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Report of GARD Consultancy

Crop Agronomy

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REPORT ON GARD CONSULTANCY
IN THE GAMBIA
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Final Report

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REVIEW OF RESEARCH PROGRAMS AND SUGGESTIONS FOR THE FUTURE

CROP IMPROVEMENT:

Crop Improvement is responsible for screening and selection of superior varieties of maize, sorghum, early and late millet, groundnut and other upland crops with the exception of rice. Seed of promising lines is to be increased and made available to the Seed Multiplication Unit (SMU) or such other programs as designated to assume multiplication and distribution to growers. This project is headed by Albert Cox, who is also Principal Scientific Officer for the Sapu station, so a portion of his time is devoted to administration.

In 1980, Cox and Rao collected local varieties of maize, millet, sorghum and groundnut from sampling along both south and north banks, the length of the country. Each sample was divided into three portions, with one going to preservation in Nigeria, one in Rome and one remaining in The Gambia. The status of the Rome collection is unknown. Some of the collection in Nigeria was lost due to failure of the storage facilities. Most of the collection in The Gambia has been salvaged by renewing it annually since failure of the only cold seed storage area shortly after the collection was made. This collection can serve as a valuable source of local lines for further evaluation, and in fact some lines have appeared promising.

Each year several international trials are conducted. In 1985 the trials were as follows:

<u>Source</u>	<u>Location</u>	<u>Species</u>	<u>No. Entries</u>	<u>No. Reps</u>
1. CILLS	- Sapu	Cowpea	8	6
		Millet	8	6
		Sorghum	4	6
		Maize	8	6
2. CILLS	- Kuntar	Sorghum	9	6
		Maize	8	6
3. CILLS	- Mankamong	Millet	8	6
		Sorghum	12	6
		Maize	8	6
4. SAFGRAD	- Sapu	Cowpea	15	5
		Maize (1)	10	4
		Maize (2)	13	4
5. IITA	- Sapu	Cowpea (1)	10	4
		Cowpea (2)	20	4
6. ICRISAT	- Sapu	Sorghum	30	2
7. Local (National Program)	- Sapu	Sorghum	40	2
		Groundnuts	6	4

In addition to the trials, seed increases were made of promising varieties of these crops.

Many of the trials were plagued with problems, and certainly such factors as drought, lack of petrol to get to and tend the plots, lack of funds for labor, etc., contributed to the difficulties. Still, considering performance over a number of years, it has been possible to identify some lines that appear to be promising under Gambian conditions.

Many of the varieties being evaluated in the program are lines that have been released by the originating station some time ago, and the newest releases are not necessarily under trial. Written correspondence or notification of new releases is unsure, although presence at international meetings and work planning conferences should facilitate such exchange of information. Since The Gambia is not engaged in variety development, there

may be a feeling in other countries that The Gambia only "takes" but does not "give". Perhaps it would be possible to participate in performance trials of elite lines being considered for release by originating stations. Then The Gambia could "give" by providing useful data on adaptation and performance, but would gain by seeing the very latest lines and hopefully being able to secure seed for use in The Gambia of the very latest releases. This might be initiated with groundnut trials, where production has been lagging and new varieties have not been adopted. Certainly, screening for possible superior new groundnut varieties should have priority because of the importance of the crop as a cash crop to growers, the importance of exports to earnings of the country, and the fact that the variety grown is an old release. It is reasonable to suppose that superior varieties have been developed and released since the variety Senegal 28-206.

It is my recommendation that variety screening trials be continued. Judicious judgement of trials to run and of the entries in each should be exercised so as to spend precious time and funds only on those which offer some promise of success. It may be necessary to grow some trials in alternate years. Careful evaluation of local varieties should be continued and even expanded to sample more of the variability present, since any variety being grown here must have shown some adaptation and have some desirable characteristics to have survived.

The international trials not only provide a chance to evaluate lines which may prove useful here, they provide an opportunity for the project leader to visit other programs and maintain valuable contacts with colleagues in other countries. This is because in at least some of the trials, funds are provided by a donor agency to attend an annual meeting on those trials. This

is of real benefit and is not to be minimized since such interaction would otherwise likely not be possible.

Trials of new crops fall under the domain of this project and in the past such crops as sunflower, sesame, sugar cane, cowpeas and soybeans have been conducted. Sesame and cowpeas have both appeared promising and increased emphasis should be given to identifying superior varieties of these species. Sesame appears to be very drought tolerant, essentially going dormant during dry periods, and then resumes growth and production upon the resumption of moisture. It is an oil crop which might be used for local consumption and/or export. Cowpeas are already grown to a limited extent but offer great potential as an intercrop with maize. The cowpeas must be suited to local conditions, including photoperiod, so that they flower and produce grain for human consumption.

Facilities designed for long term storage of seed stocks (temperature and humidity controlled) are urgently needed. So, also, is secure storage to prevent the theft of valuable unique seed stocks that presently occurs.

The project leader is assisted at Sapu by Musa Mbenga, who started the M.S. program at Cornell, New York, in September, 1986, under the GARD project. He will thus leave a void for 2 to 2 1/2 years. Mr. Tijan Jallow is completing the Ph.D. in the West Indies and if he is posted to Sapu he can presumably take over some of the responsibilities formerly held by Mr. Mbenga. Dr. Posner may be able to offer some assistance and advice, though not a great deal of time.

It does not appear necessary to provide a long term technical assistant. Mr. Jallow and Dr. Posner can help fill in until Mr. Mbenga returns from training. Some short-term technical assistance in seed production, isolation needs and mechanisms, maintenance of purity consistent with maximum seed

production, seed conditioning and seed storage would be beneficial. This might be accomplished through an annual STTA visit to The Gambia of two to three months.

Crop Improvement trials at Yundum have been conducted by Mr. Mohammed Cole who initiated M.S. studies at Wisconsin in September, 1985, under the GARD project. Those responsibilities in his absence are being assumed by Solomon Owens, maize agronomist. There will thus be a 2 to 2 1/2 year period when help would be of assistance in maintaining a viable program, and such assistance would relieve Mr. Owens of some of the additional responsibilities he inherited on top of an already active maize program. Some assistance, though limited, may be provided by Dr. Posner. It would be helpful to provide some technical assistance during the 2 to 2 1/2 year period but this is probably not as high a priority as providing assistance to other programs.

The project leader would benefit from short-term visits to IITA and Samaru in Nigeria; the ICRISAT Sahelian Center, Niamey, Niger, and Senegal. These visits would allow him to establish closer contact with cereal, legume and groundnut researchers there, permit him to collect groundnut varieties tolerant to rust, cercospora, drought and of early maturity, and to check on the status of the 1980 germ plasma collection from The Gambia with the hope that entries lost from The Gambian collection might be replaced with those entries from the Nigerian deposit. He would also benefit from a visit to the U.S. where he could study research techniques, research in progress, analysis of experiments and project management. A visit in late November - early December would coincide with the annual meetings of the American Society of Agronomy. It would be of benefit to attend these meetings, present a paper there and establish contact with a number of researchers from the U.S. and around the world. A visit in August would permit viewing many experimental

trials in the field. If the visit were to involve the analysis of data, then it would probably need to be scheduled for some time after January 15, by which time data from the field experiments should have been collected.

CULTURAL AGRONOMY:

Cultural Agronomy is responsible for taking the improved varieties identified through the Crop Improvement program, or the locally grown varieties, and identifying production and management practices suited to them. This program is headed by Mr. Thomas Senghore, located at Sapu, who presently has no back-up trained to the B.S. level or beyond.

Prof. Willey, ODA consultant, held detailed sessions with Mr. Senghore reviewing results of past research and proposing future research both on-station and on-farm. His review is contained in his consultancy report. Briefly, he recommends that on-station research be reduced and knowledge gained from previous studies be applied to setting up on-farm studies. Such studies will help scientists determine what technologies can be adopted by farmers, and provide vital feedback on requirements and constraints at the farm level. This approach is consistent with the Farming Systems emphasis of GARD. Prof. Willey recommends that intercropping be emphasized in future research both on-station and on-farm. He feels that cereal/groundnut, cereal/cereal and cereal/"additional" legume where the key legume would be cowpea, should be the on-station research focus for upland crops. For on-farm the key intercrops should be cereal/groundnut and cereal/cereal. Specific trials are proposed.

I concur in the recommendations for reduced number of trials on-station and for some intercropping studies because intercropping is important,

particularly in MID. However, sole cropping research should not be completely excluded, particularly on-station, where it is important to learn the characteristics of a variety and its response to cultural practices without the confounding effects of another species.

Studies this past season by the cultural agronomist and the ODA socio-economist in cooperation with extension resulted in data from some intercropping trials. This provides a useful base from which to start.

The extent to which intercropping is practiced and the manner in which it is practiced needs to be surveyed. This need not be a major undertaking requiring a substantial amount of labor and funds, but should provide a stronger basis on which to plan research. Information is needed on what proportion of a farmer's fields are intercropped, what species are involved in the intercropping, what is their spatial arrangement, what plant populations are used of each, what cultural practices are followed such as delayed planting of one after the other, and what does the farmer see as advantages and disadvantages of intercropping over sole cropping. While the range of practices will be considerable, the range and averages will be very helpful in defining relative research needs.

I recommend that some herbicide research be undertaken in the cultural agronomy program. Research is supposed to lead - not follow - and so it is appropriate to conduct trials of herbicides on the major crops. This should include both pre-plant and post-emergence treatments. Controls should include unweeded and conventionally weeded plots. It is obvious that weeding is a substantial limitation to crop production. A grower may be unable to keep up with weeding, particularly during a season with frequent rains, or may choose to weed a portion of the crop and neglect another portion, resulting in decreased production.

A significant effort must be put into advancing a groundnut production package of seed dressing, population, fertilizer and cercospora control through sulfur dusting or other means, and getting this out to those farmers who are most likely to adopt the improved practices.

While most research effort must be given to the major crops of groundnuts, maize, millet and sorghum, and to promising crops like cowpeas and sesame, limited effort should be given to minor crops such as bambara groundnut and findo. It may be possible to increase production of these minor crops, adding substantially to the self-sufficiency of the family. Efforts should include variety evaluation and cultural practices.

There is an acute need for the ability to have soil tests run accurately and promptly so that research results can be correlated with soil tests and so that most efficient use can be made of fertilizer.

Lack of a well trained back-up person to the project leader is a serious concern. If Mr. Tijan Jallow is posted to the Sapu station upon completion of the Ph.D. program in the West Indies, he could work closely with the project leader and this would help tremendously. Dr. Posner will be able to provide some help and suggestions. Cooperative trials with the ODA socio-economist will provide some assistance. Training to the B.S. level of one or two AA's would enhance their capabilities to the project.

The project leader will benefit from the continued consultancy of Prof. Willey and the proposal for him to go to East Anglia to analyze data will serve the dual purpose of prompt analysis of data and increased competency in data analysis and summarization.

The number of commitments which takes the leader away from the project needs to be reduced. It is important to be actively involved in leadership of

the project and this requires the presence of the investigator. Priorities need to be established so that maximum benefit is realized from the investigator's time.

If a research associate joins the project during the summer of 1986 and returns for 12 to 18 months starting in June of 1987, this will further supplement the efforts of the project leader and provide some back stop. At this time it appears further short-term technical assistance will not be required.

RICE AGRONOMY:

The rice agronomist, Mr. Alphasain J. Marong, who is based at Sapu, is responsible for all phases of rice improvement including variety evaluation, the first phases of seed multiplication and cultural studies. These include the five ecosystems of rice, Upland (Tandako), Lowland shallow flooded (Bantafaro), Deep flooded swamp rice (Gibba Faro), Mangrove swamp rice (Bafaro) and Irrigated. The research has been concentrated at Sapu.

Research has involved variety performance, fertilizer rate and timing response, date of planting, plant population, row spacing, and herbicides. These trials have been carefully conducted and analyzed and for the most part have provided helpful information on which to base further studies and to extend material and practices to growers. The number of trials has been reduced in accordance with the level of support so as to permit the researcher to satisfactorily complete those studies initiated.

The project leader is very capable and the greatest contribution from GARD can be in enhancing his effectiveness. Timeliness in availability of supplies and equipment is a serious constraint and needs to be addressed.

Fields must be available at the proper time for planting; if irrigated, must have adequate water control; tillage must be performed on time; fertilizer and pesticides must be available when needed.

Packages of the best varieties and management practices for them should be further advanced to on-farm trials in cooperation with the extension service. The project leader already has good rapport with growers and this has contributed to relevant research studies.

Variety performance trials must continue in order to identify new lines which may be more reliable and productive in The Gambia. Seed increases of promising lines should be moved ahead as rapidly as possible to permit more wide-scale testing and the early release of the best lines.

In most cases, the best dates of planting have been identified so this area needs little further study. Planting in rows rather than broadcast which facilitates weeding by hand or in some cases by animal traction has been shown to be advantageous and needs little additional work. However, the optimum plant population needs to be determined for each variety under the level of fertility practiced, and this should continue.

Weed control research, particularly on upland rice, needs to be expanded since weeds are a severe limitation to production. Animal traction for mechanical weed control needs a great deal of study in order to determine the most effective and efficient program.

Herbicide trials are needed to measure objectively the weed control, greater efficiency of fertilizer and soil moisture in weed-free fields and increased productivity per unit of labor input. For instance, herbicide use may permit a farmer to increase the hectareage of rice grown, the production per hectare, or both.

Of recent interest is the possible intercropping of rice with maize, millet or groundnuts, or the sequential planting of rice and vegetable crops. Some limited studies of intercropping might look at the promise of this practice, but such studies should be preliminary and not extensive. Rice/vegetable sequential planting where water is available deserves study and preliminary small scale experiments should be initiated.

It would be helpful to work with the Crop Protection Service (CPS) in studies of insect problems in rice and such studies should be encouraged.

Upland rice has not been studied in the Western Division since 1980. With the increased cost of rice and reduced ability to pay, as many families as possible are trying to produce at least enough rice for home consumption. Studies should be resumed and could be in cooperation with the small scale reclamation projects being undertaken by the Soil and Water Management Unit (SWMU).

The back-up to the project leader in rice improvement consists of Babou Jobe and Momodou Sanneh, neither of whom has the B.S. degree. It would be desirable for each of these to receive training to the B.S. level, and consideration could be given to continuing one on to the M.S. level.

Some technical assistance can be provided by Mr. Thomas Remington, with the idea that he would work at Sapu with Mr. Marong during the fall and spring of 1986-87 and then relocate to Yundum to work on rice for the wet season of 1987. It is anticipated that he will spend two years in The Gambia.

The project leader could profit from visiting rice research programs at South Korea, IRRI in the Philippines, India and the University of California-Davis. Because of his aptitude for statistics, consideration should be given to taking him to the U.S. after wet season rice data is available, approximately January 15, for analysis of the data. This would

develop his skills in computer analysis and would permit consultation with agronomists and statisticians. Research Associates should be able to maintain direction of his research program during these brief absences.

MAIZE IMPROVEMENT:

The maize improvement program is responsible for variety evaluation and cultural practices involving maize. It is based at Yundum. The project leader is Solomon Owens.

Variety evaluation has suggested that Pool 16 is the most promising of the white maize tried while Across 7434 is also of interest. Seed of both varieties is being increased for further testing and possible release. Variety trials will be discontinued in 1986 since Mr. Owens will have responsibility for Crop Improvement and some Cultural Agronomy trials at Yundum while Mohammed Cole is in the U.S. for M.S. training.

Sufficient research has been completed with maize to identify desirable management practices and such a package has already been extended. Many of the recommendations have been adopted by farmers though financial constraints in particular have delayed acceptance of some. A serious need is for timely and reliable soil tests which will permit the most efficient use of fertilizer.

Intercropping trials of maize with cowpeas have been initiated and this appears promising. Choice of cowpea variety is important as it must produce grain for human consumption to be attractive to growers. This research should be continued and expanded to include other grain legumes.

An important aspect of the maize program is the value of the stover in feeding cattle. Maize stover has been shown to be very useful in maintaining

animals during the dry season. Continued research on the best varieties to use for combined grain/stover is needed.

The maize cultivator developed under this program has shown some useful attributes. However, it is too heavy, pulls too hard and is too expensive for the growers. The design of the cultivator should be turned over to the SISMAR Co. of Senegal and the Agricultural Engineering Department of The Gambian Ministry of Agriculture. The limited resources of the GARD project should not be used in its further development or testing.

The maize program is functioning well and again here emphasis of GARD should be in assisting the researcher in securing necessary supplies and equipment and the timeliness of field operations. Help in the analysis of data is another need.

The maize program would benefit from having a back-up person to Mr. Owens trained to at least the B.S. level. The most likely candidate for this training is Amidou Mballo. There does not appear to be a need for expatriate technical assistance at this time.

Mr. Owens could benefit by going to the U.S. for analysis of his trial data after the field season is completed. This would enhance his capabilities in analysis and summarization of data and establish communication with additional maize researchers in the U.S. His visit might be timed to coincide with a state, regional or national meeting involving maize. Short-term visits to international centers such as CIMMYT and IITA should be considered as a means of helping to stay current.

FORAGE AGRONOMY:

The forage agronomy program has been a component of the Mixed Farming Project. It has been allied in much of its work with the range management

unit, also a component of MFP. From 1982 to 1984, emphasis in the forage program was on the introduction and evaluation of legumes. Over four dozen different legume cultivars have been tested, with only a few appearing potentially useful. To be successful in The Gambia, they need to be adapted to the amount and distribution of rainfall, must be able to compete with weeds, and must resist insect and pest (including rodent) attack. Stylosanthes hamata and S. humilis appear to possess many of these characteristics.

Grasses have not received as much emphasis in the forage program as legumes, but a local grass, Andropogon guyanus (gamba grass) has looked promising. It is highly productive and is present when other feeds are scarce or gone. Panicum maximum has also been highly productive but doesn't do as well in the dry season as gamba grass. The range unit has been working on the above two grass species, as well as Cenchrus ciliaris (buffel grass).

Seed multiplication of tropical legumes was started in 1985 at Sapu. Bombo Ceesay, a project member, made short-term visits to Texas and Florida to study techniques of seed production and Dr. Russo visited Ethiopia for the same reason.

Cattle feeding trials of crop residue have been conducted at the Farmyard at Yundum from 1982 through 1985. These studies have shown it is possible to maintain the body weight and condition of cattle during the dry season, and in fact gains are possible if supplement is provided in the form of groundnut hay or cake.

Intercropping of maize with pigeon peas was studied in 1984 and 1985 though the pigeon peas were not too productive. During 1985 maize was intercropped with cowpeas. The varieties of cowpeas used were not adapted and

no quantitative data were obtained, though vegetative growth of the cowpeas was good.

Also during 1985, maize was undersown with Stylosanthes hamata, S. humilis and S. capitata at Yundum, Sapu and YBK. Poor seed quality of the maize planted resulted in loss of the trial.

Because animals are an important part of agriculture in The Gambia, it is important that the forage agronomy program be continued. Emphasis should be given to cattle but with recognition that sheep and goats are also consumers of crop residue and as such must be considered in forage establishment, preservation and utilization. It is recommended that legume seed production be continued and expanded so as to supply seed for establishing legumes on-farm. Although grasses have come mainly under the range management unit, those nurseries should also be expanded to provide grass seed for establishing plots on-farm. The YBK nurseries have been most productive so they should receive priority but the Sapu nurseries should be increased since they are convenient to the experiment station and the facilities it offers. Little if any effort should be spent on seed nurseries at Yundum since they have been least productive.

Continued introduction of new species of legumes and grasses should take place, but care should be exercised to spend effort only on those with a good chance for adaptation based on their performance in similar ecologies. Since Sapu is more representative of growing conditions in The Gambia than is Yundum, variety evaluation should be best undertaken at Sapu.

Feeding trials at the Farmyard at Yundum have illustrated the value of feeding forages and stover. These trials, however, have been beset with problems. In the interest of most efficient use of resources, it is recommended that these trials be discontinued until such time as the need can

be justified. Collection, storage and feeding of stover in the villages should continue to be encouraged, primarily through extension efforts. The use of rice straw should be promoted.

The possibility of underseeding legumes into maize appears to be a very worthwhile effort. The legume could provide some nitrogen to the maize crop, and would improve the quality of browse or crop residue harvested for storage in the villages. Legumes underseeded should be forage legumes, with grain legume interseeding a responsibility of the maize improvement project.

Likewise, legume underseeding in cereals should be tried. It might be possible to establish legumes into rice stubble to provide nitrogen to the soil and grazing for livestock.

The value of cover crops in soil conservation and improvement of soil productivity needs to be studied. Such studies should be in cooperation with the Soil and Water Management Unit. Soil structure, water infiltration rate and productivity of cereal crops following legume crops should be compared with lack of cover or legume crops. The forage plots already established and protected by fences could be used in these studies.

Trials with Leuceana have shown this species to be difficult to establish in The Gambia and not especially productive once it is established. Further effort with this species is difficult to justify.

The leader of the Mixed Farming Project forage agronomy program since 1984 has been Dr. Sandra Russo. Her Gambian counterpart is Musa Bojang, who has just returned to the forage project after receiving the B.S. degree from Colorado State. There is no back-up to Mr. Bojang. Consideration should be given to identifying a person with a B.S. degree who can work with the forage unit and become better qualified to participate in leadership of the project. A technical assistant is needed to help retain the viability of the program

with the completion of the MFP and the loss of the expatriate project leader and until Mr. Bojang has worked into full leadership responsibilities. This assistance will be needed for at least one year and possibly two to three. A possibility for assistance after this time would be a Research Assistant in forage agronomy who might assist for 1-2 years after which full Gambian leadership would be expected.

Two possible candidates for B.S. degree work from the forage program are Kutubo Sanyang and Lamin Jobe.

TRAINING

GENERAL COMMENTS:

Because of the scarcity of researchers trained to the B.S. and M.S. levels, there is inadequate backup to the leaders of the research projects. It is important that persons be trained to relieve the project leaders of some of their present responsibilities, and to assume leadership in the absence of the project leader. Because this need is acute, emphasis should be given to training a number of persons to the M.S. and B.S. levels during the first few years of the project. While this will remove some of the most capable people from the research projects temporarily, it will be best to do so immediately, so that in two to three years they can return in an even more productive capacity. Some of the slack during this period may be relieved by expatriate technical personnel or Peace Corps Volunteers.

TO MASTER OF SCIENCE DEGREE:

Persons nominated for training to the M.S. level are those who have been working in research and who should have demonstrated the potential for

successfully completing the course of study and being productive researchers upon the completion of the degree. Unless their previous training has provided a good basic understanding, their course work should include soils and soil fertility, plant pathology, entomology, genetics, biometry, experimental design, and the use of computers in word processing and the analysis of data.

Because much of the value in advanced degree training comes from close association with the research program, each candidate should be closely involved with the research program of the project with which (s)he is associated. Consideration should be given to having the student continue for the entire duration of training with the program of the major advisor. This may be more effective than having the student return to The Gambia to conduct research and then return to the University for continuation of course work. If research for the thesis is conducted in The Gambia, it is essential that the candidate be closely supervised by a resident advisor.

Likewise, the principles learned in training are more important than the species or cultural practices employed. Because an important objective of the GARD Project is to establish and maintain contacts that can be of lasting value to the Gambian researchers, it is suggested that emphasis be given to training at one of the member institutions.

Programs and possible nominees for M.S. training are as follows:

Crop Improvement:

Musa Mbenga - presently undergoing training at Cornell
Mohammed Cole - " " " " Wisconsin

Cultural Agronomy:

Rice Improvement:

Forage Agronomy:

Maize Agronomy:

TO BACHELOR OF SCIENCE DEGREE:

Persons nominated for training to the B.S. level should be those who have demonstrated high scholastic aptitude and strong potential for productive research. Many of these students will have an academic background which will permit them to complete requirements for the degree in three years. Their academic programs should include soils and soil fertility, plant pathology, entomology, genetics, biometry, experimental design and the use of computers in word processing and the analysis of data. At least one, if not all, of the summer periods between academic semesters should be spent in active participation on a research project. Most students should be trained at one of the participating institutions. Consideration should be given to continuation for the M.S. degree for those students who have shown aptitude, competence and motivation.

Programs and possible nominees for B.S. training are as follows:

Crop Improvement:

Momodou A. Faye

Cultural Agronomy:

Kemoring Tarawally

Rice Improvement:

Babou Jobe

Momodou Sanneh

Forage Agronomy:

Kutubo Sanyang

Lamin Jobe

Maize Agronomy:
Amidou Mballo

SHORT-TERM:

It would be helpful for research project leaders to spend a period of one to three months at one of the member institutions. This will enable the researcher to become acquainted with the institution, its staff and its facilities. It has been suggested that one way of doing this would be for the researcher to bring the data from the trials conducted during the past season to the institution for analysis. The researcher would be familiar with the trial, the way it was conducted, and the manner of data acquisition, while his counterpart at the institution could help provide facilities and technical assistance in analysis and interpretation. Such visits would probably need to be scheduled after January 15, to allow for the completion of data collection.

Another purpose of such visits is to become acquainted with administrators of the institution and to learn management techniques.

It might be advisable to take one or more short courses while at the institution. Such courses might be in Integrated Pest Management, Computer Use, or Crop Protection.

Attendance at a scientific meeting might also be scheduled for a visiting researcher. The American Society of Agronomy annual meetings are usually scheduled for late November - early December, which wouldn't coincide with a January - March visit, but other meetings or other dates might be possible.

Support for periods of a week up to two months might be provided for researchers to visit areas of expertise in their subject field, or to enable them to obtain materials or techniques on a personal basis. Such visits might be to International Research Centers or national programs with relevant training and research.

It would be helpful to have some short courses for agricultural assistants in experimental technique, data collection, and trial summary. Because most of these people have a minimum of academic training and only on-the-job training in research, they often do not understand or appreciate what is involved in good research. Consequently, trials which were carefully planned and in which considerable time and funds have been invested may be of little value or lost completely. A better understanding of why they are doing the trial, what it means, and the value of the conclusions reached, should encourage greater interest and job satisfaction.

Programs and possible nominees for short-term training are as follows:

Crop Improvement:

Abdoulie Bojang "2" - requests two-year diploma program.

Ebrima Manneh - requests 3 months farm visit in U.S.

TECHNICAL ASSISTANTS AND RESEARCH ASSOCIATES

ODA:

Technical assistance to The Gambia is provided from many sources. One source important to the GARD project is that provided by the United Kingdom through their Overseas Development Authority (ODA). Duncan Boughton, a socio-economist, is located at the Sapu research station and works closely with Gambian researchers there, particularly in on-farm trials. Professor R. W. Willey of the University of East Anglia has just completed a two-week consultancy sponsored by the ODA. He is an expert in intercropping and consulted closely with Thomas Senghore, the cultural agronomist. Prof. Willey is expected to consult on a regular basis, and Mr. Senghore is scheduled to

take data from the trials proposed in consultation with Willey, to East Anglia for analysis.

GARD - OUTSIDE MEMBER INSTITUTIONS:

Provision is made in the Project Paper (PP) for GARD to bring in technical consultants. One of these, Paul Starky, has just completed a short consultancy. He is an expert on animal traction in Africa. He may continue to consult on a regular basis.

GARD - FROM MEMBER INSTITUTIONS:

Dr. Josh Posner, of the University of Wisconsin will join the GARD project July 1 as a farming systems agronomist. He will work closely with Gambian researchers and extension people in designing and executing on-station and on-farm research. He can also serve as a University of Wisconsin advisor to Gambian and U.S. graduate students doing research in The Gambia.

Areas in which further assistance can be utilized are discussed under specific research program needs.

PEACE CORPS VOLUNTEERS:

I did not have the opportunity to meet the Peace Corps Volunteers (PCV's) scheduled to be associated with the GARD project, but I understand their assignments to be as follows:

One with horticultural interests and capabilities will work with the horticulturists based at Yundum.

One with computer skills will work with the GARD project at Abuko.

The third will be based in the vicinity of Sapu and will be involved with on-farm trials.

PREPARATIONS FOR AGRICULTURAL RESEARCH ADVISORY BOARD (ARAB) MEETINGS

I met with leaders of Crop Improvement, Cultural Agronomy, Rice Agronomy, Maize Agronomy and Forage Agronomy previous to the ARAB meetings. Research conducted during the last year was reviewed along with plans for the next year. Data analysis and summarization of results was still in progress, and thus in some cases was not available for study. We did refer to those treatment means and those analyses which had been completed. Since summaries of these trials are to be available and presented at the ARAB meeting, I will not try to reproduce them here.

COMMODITIES:

Commodity needs were discussed with each of the projects and lists were prepared. There is a lack of catalogs and references which makes it difficult to specify exactly what is needed, its approximate cost, and source. More such references need to be accumulated.

A system for securely storing supplies and equipment and checking them out needs to be established, plus an auditing system that checks once a month or so.

GENERAL COMMENTS

Securing meaningful data from experiments has been a chronic problem. Some of the difficulty lies in undertaking a more ambitious program than time of the researcher and resources can support, some is due to unreliability of support and supplies, some to environmental variability in soils and moisture, some to accidents such as animals getting in the plots and some to lack of preparation or training of agricultural assistants. Further problems have been encountered in the design of experiments and in the analysis of data collected.

Additional training through visitations, short courses and degree programs will increase the capabilities of the researchers. Short in-country or out-of-country training programs for AA's will improve their skills and increase their effectiveness. Every effort should be made to have the equipment and supplies in advance of starting a trial, and provision should be made for timeliness of operations such as plowing the soil or preparing it for planting.

Careful attention needs to be given to the amount of time that a project leader has available to the project. Conferences in or outside The Gambia, training sessions in or outside the country, time spent reviewing programs with consultants, and many other individually worthwhile endeavors can collectively seriously interfere with the research program. Participation in such activities needs to be limited so that priority is given to being present on the project and exercising effective research leadership.

Analysis and interpretation of data has been a real problem and continues to be a problem. Data collected by some of the programs at the Sapu station have been taken to Abuko or the FAO fertilizer project for analysis. This is inefficient since the person who conducted the trial is separated from those who are asked to analyze it and the data are not available for use of the researcher while it is off for analysis. This has been a problem during my visit since for some programs we did not have the 1985 trial results to review.

IBM-PC computing facilities need to be made available at both Yundum and Sapu. Computers have been located at Abuko under the MFP and this has worked out reasonably well for the researchers based at Abuko or Yundum. Sapu is designated as the primary research station for field crops and much data is generated from trials there. It is my strong recommendation that one or more IBM-PC computers be installed at Sapu for use in analyzing data and preparing summaries and reports of the research. Researchers should be trained in their use and helped to develop the skills necessary to analyze their own data. Continuous electricity is a must for operation of the computers and printers and for lights, so that the machines can be operated throughout the day and evening and on weekends. Their operating environment needs to be air conditioned. They must have dust-free conditions, such as an inside room or one without windows.

Library facilities are nil at both Yundum and Sapu with the only references in the offices of individual researchers. Efforts should be undertaken to establish at least minimal collections of references. Key publications should be stocked for the use of all, and insofar as possible subscriptions to the most useful journals should be established. It may be possible for contacts at the GARD institutions to locate reference collections, such as copies of journals received over many years, by faculty

retiring from the University who would be pleased to donate their collections for use of researchers here. Many reports have been written over the years by Gambian researchers, expatriate researchers and technical experts called in for consultation. These reports contain a great deal of useful information. An effort should be made to secure a complete collection of these reports with one copy of each placed at Yundum and another at Sapu. Many international centers provide special reports as well as periodic reviews free of charge. These centers should be contacted and relevant publications solicited. The experience and expertise of Mr. Diallo will be invaluable here.

As the level and intensity of research originating from Sapu researchers rises, the need for adequate secretarial assistance also rises. Provision needs to be made for clerical assistance at the Sapu station.

Seed viability is quickly lost under environmental conditions in The Gambia. About the only feasible way of preserving viability is through storage of seeds in a cold room, preferably with reduced humidity. Yundum does not have such a facility and the cold room at Sapu has not operated in some time. It is being rehabilitated by the World Bank under ADP II, but no provision has been made for continuous electrical power. The condensation resulting from the fluctuating temperature as air conditioners operate for an hour and a half at noon and three and one-half hours in the evening will be detrimental to seed quality. Provision should be made for continuous electrical power. An air conditioner should be installed in a seed storage room at Yundum in order to improve storage conditions there. While it probably will not have the conditions required for long term storage of valuable seed stocks, it will permit the storage and carry-over of seed stocks needed in trial work.

Basic equipment and supplies are lacking for research work, and the condition of present equipment is frequently poor. As new equipment and supplies are purchased it is important to locate these in a secure location and provide for accountability. A system of checking items out with times, dates and signatures should be established and periodic and frequent inventories should be carried out to identify problems. Purchase and use of rugged simple equipment should be encouraged over sophisticated but vulnerable items.

Fuel supplies have perhaps been the most limiting factor in research. Lack of fuel has curtailed almost all on-farm trials and has hampered on-station trials. Fuel supplies should be stockpiled before the start of the season in secure storage so that research planned can be completed.

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Table 1.

Possible Degree Training Program

	Year				
	1	2	3	4	5
To M.S. Level:					
Crop Improv.	Mbenga Cole	Mbenga Cole			
Cult. Agron.					
Rice Improv.				B. Jobe	B. Jobe
Maize Improv.					
Forage Agron.					
To B.S. Level					
Crop Improv.					
Cult. Agron.		Tarawally	Tarawally	Tarawally	
Rice Improv.		Jobe Sanneh	Jobe Sanneh	Jobe Sanneh	
Maize Improv.		Mballo	Mballo	Mballo	
Forage Agron.		Sanyang L. Jobe	Sanyang L. Jobe	Sanyang L. Jobe	

The above persons are possibilities. They may or may not be nominated for the indicated training.

Table 2.

Possible Technical Advisors and Associates

Year

	1	2	3	4	5
STTA:					
Crop Improv.	(LeMahieu)	(LeMahieu)	(LeMahieu)	(LeMahieu)	(LeMahieu)
Cult. Agron.					
Rice Improv.					
Maize Improv.					
Forage Agron.	(Schlough?)	(Schlough?)	(Schlough?)	(Schlough?)	(Schlough?)
General	(Gritton)	(Gritton)	(Gritton)	(Gritton)	(Gritton)
LTTA:					
Crop. Improv.					
Cult Agron.					
Rice Improv.					
Maize Improv.					
Forage Agron.	0.5	0.5			
Agron./Farming Systems	1(Posner)	1(Posner)	1(?)	1(?)	1(?)
Res. Assoc.					
Crop. Improv.					
Cult. Agron.	0.25 (Wright)	0.5 (Wright)	0.25 (Wright)		
Rice Improv.	0.25 (Rem- ington)	1.0 (Rem- ington)	0.75 (Rem- ington)		
Maize Improv.					
Forage Agron.			1(?)	1(?)	

The above persons are possibilities. They may or may not contribute as indicated.