in advance of the planting season, and between TanSeed and the Farm Manager an "agreement is reached" in regard to selection of crops and varieties of foundation seed, hybrid seed and certified seed according to TanSeed's demands and the farm's capabilities.(not a mutual agreement according to farm managers).

Arusha is a relatively narrow and long farm with much border exposed to local farms growing indigenous varieties, which can cause cross-pollination and thus contamination of the seed crops. Tight planning, as well as closer management, is required to assure proper isolation in order to avoid such contamination.

A limiting factor in hybrid seed production is labor. One hundred acres is felt to be the maximum acreage on this farm which can be adequately tended during the critical production months of May and June, when both corn-detasseling and coffee-picking compete for hand labor.

Two attempts in two successive years to grow hybrid seed on this farm failed. On the first, the seed was color-coded erroneously, an error which was traced back to TanSeed, with no fault on the part of the farm. It was unfortunate because the yield would have been exceptionally high. On the next attempt the following year it was dry at planting time and the plants, after emerging, died for lack of moisture.

Beans have had their bumps too on this farm. The first time I viewed the farm in 1979 the 100-acre bean crop was a failure, but rather than retreating until definite causes for failure were determined, the next year the acreage was doubled to 200. That crop also failed, apparently for the same reason (Heroid Blight). This is an egregious example of poor crop planning, but it is not clear who insisted on this course of action.

III. C. Dabaga Farm

1. Physical Factors

This 2,400 acre farm is located on a gravel road about 30 miles southeast of Iringa in the Southern Highlands of Tanzania. Due to its 6,500' elevation the temperatures are generally cool, ranging between 14°C/57°F to 26°C/79°F. The annual precipitation of 34 inches is concentrated but well distributed during the growing period.

TABLE OF AVERAGE RAINFALL BY MONTHS AND YEARS IN MM FOR A 34-YEAR PERIOD

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Yearly
207	155	130	79	22	0	15	15	0	0	0	232	861

The farm's service buildings and headquarters are located off the gravel road on a rolling, graded dirt farm road by a distance of about 3/4 mi. On occasion during the heavier rains this road is only passable by tractor or a 4-wheel drive vehicle. This sometimes causes problems in receiving needed fuel and supplies for the farm's operations.

The farm's records show that 2500 acres are tillable, but for all practical purposes under present conditions only 1,400 or 1,500 acres should be cropped. Use of intertilled crops should be limited to 1 in 4 or 1 in 5 years in the rotation on some of the steeper slopes, and contours and terraces should be redesigned to increase tillable acreage to full potential.

III. C. 1. (continued)

Soils: The topography is generally gently-to-medium rolling with 5 to 15% slopes coming off some fairly broad ridge tops of 2-4% slopes. The majority of the land is inherently productive. This productivity can be maintained with good soil conservation practices through good planning and management.

Machinery and Spare Parts: Please refer to the machinery section on Msimba Farm under III.A.1. In the listing are the new machinery, buildings and equipment ordered for Dabaga Farm. The spare parts have arrived, and the machinery is arriving now. There was an unfortunate shipping delay, which is discussed under Msimba Farm at III.A.1.

Machinery and spare part needs have been increased by use of the machinery for other than seed farm purposes:

(i) Up to 100 acres of crops have been grown for the workers on the farm. Prime time and use of machinery have gone into this effort, with the seed production effort sometimes secondary.

(ii) There was a time when some of the field equipment--tractors, harrows, etc.--was being used off the farm in fields of farm workers, friends of the farm management or people with political influence. Dabaga Farm won the Saba Saba Day Achievement Award last year. This was not for achievement on the farm but for work with tractors, equipment and operators off the farm.

III. C. 1. (continued)

There was a period of time when no U.S. technical representation was on the farm. Machinery was being misused, causing undue wear and damage. The USAID Project Officer deferred shipment of machinery, equipment and spare parts to this farm until the problem could be resolved among USAID/T, TanGov and the contractor. (As it turned out, AAPC had not taken action on the major ($800,000) PIO/C anyway, so there was no increased delay in this shipment.)

Equipment: Duane Eriksmoen of Experience, Inc., in his October 24, 1980 trip report criticized USAID/T project implementation for changing the IHC combine specifications from a 1460 model axial flow combine, supposedly with a 6 row x 36" corn header, to a 1440 axial flow combine with no corn header. To set the record straight, Mr. Eriksmoen was in error in that the specifications for the 1460 had not included a corn headed, as stated.

The change in specifications was made during the 10-month period when the contractor did not have a Chief of Party on board. The decision to make the change, taken by the Project Officer, was made because (as stated by the International Harvester's East Africa Sales Representative, George Thompson) the 1460 model was not yet in production and, due to great demand, would not be available and on site in Tanzania until late 1981. The 1440 was in production and more readily available and it could get the job done with a little more time. (Both had the same power unit but the 1460 was equipped with a supercharger which the 1440 did not have. The added power made possible by the supercharger, however, also added

III. C. 1. (continued)

strain on the machine, making the unit more vulnerable to breakdown.) Additionally, the 1460 would cost not $52,000, the price quoted before IHC's strike, but close to $65,000 as compared with $55,821 for the 1440 on the new price level.

With the arrival of the new Project Coordinator it was decided not to have an axial flow combine at all, in order to maintain standardization for parts and service of the IH-715 model combines which the other farms have, and also because the Agro Mechanics are familiar with the overhaul and repair of this model.

A modern U.S. system for seed handling, drying and storage was planned for the farm. It did not arrive in time to be used for this crop season. See VI, Recommendation 1.

An old maize sheller used last year is to be replaced with a new seed maize sheller/cleaner similar to equipment at the other farms. Formerly, the maize was sorted and shelled after drying on a large concrete slab.

Buildings: The buildings on Dabaga were developed around general grain farming, truck cropping and dairy farming. Most are now old and not especially compatible with the needs of a modern seed farm. Some, however, have been remodeled and have been put into use for seed handling, processing and storage.

Four 6,000 bu. metal storage and drying bins, a grain drying unit and grain conveyors have been ordered with USAID/T funds for Dabaga

III. C. 1. (continued)

Farm. When erected, this will make a modern seed-handling facility.

Pole-type cribs similar to those on Msimba Farm have been planned for construction on this farm for the first drying on the ear as the maize comes from the field. As of recently, the construction of these cribs had not begun, the reason being that chain link fencing or expanded steel was not available to TanGov since the necessary materials were not available through legal channels (as opposed to the black market).

In addition to the grain bins, USAID/T had offered to provide a 40' x 60' x 12' metal, general purpose building, but TanGov wanted to construct the building with local materials and have USAID/T put the money saved into machinery and spare parts. This idea was agreed upon a year ago. The construction of this building, 60' x 200', has now begun.

Water and Electricity: The domestic water supply is from a pond which is spring-fed but which also catches surface runoff water. It is pumped to tanks on a tower, and from there it flows by gravity to the points of use. It must be filtered and boiled for drinking water. USAID/T furnished filters for the two technicians' houses.

The farm is not near a main electrical power line, and all electricity is generated on the farm at great expense. In order to preserve fuel, the power plant is in operation 76 hours per week.

There are two generating plants on the farm. A large 100 Kw

III. C. 1. (continued)

Caterpillar-driven generator will furnish adequate electricity and will be used when seed processing and grain-drying operations are in effect. A smaller 23.5 Kw generator driven by a Lister engine is on loan from USAID/T to the project. (See VI, Recommendation 2.)

2. Management and Staffing

Management and staffing have been a problem. The first U.S. Farm Manager/Agro Mechanic, Lewis Jones, was especially qualified in farm management and hybrid seed corn production (the crop for which this farm was specifically selected). He was on board and had the first crop planted when an inexperienced U.S. trained participant, just returned from New Mexico State University with a B.S. degree in agronomy, was assigned to Dabaga Farm as Jones' counterpart. Lack of experience cannot be held against a person, but according to Jones, he was more interested in local politics than farming and was not ready to learn or to take suggestions from Jones. The relationship came to an impasse, and efforts by USAID/T and TanGov failed to mend the fences. USAID/T requested then that TanGov replace Jones' counterpart with another agronomist who had been trained under the participant training program. The rationale was that the TanGov man would be in-country and the replacement could be effected within a few weeks' time, as compared with months to replace the U.S. technician. TanGov would not yield so months then did elapse--from early January to late April.

III. C. 2. (continued)

Jones' replacement has bent over backward to be compatible with the Tanzanian co-manager--so much so that farm planning and positive management suggestions and decisions have been somewhat insufficient. Dabaga lacks top leadership!

Within the past year there has also been conflict between the U.S. Agro Mechanic, joined by his counterparts, and the farm management. Attempts have been made to resolve this problem, and visible progress has been made. The Agro Mechanic had been faulted for not having equipment ready for field operations, but he had not been brought into the farm's management so that he could know what was expected of him. When told what was expected it appears that he made every effort to cooperate.

The second line of management is quite good in that once the crops are planted the Bwana Shamba's are able to get the weeding, fertilizing and detasseling done on a timely basis with hand labor.

III. D. Kibaha Farm: History of Farm and Current Status

Kibaha, the third farm to come under seed farm development, has been a subject of considerable discussion and conflicting ideas between TanGov and USAID/T (the Project Officer carried the load). When USAID/T, following the recommendation of the Missouri Survey Team, made the determination to discontinue the farm as a Foundation Seed Farm, TanGov objected strenuously, saying Kibaha was a political issue and was of no concern to USAID/T. Behrens countered that it was USAID/T's concern because it was affecting the success of the project by being a constant economic and manpower drain on the project, and would continue to affect the project's future success. After some time it was decided (mostly unilaterally) that USAID/T would not support further development of Kibaha as a seed farm in the way of additional machinery and equipment but would supply spare parts for those pieces of machinery and equipment already on site and would also provide one additional year of technical assistance. That year having passed, the U.S. Farm Manager-Agro Mechanic left the farm July 9, 1981.

This farm was abandoned as a sisal farm some years ago and is still being cleared with TanGov funds of bush that grew up in the intervening years. It was intended as the seed farm which would represent the Coastal Ecological Zone, and it was to produce seed suitable for this zone. Elevation and rainfall were the key variables in the selection of this and all of the other farms.

Unfortunately, Kibaha turned out to be a poor selection. Even one of the key variables showed up as a disappointment. Appendix C shows

III. D. Kibaha Farm (continued)

1000 mm average annual rainfall (40 inches) for Kibaha. Of the 40 inches, however, only 62% or 25 inches comes during the 5-month growing period. Of this 25 inches, up to 20% is lost to deep soil percolation (below the root zone) and runoff due to the very sandy soils and rolling topography. Twenty inches is grossly insufficient moisture to grow any of the seed farm crops.

Soils: The sandy soils found on this farm are inherently non-productive. Ninety percent of the plant nutrients plus water must be added in order to produce even a mediocre crop. Initially, 5 tons of lime per acre at $100 per ton would be needed for a crop, and thereafter 1 ton per year of additional lime. Other fertilizer costs would amount to between $200 and $300 annually. The value of the crop produced would not begin to cover even these costs alone.

"From an economic viewpoint, the farm probably would always be a low return/high cost operation. It seems doubtful if the low and erratic yields would generate enough annual income to cover the cost of soil treatments alone. In such case, nothing would be available to cover the other variable costs--machine costs, chemicals, labor, etc.,--to say nothing about the high annual fixed costs resulting from the substantial investments needed on a seed farm." (Tanzania Seed Survey Industry (1979) Missouri Survey Team No. 2, P. 22)

The first U.S. Farm Manager-Agro Mechanic, Lewis Jones, recognized the deficiencies of the farm and brought this situation to the attention

III. D. (continued)

of TanGov, the contractor (Experience Incorporated) and USAID/T. This prompted a soil survey of this farm, the other three farms and two other potential seed farms, Urambo and Songea. Unfortunately, the soils survey came too late. Had it been made before selection of Kibaha as a foundation seed farm it could have saved the expense and difficulties involved in clearing squatters who had moved onto the land after the sisal farm abandonment; and the costs of land acquisition, land clearance, construction of two top staff houses (with money coming from a U.S. Agri Sector Loan), and construction of an electrical power line and a fresh-water main, both 3 miles long from the connection point.

This farm had three very good U.S. farm management technicians during the period of 3+ years when U.S. technical assistance was provided. This gave the farm a very fair chance to prove its capabilities, but even with top management, success in producing cereals and grains could not be achieved.

IV. The National Seed Testing Laboratory

A. Organization and Management

The National Seed Testing Laboratory (NSTL) is the vehicle through which TOSCA carries out its legislative mandate to act as the official Seed Certification Agency for Tanzania (see I.B.). NSTL performs three functions:

(i) Adequate and timely field inspection of crops;

(ii) Laboratory and field plot tests;

(iii) Harvest, processing and storage checks to see that foreign seed is not introduced; that moisture is at a proper level for storage; that the seed is actually as described on the bag tag; and that germination is properly noted as it decreases from date to date.

These are actually combined functions of NSTL and TOSCA.

The Director of NSTL serves as the top TOSCA official, although he has not been so designated by MinAgri. The staff at NSTL is also TOSCA staff: headquarters staff, laboratory staff and field staff.

B. Personnel

NSTL is staffed with two returned U.S. trained participants. The Director (No. 5 on Appendix B) is technically qualified but is not strong in management. The second (No. 20 on Appendix B), together with a substaff of about eight persons, is responsible for both laboratory and field testing duties, moving from one activity to the other as required.

A U.S. technician Seed Analyst, provided by the contractor on a

IV. B. (continued)

short-term (8-month) contract, is now at NSTL, charged with the following duties:

(i) Setting up and making operational the laboratory equipment;

(ii) Training laboratory technicians and field inspectors;

(iii) Reviewing Tanzania s Seeds Regulation Act, with a view to making suggestions for changes to fit the current situation in Tanzania.

He has completed (i) and (iii) above and is still in the process of carrying out the training function.

Cooperation and communication between the top staff of NSTL and the U.S. technician have been slow to develop: there was in the beginning a resistance to learning from him, but this resistance seems to be breaking down. The technician is a highly qualified seed analyst and is temperamentally well suited to deal with the situation.

C. Physical Factors: Building, Equipment and Transport

The NSTL, located on the grounds of the Faculty of Agriculture (Tanzania's agricultural college) at Morogoro, was built with money from an Agri Sector loan. The laboratory was equipped with project money. The temperature/humidity seed storage vault was improperly designed and could not be used without modification. Some of the equipment, being of U.S. origin, was designed for 110 volt current and was burned out by being plugged into 220 volt current when it was being installed in the laboratory building. Other pieces of equipment were damaged by non-staff itinerants coming into the laboratory and playing with the equipment.

IV. C. (continued)

The U.S. technician, on taking up his post, took note of this and ordered replacements of parts or of items, as needed, and the equipment is now operational.

There are two vehicles, which are insufficient for the field testing functions. However, by December 31, 1981, two other suitable vehicles will be available from the project, and it has been recommended that they be turned over to the NSTL. If the recommendation is followed, transport will be adequate.

At the present time full use of the laboratory and a fully functioning TOSCA organization is not a reality. NSTL is understaffed with trained people. To be fully functional NSTL will require not only additional qualified personnel but also adequate transport.

Sufficient personnel was trained under the participant training program who could fill the personnel need, and the additional vehicles will be available at the end of this year. It remains for MinAgri to make the decisions to eliminate the constraints at the National Seed Testing Laboratory.

V. Project Achievements

The project outputs of four foundation seed farms (see I.A.) have been realized with the exception that one of the four, Kibaha Farm, was determined to have been poorly selected and to be insufficiently productive to accomplish its purpose as a foundation seed farm; and was virtually dropped as a seed farm so far as USAID/T assistance was concerned. Dispensing with Kibaha as a foundation seed farm, however, is not a hindrance to the project since the crops suitable to the ecological zone which Kibaha represented can be grown on Msimba Farm; and the remaining three foundation seed farms (Msimba, Arusha and Dabaga) can fulfill the nation's needs for foundation seed for the next ten years at their present productivity level. With improved production, the ten-year period would be extended proportionately.

USAID/T's primary contribution toward the project objective of

> "developing a system which can produce the quantities of improved/high quality food crop seeds to satisfy national demand"

was the development of the foundation seed farms (I.C.) Two of the foundation seed farms have now matured sufficiently to operate successfully without U.S. technical assistance. Msimba Farm has been Tanzanian-managed for two years and Arusha Farm for three years. The third, with good management, could reach this stage in another year's time (see VI, Recommendation 8). Sufficient personnel have been trained in the participant training program not only to operate the farms but also to constitute a backup force to replace project personnel

V. (continued)

lost through attrition. With the buildings already in place, plus those provided for (primary seed-handling, drying and storage structures for Dabaga; and a chemical and fertilizer storage building for Arusha) the infrastructure on all farms will be complete, and the farms will have an adequate basic set of buildings. Each of the three farms has a full line of farm machinery, with sufficient spare parts on hand for the next 2-3 years or more and with a system for providing spare parts to the farms from the Vingunguti Spare Parts Center and for procuring new ones as needs arise.

The system has been developed, with USAID/T's assistance, for producing improved/high quality food crops seeds in quantities sufficient to satisfy national demand, starting with research seed and taking that through the various processes to breeder seed, to foundation seed, and finally to certified seed for the Tanzanian farmer. The project objective has been accomplished.

Maize, sorghum and millet are the staple crops of the country, maize being the most important in terms of demand. Staple food crop seeds of maize, sorghum and millet are being produced in sufficient quantities to meet national demand. Tanzania, with USAID/T's assistance, has become self-sufficient in its staple food crop seed production: the project goal has been achieved.

VI. Recommendations

1. USAID/T extend PACD to September 31, 1982 and post a qualified U.S. technician on Dabaga Farm to see that the grain dryer, grain-drying bin and storage bins are operational and put to proper use during the next crop harvest season.

2. USAID/T grant to TanGov the Lister electrical power plant now on loan to Dabaga Farm, for its continued use.

At the present time additional funds are limited to completing the current Experience Incorporated-USAID/T contract, with the possibility of continuing with one technician as recommended in No. 1 above. However, Recommendations 3 through 7 are made in the event that money should become available and USAID/T should consider assistance to the Tanzania Seed Industry.

3. USAID/T request TDY technical assistance to make a complete soil conservation farm plan for Msimba, Arusha and Dabaga Foundation Seed Farms, covering crop planning, surface and subsurface drainage, irrigation, contouring, terracing and land shaping.

4. If any form of USAID/T support beyond the above is to be given to the Seed Industry, discontinuance of Kibaha as a foundation seed farm should be made an issue.

5. Arrange for the posting of a U.S. trained participant agronomist on Dabaga Farm to supervise hybrid maize production and breed and maintain inbred lines. USAID/T provide him with an additional year's training at CIMMYT in Mexico to develop maize breeding capability.

VI. Recommendations (continued)

TanSeed observes that the demand for hybrid seed is increasing at the rate of 10% per year. Most of its hybrid seed supply has been imported from Kenya, with a portion being produced at TanWattle Company in the Southern Highlands near Dabaga. Dabaga Farm, which was especially selected to grow hybrid seed, began producing it in 1981. With a qualified plant breeder, Dabaga Farm can do the basic crosses of inbred lines to produce hybrid lines and is a logical site to conduct such operations.

6. Develop another seed farm in the Southern Highlands to help meet the increased demands for hybrid seed.

Hybrid seed should not be confused with foundation seed, which the three foundation seed farms can produce in ample supply.

7. Should USAID/T or other donor determine to give assistance to the Tanzanian Seed Industry, it is strongly recommended that TanSeed be used as the "plenary gear" in the plan. Technical assistance would be valuable in the following areas:

   Extension agronomy
   Production/quality control agronomy
   Marketing
   Seed Facilities

8. Msimba Farm and Arusha Farm should be organized under a form of Seed Industry Parastatal, with the Spare Parts Center at Vingunguti becoming an arm of the farms.

Msimba and Arusha Farms, after 8-10 years of development, have reached a state of maturity in which it is no longer necessary for them to be under the protective and guiding wing of MinAgri. (With good management, Dabaga Farm should reach this state in another year's time and follow its sister farms.)

VI. Recommendations (continued)

With proceeds going to the farms for all produce raised on the farms (see 19 below), they can pay wages sufficient to attract and keep qualified personnel, which is not the case under the Government wage scale.

Farm needs could be better served under the parastatal arrangement. There have been crop losses due to lack of essential inputs such as herbicides and fertilizers! The system of being dependent on outside management is not conducive to efficient operations. If the foundation seed farm managers were the management body giving orders to a purchasing and supply agency, inputs would be more complete and more timely, with fewer crop losses, resulting in higher production.

If the present situation continues--with insufficient wages to keep qualified personnel on the farms and with no control over securing the required inputs--discouragement will set in with the farm management and other key personnel, subjecting the system to the possibility of breakdown.

9. A more realistic pricing pattern should be established for the various certified seeds to be purchased by the farmer, which should be sufficient to allow the Seed Farms and TanSeed to meet operating costs and earn a small profit.

Certainly, the contract grower must receive--for the extra effort he spends in producing certified seed--more than the normal profit usually received for ordinary milling grain. The farmer could be Government-subsidized in purchasing certified seed.

VI. Recommendations (continued)

10. MinAgri should take a more active role in research concerning the production of inbred lines and single crosses for hybrid maize production.

At the present time TanWattle at Njombe is preserving some of the inbred lines which were developed under a regional program of the East African Community (formerly composed of Tanzania, Uganda and Kenya). Most of the research and development work was done in Kitali, Kenya but the resulting lines are adapted to the higher elevations of Tanzania, as well as Kenya and Uganda. Some parent lines have already been lost to Tanzania and are no longer available from Kenya in the absence of information exchange, which ceased with Tanzania's closing the border.

TanWattle also crosses the inbred lines to produce hybrid lines.

TanWattle would like to be relieved of these functions. If it does discontinue such activities at this time, these lines may be lost completely.

11. Transfer sales and distribution functions out of TanSeed to a marketing body to permit TanSeed to concentrate on the production and processing of quality seed. This transition should take place over a period of 2-3 years to assure that the marketing body is fully functioning by the time it assumes full responsibility for sales and distribution.

12. Environmentally controlled storage should be provided for each foundation seed farm.

13. Environmentally controlled storage should be provided for the research farms.

14. Environmentally controlled storage should be provided at all processing sites and points of distribution of the certified seed to the farmers.

15. Contractual arrangements with TanSeed for growing certified seed should be mutual (see III.B.3., P. 19).

Farm Actions

16. The farms should require TanSeed to take rapid delivery of seed as soon as it has been harvested, treated and bagged for delivery; and should move all commercial grain ready for sale to National Milling Corporation or other purchaser, collecting money upon delivery.

17. The farms should pay sufficient wages (higher than the present Government pay scale) to attract and keep qualified personnel.

18. If the foundation seed farms remain under MinAgri, the current incentive program of worker benefits from the production on the farms (ranging from zero or near zero at Arusha to a considerable amount at Dabaga) should be legalized and made uniform for all farms.

Such a program should not constitute an abuse of production, as happened at Dabaga this year, where 100 acres of maize were grown for the workers on prime time. This was supposedly for food needs for the family, but was far more than enough for family needs.

19. The farms should receive the total proceeds of all produce sold off the farms.

In connection with the incentive program at Dabaga (18 above) the production beyond the workers' needs resulted in sales by farm personnel

VI. Recommendations (continued)

for their own exclusive advantage, instead of revenue to the farms. In addition, farm management received a profit from the sale of the farm's milling maize, at a rate of two to four times the official price paid by them at the farm.

Also, people in MinAgri had access to a certain amount of this milling maize. It was delivered with seed farm vehicles, using farm drivers and farm fuel for the lorry. Often the lorry would return to the farm empty or with a spare part or supplies which could have been carried in a small vehicle.

This diversion of the workers' excess maize and the milling maize constituted a loss to Dabaga Farm. Every product leaving the farm should be returned to the farm in the form of the full sales proceeds.

20. The farms should keep logs on all vehicles.

21. Msimba Farm: Encourage local, district and regional planners to build a new all-weather access road to the farm.

This same road could also serve the Illonga Research Farm, as well as the nearby town of Kilosa.

22. Msimba Farm: Find alternative uses for the maize-drying building and seed-processing and -storage building (which are not being used and very likely will not be used for the purposes of the drying and processing of maize (III.A.1).

23. Arusha Farm: Find alternative uses for the ear corn-drying facility and in its place, rather than going toward floor-drying and hand labor, construct modern metal drying and storage bins which can be used with modern drying and handling equipment.

VI. Recommendations (continued)

24. Arusha Farm: Complete the irrigation system.

Pipes and sprinklers are on hand, but pumps will have to be purchased and installed.

25. Arusha and Dabaga Farms: Utilize machinery for cultivating, harvesting and post-harvesting rather than hand labor.

Dabaga and Arusha are reverting to drying floors (concrete slabs on the ground, not covered with a roof) which requires hundreds of laborers for sorting and shelling. This involves high labor costs and some crop loss due to theft. Machines, if properly operated, can do the job with less expense, do it better and on a more timely basis.

26. Dabaga Farm: The farm road leading to the buildings from the main all-weather road should be regraded and all-weather surfaced, with construction of adequate stream culverts or bridges.

27. Dabaga Farm: Construct a multi-purpose building which can be used to store supplies, spare parts, tools and for machinery repairs.

28. Dabaga Farm: Construct natural-air drying cribs to receive the maize from the field at harvest time for elimination of about 10% of the moisture before putting the grain into the more costly drying process of removing the remaining (approximately) 3-4% moisture.

Appendix B

Seed Multiplication Project

621-0092

Complete List of Participant Trainees

Beginning Date: March 1971

Ending Date: December 1981

(Fully Funded)

	Name	Degree and Institution	Field of Study	Present Employer	Position
1.	Lema, Aisha	B.S. Mississippi State U.	Seed Analysis	Faculty of Agriculture Morogoro	Seed Analyst
2.*	Lujuo, Emmanuel	B.S. Purdue U.	Agronomy	Msimba Seed Farm	Farm Manager
3.	Lussewa, Bakari	B.S. Purdue U.	Agronomy	State Seed Farm-Urambo Tabora	Farm Manager
4.*	Lusuva, Tiberius	B.S. Mississippi State U.	Ag. Eng.	Msimba Seed Farm	Engineer and Agro Mechanic
5.*	Mallya, Joseph	B.S. U. Minnesota	Agronomy	National Seed Laboratory	Director
6.*	Mashelle, Michael	B.S. U. Minnesota	Agronomy	Min/Agri	Seed Mult. Project Mgr.
7.*	Mseke, Paschal	B.S. Oklahoma State U.	Ag. Eng.	Kibaha Seed Farm	Farm Manager
8.	Mushi, Adalbert	M.S. U. Idaho	Entomology	Kilimo Tengeru	
9.	Mwakikosa, Leonard	W. Illinois U.	Agronomy Farm Mgt.	Resigned	
10.	Pallangyo, Emiliono	Mississippi State U. Incomplete due to illness	Agronomy	Kilimo Mkongo	Farm Mechanic
11.	Shempemba, Fabyan	M.S. Oklahoma State U.	Agronomy	NAFCO DSM	Operations Manager

*Asterisk indicates personnel now in the project.

	Name	Degree and Institution	Field of Study	Present Employer	Position
12.	Nyasi, Peter	B.S. U. Minnesota	Agronomy	Prime Minister's Office	RADO Morogoro
13.*	Evarist, J. J.	None	Agro. Mech.	Msimba Seed Farm	Agro Mechanic
14.	Masanja, G. K.	B.S. U. Minnesota	Agronomy	Kilimo Kilangali Seed Farm	Farm Manager
15.*	Magiri, Athuman	None	Extension	Arusha Seed Farm	Agro Mechanic
16.	Mosha, Ernest	B.S. W. Illinois U.	Agronomy	TanSeed Njombe Branch	Production Agronomist
17.*	Mmari, Charles	B.S. Mississippi State U.	Agronomy Extension	Arusha Seed Farm	Farm Manager
18.	Mizambwa, Ralph	B.S. W. Illinois U.	Agronomy	Kilimo Avalon Hse	AO II
19.	Mshanga, Hanson	B.S. W. Illinois U.	Agronomy		AO
20.*	Mzee, Lawrence	Not completed W. Illinois U.	Agronomy Extension	National Seed Laboratory	Staff
21.	Shayo, Anisath	None U.S.D.A.	Plant Science	Kilimo Pamba Hse	Field Officer
22.	Said, Yusuf Ali	None CIMMYT	Crop Research	Illonga Research Farm	Field Assistant
23.	Jecha, Muslih Haji	None CIMMYT	Crop Research	Illonga Research Farm	Field Assistant
24.*	Bundala, Charles	B.S. New Mexico State U.	Agronomy	Dabaga Seed Farm	Farm Manager
				To be Assigned	
25.	Manen'to, Benjamin	B.S. California State U.	Agronomy	Dabaga Seed Farm	Assistant Farm Manager
26.	Hemad, Masoud Mohamed	B.S. California State U.	Agronomy	MinAgri Zanzibar	

	Name	Degree and Institution	Field of Study	Present Employer	Position
27.	Silima, Omar Issa	B.S. W. Illinois U.	Agronomy	MinAgri Zanzibar	
28. *	Ishengoma, Cornel	B.S. W. Illinois U.	Agro Mech.	Spare Parts Center	Manager
29.	Khamis, Bakari	None IITA Ibadan	Legume Production		
30. *	Mwasongole, Thomas	None W. Illinois U.	Agro Mech.	Arusha Seed Farm	Agro Mechanic
31.	Mollel, L. L.	None W. Illinois U.		Currently pursuing M.S. degree in Ag Engineering at DSM Univ.	
32. *	Mwasankinga	None W. Illinois U.	Agro Mech.	Dabaga Seed Farm	Agro Mechanic
33.	Kajandalila, F. M.	None W. Illinois U.	Agro Mech.	Kilimo MPWAPWA	Agro Mechanic
34.	Mwaisake, D. E.	None W. Illinois U.	Agro Mech.	Kilimo Ukiriguru Research Farm	Agro Mechanic
35.	Ndunguru, A. K.	None W. Illinois U.	Agro Mech.	Tengeru Seed Laboratory	A. O.
36. *	Lugazo, E. K.	None W. Illinois U.	Agro Mech.	Msimba Seed Farm	Agro Mechanic
37.	Mbiso, A. M.	None W. Illinois U.	Agro Mech.	MATI Ukiriguru	Agro Mechanic
38. *	Mangi, A. A.	None W. Illinois U.	Agro Mech.	Arusha Seed Farm	Agro Mechanic
39. *	Mjokva, Z. M.	None W. Illinois U.	Agro Mech.	Kibaha Seed Farm	Agro Mechanic
40. *	Makenja, M. E.	None W. Illinois U.	Agro Mech.	Msimba Seed Farm	Agro Mechanic
41.	Mageuza, B. K.	None W. Illinois U.	Agro Mech.	R.O.D. Songea	Agro Mechanic
42.	Zebele, A. T.	None W. Illinois U.	Agro Mech.	Rice Seed Farm Kilango	Agro Mechanic

	Name	Degree and Institution	Field of Study	Present Employer	Position
43.	Matemu, Joseph	B.S. North Carolina State U.	Agronomy	MinAgri Zanzibar	
44.*	Swai, Josaphat	B.S. Louisiana Tech U.	Agronomy	Arusha Seed Farm	Assistant Farm Manager
45.*	Mpunga, G.	None Mississippi State U.	Seed Improvement	National Seed Laboratory	
46.	Mnko, S. N.	None Mississippi State U.	Seed Improvement	TanSeed	Production Agronomist
47.*	Mbaga, A. A.	None Mississippi State U.	Seed Improvement	Msimba Seed Farm	Assistant Farm Manager
48.	Moswa, E. G.	None Mississippi State U.	Seed Improvement	TanSeed	Senior Agronomist
49.	Ngonyani, L. X.	None Mississippi State U.	Seed Improvement	TanSeed Njombe	Branch Manager
50.*	Haule, R. T.	None Mississippi State U.	Seed Improvement	Dabaga Seed Farm	

MONTHLY RAINFALL TOTALS (in mm.) FOR 1965-77 - KIBAHA FARM*

Year	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1965	26.2	70.0	40.4	175.8	157.0	1.3	2.7	46.0	37.0	22.0	76.1	102.1	760.2
1966	163.7	119.2	142.0	152.3	102.8	73.0	6.6	32.1	11.5	58.0	42.7	93.7	997.6
1967	1.8	38.1	197.9	188.5	191.3	30.7	67.7	35.2	87.1	79.9	201.0	96.5	1227.7
1968	16.7	33.2	194.9	277.8	103.0	37.4	6.2	44.6	7.9	19.7	?	122.2	?
1969	81.9	127.5	238.6	270.1	102.2	19.2	35.3	27.1	8.0	41.0	160.4	14.9	1126.2
1970	93.0	102.2	72.3	175.2	20.1	0.0	13.2	1.2	12.7	8.9	12.8	133.7	1687.3
1971	83.0	78.6	125.9	221.6	80.8	70.0	27.5	9.3	3.3	16.3	27.3	137.0	880.6
1972	0.0	31.1	171.9	146.1	347.5	0.0	25.4	0.0	28.7	256.7	240.7	164.3	1732.2
1973	49.0	166.8	111.0	338.5	19.0	28.0	2.0	30.0	0.0	22.5	72.0	133.0	1001.8
1974	64.5	30.5	134.0	338.1	75.0	15.0	93.0	0.0	0.0	60.6	21.0	24.4	858.1
1975	23.7	3.4	243.6	270.4	216.1	15.5	9.3	5.4	100.6	3.6	7.3	60.6	959.5
1976	21.5	38.3	118.6	170.1	116.5	18.2	53.7	6.2	39.9	47.7	38.6	35.2	734.5
1977	94.1	98.2	131.9	230.9	87.7	0.5	11.1	24.1	51.2	42.5	149.6	117.5	1042.1

MEAN MONTHLY RAINFALL FOR 12-YEAR PERIOD

	58.5	77.0	144.0	248.2	129.6	26.1	29.1	18.3	34.4	55.0	87.7	92.7	1000.0
	2.3	3.0	6.0	10.0	5.0	1.0	1.0	0.9	1.4	2.0	3.5	3.7	40.0

Of an average of 1,000 mm. of rainfall received on Kibaha during a year, 620 mm. comes during the five-month growing season. Even though about 370 mm. is received during the remaining seven months, its effectiveness is largely lost because it comes in small amounts and is lost through evaporation or runoff.

*Official Tanzania weather stetion figures