UNDP/FAO DRYLAND FARMING RESEARCH AND DEVELOPMENT PROJECT
KEN/74/017

AND

USAID/USDA DRYLAND CROPPING SYSTEMS RESEARCH PROJECT
615-0180

EXECUTIVE SUMMARY

JOINT INTERIM EVALUATION

Nairobi 22 March 1982

A. PROJECTS' OBJECTIVES AND RELEVANCE TO GOK OBJECTIVES

1. The GOK objectives for the arid and semi-arid lands areas can be briefly summarised as follows:

(a) Increasing productivity, production and reliability of production in dryland areas and establishing a sustainable production system consistent with the natural resources potential of the areas.

(b) Integration of the arid and semi-arid lands into the national economy.

(c) Building of institutions and services, i.e., research, extension, cooperatives, input distribution, marketing, credit, transport, and water supply.

2. The combined objectives of the UNDP/FAO and USAID/USDA projects were designed to be responsive to GOK objective (a) and to assist in the attainment of objectives of (c). Achievement of GOK objective (b) will naturally be enhanced through achievement of objectives (a) and (c). The combined objectives of the two projects are:

(a) To develop technologies for more efficient use of land and water resources.

(b) To increase productivity and production through improved crop varieties, cropping systems, and crop protection, within a stable, risk averting farming system.

(c) To develop more productive livestock production systems integrated within whole farm production systems.

(d) To contribute to development through training and otherwise of the NDFR station at Katumani and of KARI at Muguga, as effective national research institutions.

(e) To improve the delivery systems through pre-extension trials and involvement of extension personnel in on-farm trials.

3. Given the natural setting in the arid land areas, the constraints imposed by limited and irregular rainfall, past inappropriate use of crop and range lands and the ever increasing population, the above objectives appear to be appropriate and within the capabilities of the resources being committed by the two projects. It was noted, however, that given the usual lag time in moving from project agreement to implementation, the usually long incubation period in research before useful results can be disseminated, and especially the long term nature of institution building, the 4 and 5 year periods of the UNDP/FAO and USAID/USDA projects respectively were too short to assure achievement of either the major short term technical objectives or the longer term institution building objectives.

B. ADEQUACY OF THE PROJECT DESIGNS

4. Project design must take into consideration the constraints addressed and the resources available. The primary constraints in the dryland areas are listed below.

(a) Rainfall is between 500 and 800 mm per annum, unpredictable as to amount from year to year and erratic as to distribution within a bimodal pattern. This has important implications in terms of possible appropriate technology. The risk of inadequate amounts and distribution of rainfall limits the production options, particularly with respect to those which could contribute to high productivity under more favorable conditions, e.g., use of fertilizers and pest control chemicals and high plant densities.

(b) In the more densely populated areas--ever expanding as the population increases--there is decreasing land productivity through loss of soil from erosion, depletion of nutrients due to continuous cropping, and degradation of range due to overgrazing and disappearance of useful legume species.

(c) Availability of human labour and animal draft power, together with the time distribution of labour requirements in the farm unit's production system, determine the area which can be cultivated. Labour demands for activities such as fetching water for human and livestock use are frequently substantial and result in reduction of labour available for production purposes.

(d) The available land area, for the smallest farms frequently one ha or less, limits the land use options and hence the possible solutions.

(e) Capital is extremely limited and the capital generating potential of existing production systems is virtually nil. Consequently, capital intensive solutions must be avoided.

5. The projects address these principal constraints in several ways.

(a) Breeding and selection of earlier maturing, more drought resistant and disease and insect resistant varieties of food, cash and forage crops.

(b) Expansion and diversification of the production mix to include a wider variety of crops, cereals, pulses, oil seeds, root crops, etc., to complement maize, the staple cereal crop.

(c) Intercropping and relay-cropping to reduce risks of crop failure due to deficient rainfall and to take advantage of differential water and nutrient needs of different crops.

(d) Water and soil moisture conserving practices including weeding practices.

(e) Development and use of practices to reduce and/or prevent soil erosion.

(f) Improvement of the livestock component of the farming system with greater attention to breed selection, husbandry, management of pasture and range lands, use of crop residues, and production and conservation of fodder and forages.

(g) Development of more appropriate tools for oxen traction to reduce the demand for human labour in soil preparation and weeding and improve the economy of soil moisture utilization.

(h) Rotations with legume crops, including study of nitrogen fixation, and use of manures, as alternatives to high cost chemical fertilizers.

(i) Development of rainfall prediction methods which permit selection among important food crops to be planted in different seasons, and provide guidance for choices of practices and inputs, specifically plant populations and fertilizer rates, in accordance with actual early season rainfall. Research on the relationship of water to crop yield to underlie the above practices.

(j) Integrated pest management systems for smallholders.

(k) While the foregoing activities focus principally on components of technology, a farming systems approach was prescribed by both projects as the most effective means for rapidly introducing improvements in technology into the farmers' production systems.

6. The activities outlined were seen as adequate for achievement of stated objectives. Nevertheless, there are a number of design defects. Although the two projects were designed concurrently with a conscious effort to achieve complementarity, the institutional arrangements have not been able to provide for the coordination of inputs and work programs which are necessary to assure this complementarity. The establishment of the USAID/USDA base of operations at Muguga, while providing for use of established office and laboratory facilities, is outside of the dryland area and some 85 km from the principal field station for the dryland area. This has handicapped field work at the NDFR station and on farms in the dryland area. This is also an impediment to close interaction between staffs of the USDA and FAO teams as well as between and among the counterpart teams and the expatriate teams. The project design also made inadequate provision for physical facilities. This is especially true with respect to the UNDP/FAO project based at Katumani. The limited laboratory and office facilities, lack of an adequate water supply and lack of housing have adversely affected work by the FAO team.

6. While these defects of design have contributed to shortcomings in project implementation, use of inputs and the resulting outputs, they do not account for all of the deficiences.

C. PROJECT IMPLEMENTATION - INPUTS

8. In spite of design defects and a host of other problems incident to establishing the projects operationally, the projects are now well established and carrying out work in keeping with most of the objectives. The principal start-up problems included late and irregular arrival of the expatriate staffs, (one key member of each team is yet to arrive at post) some premature resignations of individuals, delays in recruitment of counterparts and in recruitment and processing of individuals for training, delays in appointment of a coordinator/team leader for the FAO team, and delay in establishment of a mechanism for coordination of project inputs.

9. Both projects are substantially behind schedule in utilization of financial resources originally committed. Although by February 1982 approximately 50% and 40% of the originally projected project time had elapsed for the UNDP/FAO and the USAID/USDA projects respectively, only 37.5% and 23% of the committed funds had been utilized. Late recruitment of personnel accounted for a substantial portion of the shortfalls, but the most serious lag has been in commitment of funds for training. Late and irregular arrival of expatriate staff has had the effect of causing about a 1 year slippage in implementation. Failure to provide certain key individuals, e.g., the maize breeder for the dryland area by the USDA and the agronomist by the FAO, has resulted in neglect of important elements of the research programme and has had adverse repercussions on other elements of the programme which were already staffed.

10. By February 1982, the NDFR station at Katumani had an adequate and reasonably qualified staff. Of 26 individuals 4, 14 and 8 had MSc, BSc and diploma level preparation respectively. On the other hand few had been on the job for more than 9 months, and a majority for about 6 months or less. The assignment of counterpart staff for the USDA team in KARI, on the other hand, was highly unsatisfactory. Only four nationals had been assigned, two individuals for each of two members of the USDA staff.

11. The same relative situation existed between the two projects with respect to training. For the UNDP/FAO project 5 participants for degree training (one of whom had completed his training), of the 8 envisioned, had begun their training. Of the 18 short term training programs scheduled, 4 had been completed, 3 were still in progress and 2 were scheduled to begin in 1982. In the USAID/USDA project, of 35 degree training programs listed in the "Life of Project Plan" for training, only 6 had commenced, and arrangements have been completed for two others. Only 2 of the 26 short term training programs envisioned had been completed.

12. The delays in moving ahead with training in the USAID/USDA project will have a serious adverse impact on the objective of developing a trained cadre of researchers for whatever institutional structure is ultimately established. Given the terms of the agreement between the GOK and USAID, all actions financed by the project must be completed by January 1984. It will not be possible to finance any new advanced training programs which usually require 2-3 years for completion. Unless this provision of the agreement is amended the academic training program of the project is now essentially ended. It is therefore recommended that agreement be reached between USAID and the GOK that the time limit for completion of training with project funds be extended beyond the current project activity terminal date.

13. Procurement and delivery of equipment has been satisfactory. Neither project contained a construction element.

14. The provision of GOK inputs has fallen short of that programmed. Adequate office and laboratory facilities have been provided at Muguga for the USDA team. The provision of facilities for support of the UNDP/FAO team at Katumani has not been entirely satisfactory. Funds earmarked for housing have not been made available. There have been delays in construction and installation of laboratories and a water supply system. Budgeted contributions by KARI for operations have been adequate. However, the use of the funds has been hampered by bureaucratic impediments. Allocations of funds for operations at Katumani have been less than desired. It is understood that this situation prevails in most projects because of general constraints on GOK budgets.

15. The levels of technical inputs were deemed satisfactory and consistent with the project objectives in most areas. A notable exception was in maize breeding for the lowlands with no inputs to date. The absence of the UNDP/FAO agronomist has retarded agronomic work, and has been a particularly serious handicap to more effective planning of pre-extension trials and the development of farming systems work.

D. CONSTRAINTS AFFECTING USE OF INPUTS AND IMPLEMENTATIONS

Institutional Relationships

16. The institutional relationships of the two projects have had a serious adverse impact on use of inputs. The UNDP/FAO project is directly responsible to the Division of Scientific Research of the MOA, while the USAID/USDA project is directly responsible to KARI, which though institutionally autonomous, is in fact dependent on the MOA/DSR. This has created a series of problems, e.g., bureaucratic impediments to effective communication, to assignment of personnel, to use of available resources, and to cooperation between the two project teams. The FAO team posted at Katumani has access to the NDFR station installation of the MOA/DSR for field work. KARI does not have field facilities in the dryland area. Consequently the USDA team must depend for field facilities on the NDFR station, over which KARI has no control. Although approximately 90% of the activities at the NDFR station are project work, the station is managed by a Director, whose relationship to the project and the two project teams remains undefined although he essentially controls the allocations of most national project resources. A further complication is the separation of responsibilities for crops and livestock research between divisions of the two ministries, MOA and MOLD. The NDFR station has a distinct crops bias undoubtedly reflecting the fact that the major resources come from the MOA. Cooperation between the research divisions of the MOA and MOLD in defining program and in the allocation of resources for research in the arid and semi-arid zones was not in evidence.

17. The logistical arrangements, whereby the FAO staff as well as the USDA staff reside in Nairobi and must travel 85 km each way to Katumani, aside from being costly, must inevitably adversely affect performance. Thus it is not possible for the staff to follow in the required detail the research activities. The professional association of the expatriate and the national personnel is seriously impaired. This is undoubtedly an element contributing to the feeling of being less than total participants in the programme by the national personnel. Because of the large amount of time consumed in travelling between Nairobi and Katumani, work in pre-extension and on-farm trails must inevitably suffer.

Inter and Intrateam Cooperation

18. A Technical Coordinating Committee (TCC), with two subcommittees and special ad hoc committees, has been established to coordinate the activities of the UNDP/FAO project. A National Coordinator, who also serves as coordinator of the FAO team, has been appointed for the overall NDFR project. These mechanisms have failed to bring about effective cooperation and coordination among the two project teams, the national counterparts, and the NDFR station, nor even within the personnel of the two teams. The relationship between the National Coordinator and the USDA team leader is undefined. There was no evidence of joint planning by the two teams and the national counterparts. The two counterpart groups are isolated one from the other by location and evidence of interaction was totally absent. It was also clear that effective cooperation and coordination within teams was lacking. This was more noticeable within the FAO team. There was little evidence of a team approach or a joint team approach. At the same time highly effective cooperation between and among individuals within and between teams was in evidence. This level of cooperation, however, was on a personal and/or professional basis. In this connection, it is worthy of note that earlier cooperative work between the Faculty of Agriculture, University of Nairobi and Katumani Station has been discontinued. Apparently the University researchers felt that support for their research program at Katumani was not sufficient to maintain the work at a satisfactory level. The Katumani management on the other hand expressed the view that the University researchers were devoting too little time to the cooperative work and were making excessive demands on the station resources.

E. OUTPUTS

Technical

19. In original concept the USAID/USDA team was to engage in basic and applied research while the UNDP/FAO team was to be concerned mostly with adaptive research with a significant element of pre-extension and on-farm trials. Within the context of the two projects this distinction is a hindrance rather than a useful distinction. An important measure of complementarity is nevertheless implied by this distinction. Whereas substantial complementarity between the plant breeding and variety selection work of the FAO team and the USAID plant pathologist and between the FAO soil conservationist and the USAID soil physicist and agro-meteorologist has been established, this has been notoriously absent regarding the agronomy and farming systems elements of the two teams.

In both cases the farming systems approach was prescribed although the USAID/USDA project was limited in scope to crops and cropping systems while the UNDP/FAO project also included animal production.

20. The combined research programs of the two projects in support of certain of the objectives appeared to the evaluation team to be progressing satisfactorily, e.g., selection and breeding work with pulses, cooperation in selection for disease resistance in pulses, study of water requirements of maize and beans under different levels of fertility and plant populations, the long term study of erosion in run-off plots, cultural methods for weed control, and improvements in animal drawn equipment in cooperation with the UNDP/FAO project KEN/74/019 on agricultural equipment. There are, however, certain important gaps in strategic areas. Nothing has been accomplished with regard to maize variety improvement in the dryland area.[1/] There has been little study of rotations for soil fertility improvement, especially rotations involving legume crops including the study of nitrogen fixation and the study of Rhizobial activity which is identified with different species. Finally little has been done to improve the soil-water-use economy.

21. The principal accomplishment in the area of soil and water conservation is the establishment of equipment for measuring run-off. This is a long term experiment designed to provide the basis for greater precision in the design of erosion control practices. In the area of soil conservation there is much debate as to the relative emphasis which should be given to research as opposed to application. In past decades practices to reduce run-off and erosion have been established in much of the area. Many of these have been highly effective while others have been less so, and in some cases these measures have aggravated the problem. A diagnostic study of a cross section of these installations to determine the basis for success or failure would probably produce more useful results in the short run than the establishment of carefully designed test installations which will require a long period before yielding useful results. In this regard cooperation with the USAID/ASAL project in Kitui District should be explored.

1/ USAID/USDA is providing a maize breeder at Kitale in continuation of assistance in maize breeding which was begum over a decade ago. This maize breeder has been at post since June 1980.

22. The livestock forage and pasture unit has focused on studies of means for improving the nutritional value of crop residues, on feeding of draft animals, on conservation of crop residues and fodder, and to a limited extent on the production and utilization of cultivated pasture and fodder crops. Many of these trials have produced results which are either negative or not relevant to the constraints within which the farmer operates because of a relatively capital intensive orientation. A substantial reorientation was proposed, and accepted, by the unit. The reorientation focused on low capital input operations, e.g., improving natural pasture by introduction of legume species, production of legume fodder species including fodder shrubs on field borders and terraces, genetic improvement of breeds by cross-breeding with superior stock, and use of females as draft animals.

23. The focus of the FAO farming systems unit has been on pre-extension trials in farmers' fields and the establishment of a unit farm. Although there has been collaboration with the livestock group in the work of the unit farm, a livestock element has not to date been incorporated in the pre-extension trials. The pre-extension trials were begun with the 1980 short rains season, about 2 months after the arrival of the farming systems agronomist. The design of the pre-extension trials appeared to have been arbitrarily made without any basis in experimental results nor in traditional practice. The design apparently represented the best judgment of the staff and was perhaps acceptable for a start. However, there has been little or no effort to determine the validity of this best judgment in more rigorously controlled tests. In the design of the pre-extension tests, proposals from the results of several years work by the USDA agronomist were totally ignored. As a consequence there has been no cooperation between the USDA agronomist and the FAO farming systems unit. The pre-extension trials of the latter and the verification trials of the former are being run in complete isolation from one another. Where both are working at the same site (the unit farm) there are conflicting reports as to the results being obtained.

24. The farming systems work has ignored one fundamental concept, i.e., the first step in farming systems work is a thorough understanding of the farmers' current systems and constraints before attempting to introduce modifications. The pre-extension work is introducing a pre-planned package without an adequate analysis of the existing systems nor an adequate experimental data base on the use of the package itself.

This is not to imply that the pre-extension trials have not had any useful effect. On the contrary, the inclusion in these trials of an early maturing composite pigeon pea variety has attracted much attention from the farmers. They are asking for seed of this variety to replace the longer maturing traditional varieties. Up to this point the focus of the research has been on the individual technologies and components of the system and not on the system itself. It is understood that the farming systems unit will now undertake in-depth analyses of existing systems including the livestock component and the family living component to serve as a basis for more rational integration of improved practices which can be recommended and which can be accommodated within the constraints within which the farmer works.

25. The pre-extension trials and the farming systems approach provide the essential linkages to the extension services. The extension personnel at the field level, technical assistants (TAs) and junior technical assistants (JTAs) play an essential role in monitoring these trials. The monitoring has not been entirely satisfactory. This is due in part to difficulties in logistics but also because of the lack of adequate understanding of their roles in the pre-extension program and in the extension program itself. Although some training has been provided to the TAs and JTAs at the Katumani Station it is doubtful that they have a clear understanding of their roles. Traditionally personnel at this level do little more than carry out instructions from various technical specialists from the District Offices. They are poorly equipped by training and orientation to interpret farmer problems and to provide effective reverse flow of information which could be helpful in the design of extension programs or as guidance which district level specialists could give.

Relations With The Extension Service

26. With respect to the role of extension service personnel in the pre-extension trials and eventually in farming systems work, it is clear that the research staffs have not established adequate communications with the DAOs, DLOs and the specialists so that there is no clear understanding of the respective roles. Thus far, working contacts by the research staffs with extension have been largely limited to those with the TAs and JTAs. The multiplicity of extension services of which the DAO and DLO organizations represent only a part does little to engender effective use of the field level worker.

Institutional Building

27. The rationale for relating the USAID project to KARI rather than the MOA/SRD was the belief that KARI would provide a better basis for building a long term research institution for agriculture broadly defined. KARI had recently been established in implementation of the 1979 amendment to the Science and Technology Act of 1977. As a semi-autonomous institution it was designed to overcome the problems of maintaining qualified personnel in research positions.[1/] In practice, however, KARI has remained subordinate to the MOA/DSR. The latter is inconsistent with inclusion of animal science research in KARI without establishment of mechanisms for relating this to the research division of the MOLD. KARI has remained an institution in name only, without its own staff and dependent on the MOA/DSR for budgets. Under this arrangement a suitable base for developing KARI as a national agricultural research institution does not exist. Consequently the institution building element of the USAID project is seriously compromised if in fact not totally negated. Given the long term nature of research and the need for continuity, this defect will seriously compromise the contribution of the project to the GOK objectives.

28. The UNDP/FAO project is tied to the MOA/DSR and the NDFR station at Katumani. This institutional arrangement does provide a suitable relationship for strengthening the institutional capabilities of the NDFR station. Its effectiveness, however, is compromised by the lack of a clear definition of roles and relationships between the NDFR station director and the NDFRD project coordinator. It is further compromised by unsatisfactory relationships between the expatriate team and the national counterpart team. Substantial personal conflicts within the FAO team do little to facilitate the strengthening of the station as a well rounded institution.

29. The recent (February 1982) creation of a new ministry (Ministry for Regional Development, Science and Technology) may substantially alter the institutional setting for agricultural research. Should all of research, including crops and livestock production, be transferred to this new ministry, either within the framework of KARI or some other institution, it is possible that a sound basis will be established upon which to build an agricultural research institution. Should agricultural research, including animal science research, continue to be fragmented, a re-evaluation of the institutional arrangements of the two projects will become indispensable.

1/ This issue is discussed in depth by the ATAC report of 1977.

30. Any recommendations for organizational changes in the two projects at this time must be deferred pending a clear demonstration of intent by the new ministry. Nevertheless, whatever the form the new institutional arrangements for crops and livestock production research will take, it is imperative that a more effective mechanism be developed for coordinating and managing the two projects' inputs into the research system. We should perhaps envision a truly joint project with pooled resources under a single coordinator.

F. PROJECT PURPOSES (FOR USAID PROJECT ONLY)

31. The purpose of the project is still valid, but little progress has been made to date towards the development of improved technical packages. Given the lag time in initiation of effective implementation it is unreasonable to expect applicable new technologies at this time.

32. The magnitudes of outputs projected in the log frame are clearly unrealistic. It is not likely that the project will have any impact on production and incomes in the project area during the life of the project, except for the relatively few farmers with which the project will work in verification and pre-extension trials. The most likely "End of Project Status" will be packages of technology adequately tested in pre-extension trials and ready for broader dissemenation by the extension services. Unless the PACD date is amended degree training will fall far short of project targets.

F. RECOMMENDATIONS

1. Recommendations for Institutional Changes

33. Recognizing that the unsatisfactory state of the institutional relationships of the two projects is a major impediment to effective cooperation and coordination, it is clear that restructuring of them is a matter of urgent necessity.

34. However, because of the recent creation of a new Ministry of Regional Development, Science and Technology and the uncertain impact that this may have on the institutional organization of research in agriculture (crops and livestock) it is difficult to suggest what changes should be made in the existing institutional relationships of the two projects.

35. Therefore, it is recommended that within the next nine months and no later than December 1982 a review of intervening institutional changes be made by a group of three individuals.1/ If such a review should reveal that little progress has been made toward greater integration of agricultural (crop and livestock) research institutions, the institutional ties of the two projects should be critically reappraised. The reappraisal should focus on establishing a satisfactory institutional arrangement for assuring effective coordination of the two projects. It should also include a review of the posting arrangements of the two expatriate teams.

Action: GOK, UNDP, and USAID.

36. In the meantime, and recognizing the difficulties which are likely to be faced in attempting to restructure the management and coordinating aspects of the two projects without the basic institutional remedies, some immediate measures should be taken to improve the existing situation. These are as follows:

(a) It is recommended that a Senior Kenyan Research Officer be appointed National Coordinator of Research in Agriculture (crops and livestock) for the arid and semi-arid lands.

Action: GOK.

(b) The National Coordinator should be responsible for coordinating the use of inputs provided by the UNDP/FAO and the USAID/USDA projects and for the allocation of all national resources committed to the project.

Action: GOK.

(c) A team leader should be named (this has already been done for the USAID/USDA team) for each expatriate team with responsibilities for directing the activities of his respective team and assuring that team members fulfill their roles in the overall program. The team leaders should be responsible to the National Coordinator.

1/ Were it not for the recent creation of the Ministry of Regional Development, Science and Technology, the evaluation mission would most likely have recommended an immediate transfer of the USAID/USDA project to the MOA/DSR in order to pull the two projects together, recognizing however that this would not contribute to the solution of the fundamental problems facing the development of Agricultural Research in Kenya.

(d) In order that the National Coordinator may fulfill the responsibilities stated in (b) above he should also be director of the National Dryland Farming Research Station, Katumani. An effective estate manager to manage the day-to-day operations of the station will also be essential.

Action: GOK.

(e) The National Coordinator should have executive authority to implement recommendations and decisions of the Technical Coordination Committee, whose mandate should be extended to include the operations of the USAID/USDA project.

Action: GOK: Chairman of the TCC.

37. Recognizing that the problems of management and coordination of the two projects, as well as other related projects, are to a large extent due to the lack of a well-defined program for research and development in the arid and semi-arid lands, and recognizing that a large number of donor supported projects have been substantially developed by the respective donors without the guidance of a national plan, it is recommended that a plan for research and development be mapped for a 10-20 year period, establishing priorities and defining resource requirements. This plan should specifically address the question of research-extension linkages and propose mechanisms and resource requirements for strenthening these linkages. The several donors should be prepared to assist the Government in preparing this plan, independently of the ongoing projects.

Action: GOK and Major Donors.

2. Operational Recommendations

38. In order to improve implementation of research and pre-extension programs by the national staff of the Katumani Station and the two expatriate teams, it is recommended that:

(a) Joint planning of annual work programmes be undertaken, involving the national staff and the two expatriate teams.

Action: The National Coordinator.

(b) An organogram of the Katumani Station be developed showing major divisions, defining the responsibilities of each staff member and identifying linkages and lines of communication.

Action: The National Coordinator.

(c) Regular meetings should be held involving the National Coordinator and the two expatriate team leaders.

Action: The National Coordinator and the FAO and USDA Team Leaders.

(d) Regular meetings should be held of the national staff and the expatriate teams. Smaller group discussions along commodity and/or discipline lines should be encouraged.

Action: The National Coordinator and the FAO and USDA Team Leaders.

3. Technical Recommendations

39. Progress in several areas in the work programs of the two projects was deemed to be satisfactory. On the other hand, some deficiencies were noted in others for which the following recommndations are made:

(a) Soil and Water Conservation

It is recommended that the work of this unit should focus more than heretofore on demonstration of the best practices which are currently available while continuing the more basic run-off studies. These practices should be introduced in the pre-extension trials, in the unit farm and in farm units selected for pilot testing of whole farm systems.

Action: FAO and USDA Team Leaders.

(b) A wider range of legume species including bushes and trees, should be included in studies of nitrogen fixation. Particular attention should be focused on identification of multipurpose species--useful for animal feed, in soil and water management and for enchancing soil fertility and physical structure.

Action: FAO and USDA Team Leaders.

(c) The livestock program should be expanded and substantially reoriented toward less capital intensive technologies. Proposals for this reorientation are detailed in an Annex to the report.

Action: Project Coordinator and FAO Team Leader.

(d) Pre-extension and Farming Systems:

The design of these elements should involve the combined effort of all team members. Because it is this aspect of the program which forges the link between the commodity and discipline research and the application of results by the farmer, it should be expanded as rapidly as improved elements of technology become available. It is recommended that a combined team consisting of the economist, the farm manager, the agronomist and the livestock specialist complete an in-depth analysis of a sample of typical farms as soon as possible. Based on this, further design of pre-extension trials should be undertaken, finally leading to testing of whole farm systems.

Action: Farming Systems Specialist.

(e) Since the satisfactory implementation of the pre-extension trials depends on active involvement of the extension personnel, especially at the local level, and since this involvement is an important element in extension/research linkages, understandings between the projects and the Katumani staffs and the District Agriculture/Livestock Officers for participation of the District staffs and the local technical assistants should be formalized. Project resources should be committed for the enhancement of this cooperative involvement of extension personnel, especially the technical assistants.

Action: National Coordinator.