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EVALUATION REPORT ON SEVEN SAARFA
COMMODITY NETWORKS AND OTHER ACTIVITIES
DECEMBER 1988 - MAY 1989
(K. O. RACHIE)

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I. BACKGROUND:

This midterm management review of the USAID-sponsored SAARFA project began on December 13-16, 1988 with a briefing and organizational meeting at the U.S. State Department offices in Washington, D.C. At that time field travel assignments were made for January 1989. A pre-departure meeting was held in Washington, D.C. on January 10-11, and four members of the Evaluation Team departed for East Africa on the evening of January 11th (see Annex "A"). Following some initial meetings in Nairobi, the team split up with Johnson and Christiansen traveling to Harare, and Rachie and Newberg (AFR/TR-Washington) proceeding on to Rwanda, Uganda and Kenya before returning to the States on January 26th 1989. A third team meeting was held in Washington on February 9-10, 1989, and a final meeting may be necessary prior to completing the report in March or early April.

The purpose of this evaluation is to review progress towards the achievement of the project purpose relative to strengthening national agricultural research systems and selected faculties of agriculture at national universities; and to suggest ways to improve the SAARFA structure, encourage donor coordination (re: SPAAR) and provide direction toward achieving the objectives of the USAID Africa Bureau's plan for the project.

This report is focused primarily on the seven commodity networks shown as items 1-7 in Text Table 1. Direct contact was made with each of the six coordinators (items 1-6) and their colleagues in East Africa (both IARC staff and NARS collaborators) in Nairobi and some of the NARS collaborating centers (see Annex B). The group of coordinators without exception proved to be high caliber professionals, enthusiastic, highly dedicated and very hard working. Similarly, their associates and collaborators were also capable and imbued with the aims and objectives of networking. This excellent group of competent professionals bodes well for the future of the project.

It was not possible to visit the mangrove/swamp rice project located at Rokupr, Sierra Leone. However, a fortuitous meeting was held with the WARDA Director General, Dr. E. R. Terry, on February 22 in Dakar, Senegal while this reviewer was on another assignment in West Africa.

Regional management of SAARFA in East Africa is vested in USAID/REDSO/ESA (Nairobi) and led by Mr. Robert McColaugh and his associates: 6 Americans and 3 Africans. The project officer specifically assigned to monitor the sub-projects is Mr. Hudson Masamba, a Kenyan. This appears to be an excellent arrangement since the responsibility for the project rests with persons highly knowledgeable about the region and its problems. Moreover, Mr. McColaugh is both deeply interested and enthused by the potential for SAARFA.

TEXT TABLE 1- LIST OF SAARFA COMMODITY NETWORKS EVALUATED

TITLE	*IMPLEMENTING AGENCY	PROJECT FY83-88/9	PERCENT OF TOTAL FY83-89	PERIOD FUNDED START	FINISH	REGION & COUNTRIES
East Africa Bean Research 598-0435.01	CIAT (also CIDA)	2.500	8.9	8-84	8-91	Primarily Kenya, Uganda,
Bases To Plant Resistance To Insect Attack 598-0435.02	ICRPE (others)	2500	8.9	9-84	9-91	Carried out mainly in Kenya
Farming Systems Research 598-0435.03	CIMMYT (CIDA)	5000	17.8	6-85	6-90	East and South Africa (13 countries)
Potato Improvement For Central Africa 598-0435.04	CIP	1557	5.5	2-86	2-91	Encompasses Zaire, Rwanda & Burundi (orig.) to be expanded
Forestry/Fuelwood Research and Development 598-0435.05	ICRAF (AID/AFR-B)	300	1.1	9-86	9-91	Headquartered in Nairobi; target areas incl. 4 zones: lowland humid tropics-the Sakel; subhumid unimodal highlands of S.A.-sub-humid bimodal highlands of E.Africa
East & Southern Africa Rootcrops Research Network 598-0435,07	IITA (IDRC)	943	3.4	4-87	4-90	Trip enter in Malawi; incl. Sudan, Ethiopia, Kenya, Uganda Rwanda, Burundi, Tanzania, Malzani, Mazambique, Madagascar
Mangrove & Associated Swamp rice	WARDA	1400	5.0	10-87	10-89	Sited at Rokupr, S.L. (80%) others: Gambia, Guinea-Bissau and Nigeria
Other Sub-Projects (6)	*Incl. other Donors	10267	36.6			
Direct Activities	DEVRES, USDA PRSA, IPRI PEDSO/ESA	5226				
Items 1 - 7		14200				

II. THE COMMODITY NETWORKS:

The six commodity networks operating in east and southern Africa include CIMMYT, CIP, ICRAF and ICIP headquartered in Nairobi, CIAT in Ethiopia (Debre Zeit) and IITA in Malawi. Two of the networks (Bases of Plant Resistance to Insect) and AFRENA (agroforestry) are sited at their institutional main centers also located in Nairobi: the CIMMYT OFR/FSR project does both in-country and regional training (latter in Harare, Zimbabwe). CIAT has staff members stationed in both Ethiopia and Uganda; and they are linked with two related CIAT bean networks supported by other donors in the Great Lakes Region (Rwanda) and in Southern Africa (SADCC Countries). IITA has only one staff member for east and southern Africa stationed at Lilongwe, Malawi. ICIPE conducts most of its activities at their major field station, Mbita Point, located on the west shore of Lake Victoria. ICRAF is moving into research (originally conceived as a training, advisory and diagnostic service) centered at Machakos about 1½ hours by road east of Nairobi.

In general terms all six network sub-projects have been successful in the following aspects and activities:

- (1) Developing and strengthening linkages between IARC's and NARS (highly successful) and NARS to NARS (successful).
- (2) The networks have been particularly successful at exchanging germplasm, sharing knowledge of methodologies, and in training.
- (3) Direct contributions to national agriculture is not yet measurable as the time period is too short. Nevertheless, improved bean, potato, cassava, and sweet potato cultivars are moving into advanced testing and farmer's field trials. Similarly, improvements in cultural practices and pest control are in widespread evaluation. Hundreds of NARS staff members have been trained and provided with information, consultation services, genetic stocks and material support.

It must be recognized that agricultural research and networking are activities with long lead times (10 to 20 years), but extraordinary multiplicative potential. The SAARFA project is less than five years in operation with some sub-projects becoming established as late as 1986 and 1987. Moreover, two IARC's (ICRAF and ICIPE) have only recently become involved in the kind of applied research appropriate to networking. However, both centers appear to be making a good start - especially ICIPE which is investigating plant resistance to stemborers of maize and sorghum.

Each of the seven commodity networks will be discussed briefly in the sections to follow:

A. CIAT - Bean Research in East Africa:

Coordination is headquartered in Ethiopia (supported by CIDA), but SAARFA supports two researchers in Uganda. Other elements of the African bean network are located in Rwanda, Tanzania and SADCC

countries supported by other donors. The East Africa network covers Ethiopia, Uganda, Somalia, and (unofficially) Kenya. The present grant terminates on July 27, 1991.

The project supports bean research oriented around varietal improvement (disease and pest resistance/high yields), training - both short and long term, and other networking activities. Special attention is given to the on-farm testing in both research and training. For small farmers in the highlands CIAT is also working on climbing beans; and for the low, hot climate of Somalia, cowpeas are advocated in collaboration with IITA.

About three training courses are held each year with an interdisciplinary workshop held every two years, and a technical workshop about every nine months.

Among the significant developments on bean improvement are: excellent resistance to Callosobruchis in storage, new releases are imminent in Uganda and Ethiopia (2 Carioca cvs., NPV-from Zambia, and Ex-Rico from Colombia). Other developments and findings include: (i) increasing consumption of beans in the region due to high cost of meat and other protein sources, (ii) increasing preference for climbing beans in Kigezi and highlands of Rwanda, (iii) rhizobia inoculum not useful, except perhaps in Madagascar, (iv) many promising intercropping schemes such as beans with bananas (being studied in Uganda), and (v) generally rising interest in beans and bean improvement among the countries and NARS in E & S Africa.

The CIAT bean program in Africa is organized into three separate networks which are coordinated from Ethiopia (Kirkby). However, each network can call on special expertise from a sister network as needed. Some CIAT staff, like bean economist (Grisley) stationed at Kawanda in Uganda, have regional responsibilities. An earlier problem occurred with Kenya when that country refused to host the bean coordination office, and Kenya did not join the network. However, this relationship is gradually warming, and CIAT does import bean germplasm through the Kenyan PQS at Muguga. Nevertheless, Kenyan participation in other aspects of networking remains minimal.

Outlook: The CIAT bean network has made good progress with earlier efforts beginning to payoff in advancing technology some cultivars are nearing official release, and in training a collaborating group of professionals in the region. However, CIAT differs from some of the other networks in that it does not delineate clearly between "regional core research activities" and networking that implies more localized (national) research, training, and interchange activities. Other IARC's, like ICRISAT, CIP, IITA and CIMMYT have favored core out-posted sub-centers with long term, on-going programs in regions where they have major responsibilities. The advantages of this arrangement are more rapid progress in technology generation, lower probability of creating misunderstandings with both NARS and donors, and a long term commitment to the region. The separation of CIAT's bean outreach activities in Africa into three regional networks appears to have several advantages: (i) provides better definition of the agro-ecology and research strategies; (ii) economy of scale - some activities like economic studies and regional training can be shared by all three networks; (iii) general preference by NARS participants for smaller networks; and (iv) the smaller, regionally-defined net-

working packages may be more attractive to donors.

The internal management review carried out in April 1988 has given CIAT good marks for progress made by the East African Bean Research Network. This was found to be a well managed scientific effort collaborating in the development and testing of new varieties and bean production technologies resulting in a strong regional network being led by an active regional steering committee, although initial implementation was delayed by two years to August 1986. The project has also made good progress on training: 7 researchers are currently studying, or in the pipeline for higher degrees, 7 scientists have been to CIAT for short courses, and 154 researchers have attended in-country or regional short courses. The bean network has also established strong linkages with other institutions operating in the region, including CIMMYT, World Bank, ILCA, IITA, and other CIAT networks in the region. However, draw-down on grant funds has been slower than expected owing to the delay in project implementation.

It is concluded that CIAT has established a successfully functioning network in East Africa despite the early implementation delay. Therefore, this sub-project should be extended until the end of SAARFA Phase I, or at least one more year.

B. ICRPE - Bases of Plant Resistance to Insects:

Support for this project began in 1984 and terminates September 1, 1991. This project is mainly oriented around research on maize and sorghum resistance to stem borers, primarily Chilo partellus: (i) evaluation of germplasm for resistance, (ii) determine and characterize the mechanism of resistance, and (iii) study the genetics of resistance. The work is carried out mainly at the Mbita Point field station in western Kenya. Field evaluations were also conducted at Kenyan research stations at Machakos, Embu, Mtwapa, and Busia (Lambrue) and at ICRPE Field Site in Ungoye. Specific studies include: evaluating germplasm, mass insect rearing, alleviating agronomic practices (eg. intercropping, time of planting and insect trapping).

Resistant/tolerant lines of sorghum identified include: Serena (moderate), IS1044 (excellent) and IS12308 (poor plant type). It was also discovered that early infestation of susceptible sorghums (eg. 10DAE) results in heaviest damage - up to 90 or 95 percent; whereas later infestation results in reduced damage to the crop. Sorghum intercropped with cowpeas or beans is less affected than when sole-cropped. The Biocontrol Section has also studied four potential insect parasites of stem borers including species of Pedobus, Denticasmias, Apanteles, and Trichogramma (egg parasite); and some insect pathogens (Nosema spp and nematodes).

The project has trained two post doctoral fellows, three research associates (short term), and three technicians (short term); and a workshop on methodology was organized for Kenyan research. Networking has developed and been extended to other countries with participation in experiments in Zambia and Mozambique. The project is also in touch with ICRISAT in India and Zimbabwe; and with CIMMYT. ICRPE has initiated on-farm trials using state-of-the-art stem borer controls including resistant varieties and generally improved practices. This is an amazing turn of events for an avowedly basic and esoteric institution!

Outlook: The major concern of the review team during the mid-term evaluation in May 1987 was whether the information obtained and sources of resistance identified would be effectively used by IARC's and NARS to develop resistant varieties. This concern was subsequently addressed by ICIPE through collaboration with Kenyan and other plant breeders.

In general, good progress is being made toward realization of the projects objectives. Therefore, funding should be continued for one more year to the end of SAARFA-I.

C. CIMMYT-II - OFR/FSR Training:

A CIMMYT FSR project has operated in east/southern Africa, and headquartered in Nairobi since 1976. The current project with a five man team, and funding of \$5 million was approved by AID on May 20, 1985 and will terminate in May 1990.

This is not a research network per se, but rather a training activity, which by all counts has been highly successful and has trained more than 100 national professionals at international and regional workshops on OFR/FSR, and 500 national research staff at in-country training courses. The regional coverage includes 13 countries from Sudan and Djibouti to Zambia and Zimbabwe. Network staff have also provided consultation on OFR/FSR and are promulgating improved research methodologies through exchange and interaction of 20 quarterly newsletters and workshop findings in 17 countries. The project has also achieved the institutionalization of OFR/FSR in at least six countries in the region.

There is no doubt about the impact of the project on current philosophies and strategies of the technology process at the national level as evidenced from discussions with researchers and their administrators in East Africa; and by the trend to institutionalize OFR/FSR. In terms of institutional development, the best progress has been made in Malawi, Zambia, Zimbabwe, Tanzania, Uganda, Ethiopia, and Swaziland.

Outlook: The OFR/FSR project will have completed its major objectives by May 1990 when it terminates, but a "smoother phase-out" would require at least another 12 months. CIMMYT will continue some training in OFR in E/S Africa (probably at Edgerton University and in Harare), but it will be tied to crop management research (CMR), mainly focused on maize. An extension to the end of SAARFA LOP is recommended. This would allow the OFR/FSR project to work intensively in one or two countries to show some tangible results of these methodologies; and to work more closely with selected university faculties of agriculture to help institutionalize OFR/FSR.

The interim Evaluation of the OFR/FSR project carried out on May 10, 1988 made 30 recommendations, the major ones concerning the following topics: (i) submission of a 1988 work plan and budget, and a remaining LOP strategy statement and budget; (ii) appointment of a field project coordinator/administrator; (iii) correcting management deficiencies and reconciliation of expenditures (as actually incurred) and capital purchases; (iv) agreement between CIMMYT and CIDA for agronomic support to CIMMYT-II (by CIDA - funded agronomist); (v) develop the means to

document and measure farmer adoption of technology resulting from OFR/FSR; (vi) Title XII support to OFR/FSR should be based on the need to strengthen NARS and extension rather than general service to the projects; and (vii) project TA should focus on the whole farming system calling on other IARC's when their expertise is required (eg. livestock - ILCA and ILRAD). These recommendations have been noted by CIMMYT and appropriate responses are being made.

D. CIP - Potato Improvement/PRAPAC:

The CIP network on potatoes supported by SAARFA includes Kenya, Uganda, Rwanda and Burundi. Ethiopia is also included with support from CIDA. The network is headquartered at Nairobi (adjacent to ILRAD at Muguga). CIP has had several years of experience in the region dating back to 1974 and can be considered a more mature program. Current support under SAARFA runs to February 13, 1991.

The primary research focus of the potato program is breeding for resistance to late blight, and other diseases together with adaptation and yield; secondly, post-harvest handling/storage is increasingly important; and improving cultural practices. Training, communications, supply of germplasm are also given high priority in this program. The best network development and functioning has occurred in Rwanda under PRAPAC. This collaborative relationship includes Rwanda, Burundi, Eastern Zaire, and Uganda (recently). The PRAPAC collaboration assigns primary responsibility for breeding for resistance to late blight resistance, seed multiplication and post-harvest studies to Rwanda; breeding for bacterial wilt and other attributes to Burundi; and agronomy, processing and adaptation breeding to Zaire.

An excellent potato training facility has recently been constructed at Ruhengiri in northern Rwanda where the national potato research center (PNAP) is also headquartered. This facility is self-contained to house and feed up to 22 trainees and has additional classroom space. Two staff houses were also constructed.

The major problem of potatoes, as elsewhere in the world, is late blight. The most common control measure is spraying with fungicides up to twice weekly during active growth. Good resistance can be bred for, but the fungus organism comprises several races each of which can build up rapidly when specific resistant genes are incorporated into a released strain. The rate at which this occurs (within 2-3 years) does not allow time for multiplying sufficient seed of new vertical-resistant strains. The alternate strategy is to develop horizontal resistance by incorporating a large number of minor genes - a very difficult and time consuming process. This objective being carried out elsewhere will require another 5 years, after which other desirable data must be incorporated into the new strains.

Despite the intractable disease problem (including LB, BW, several viruses, golden nematode and others), the CIP staff

(Kloos) believes commercial potato yields have increased by 30 percent in east and central Africa through the application of improved technology; and that use of fungicides, where feasible, increases yields by 3 to 4 times. Rwanda has developed 3 new strains being tested in advanced trials. The project has also developed in vitro culture of meristem tissue as a means of rapid multiplication of clean seed; and has studied possibilities for using true seeds.

The CIP training program collaborates directly with the national potato program and with the FSRP. They send trainees to CIP (Peru), Holland and Tunisia in addition to conducting regional national training courses (2 courses in 3 years).

Outlook: The CIP potato project has made good progress and new technology has reached advanced testing prior to recommending/release. However, the need continues for the foreseeable future and support should be continued for the LOP of SAARFA. There remain major problems like introducing new germplasm for breeding purposes which is mainly done through the Kenya PQS station at Muguga (Kidanimariam/Okioga). This facility processes only about 100 clones/9 months.

Another concern is the perception that "the Irish potato is a rich man's food" which is partially borne out by SESA/MSU studies in Rwanda. This data shows that potatoes contribute only 3 percent of the total caloric intake in Rwanda compared with 26 percent for sweet potatoes, 20 percent from beans and 19 percent from bananas. Even sorghum, maize and cassava contributed more calories than the Irish potato. Similar potato consumption figures may be typical of the region: Burundi grows 20-30,000 ha, Zaire: 40,000 ha, and Uganda about 90,000 ha compared with Rwanda's 40,000 ha.

The third issue relevant to CIP's African programs is the recent assumption of global responsibility for sweet potatoes (formerly with IITA). The sweet potato is far more important on the continent and most of the technology and leadership for improvement have been provided by IITA. This transfer of mandate appears to be going smoothly, but there will be a hiatus while CIP brings the SP program up to speed and establishes international linkages. It is not yet clear when CIP will be ready to initiate a full-fledged sweet potato network in Africa, but this should receive highest priority in the future.

E. ICRAF - Agroforestry and AFRENA:

This project began only recently (8-31-86) and will terminate on August 31, 1991. The objectives of the project are to establish a collaborative, inter-country agroforestry research network in Kenya, Uganda, Burundi and Rwanda. Headquarters are in Nairobi and trials are carried out at Machakos. The focus is on woody species improvement trials within the network leading to genetically superior multipurpose trees and shrubs for identified agroforestry technologies. Training of agroforestry researchers in member countries will also be carried out.

Outlook: The ICRAF has only very latterly and reluctantly decided to become involved in research. The field work at Machakos is interesting, but not exciting. However, some species like Sesbania, sesbaw, Cassia siamea, Leucaena leucocephala K-8, and others have been identified as promising for intercropping with annuals as fence rows or farm woodlots. However, ICRAF needs to borrow staff expertise or train one of their own at IITA on hedgerow intercropping. Another serious shortcoming is that ICRAF has no ready means of increasing and supplying its own seeds/planting materials or germplasm. Moreover, field studies and trials appeared to be conducted very deliberately and laboriously with a minimum of supervision. It might be questioned whether training should be carried out under such circumstances. Recommendation: wait and see whether ICRAF develops research and networking capability.

F. IITA - East and South Africa Root Crops Network:

This project (ESARRN) has recently come under SAARFA on March 31, 1987 and is scheduled to terminate on April 1, 1990. The primary focus is on cassava now that CIP has taken over sweet potato; but some limited effort is also placed on other R&T crops like yams and cocoyams where applicable. The project currently serves east and southern Africa with only one staff member (Alvarez, the coordinator) headquartered at Chitedze Experiment Station at Lilongwe in Malawi. Formerly it was situated in Rwanda.

The project has achieved considerable progress in supplying and exchanging germplasm pools between and among IITA and NARS in the form of true seeds of both cassava and sweet potatoes, and in utilizing both IITA and local germplasm in intercrossing schemes (mainly in Rwanda). In addition, much technology on production systems, rapid propagation and post-harvest handling has been transferred to participants. Training conducted both in the region and at IITA has achieved short and medium term training of 180 technicians, and long term training of 6 MSc. candidates.

A recent spectacular development in cassava improvement is the successful intervention in spread of the disastrous mealy bug through introducing an effective insect parasite (E.lopezi) from Latin America. This technology emerged from research done by the Biocontrol Unit at IITA. Although at least two predators appear promising for controlling the greenspider mite (GSM), good host plant resistance is also available. Therefore, an effective breeding program could make rapid progress on this problem, especially in East Africa where the pest is more widely spread.

Outlook: Cassava production has increased dramatically in East and Southern Africa in recent years now estimated at 2.6 million ha. According to professional opinion this has occurred on account of the burgeoning population growth which has brought more marginal lands under cultivation and intensified cropping on more fertile lands, thereby depleting their fertility. Cassava performs better on poor soils and during droughty periods than most other crops, and does not necessarily require storage (harvest as needed). Unfortunately, national programs have not yet recognized the emerging importance of cassava, nor have they assigned and trained professional staff to carry out research and development on this crop. Therefore, additional support for research, development and capacitating human resources is a high

priority. Moreover, the IITA network should have at least one more professional to assist Alvarez with ESSARN in some 13 member states.

Other problems as observed by the ESARRN Interim Evaluation of December 1988 include the need to strengthen training, increase expert consultation and trouble-shooting (from headquarters at IITA), assign greater emphasis to post-harvest handling, and improve management. As of September 31, 1988 - or midway through the grant period, only 19 percent of available SAARFA funds had been expended.

F. WARDA - Mangrove and Associated Swamp Rice Research:

Support for this subproject began on 9-28-87 and will terminate on September 28, 1989. The primary work is carried out at Rokupr, Sierra Leone and allows WARDA to continue to research, technology transfer and training program in 1988 and 1989. The funding is intended to support the station between the end of the WARDA II project on 12-31-86 and the anticipated onset of USAID core support to WARDA in 1989. The project is aimed at rice production in the coastal problem areas of Sierra Leone, the Gambia, Guinea Bissau and Nigeria; and it focuses primarily on varietal improvement and control of pests endemic to these problem soils areas.

Very fortuitously Dr. Eugene R Terry, Director General of WARDA, was in Senegal during the annual B/C CRSP meetings of the External Evaluation Panel, Board of Directors and Institutional Representatives in Dakar, Senegal on the 21-25th of February 1989. Therefore, a dinner meeting on the evening of the 23rd February 1989, was arranged with Dr. Terry to discuss the SAARFA bridging grant for Mangrove and Related Swamp Rice Improvement at Rokupr, Sierra Leone.

Background on WARDA:

The fate of Warda for about the first eighteen years of its existence was precarious at best. Current wisdom during those early years was that it would eventually fold up and disappear. However, the CGIAR finally stepped in and agreed to bring the institute under its aegis and support pending several urgently needed changes and improvements, beginning in 1987. The first and major change was the appointment of Dr. Terry (formerly Director of International programs at IITA). Dr. Terry then arranged for the move of WARDA headquarters from Monrovia, Liberia to Bouake, Cote'd Ivoire. It also necessitated wholesale changes in staffing - both at the support and scientific levels. Other major changes have occurred in terms of focus, strategies and modus operandi.

The WARDA has now organized its programs around distinct rice farming ecosystems in West Africa. The principal technical factors that determine such ecosystems are surface hydrology and soils. Rice ecosystems are further categorized by biological stress and human factors which characterize distinct farming systems. The three major rice ecosystems in the region are:

	AREA (000 ha)	PERCENT*	PROGRAM LOCATION
1. Continuum:			
-Upland/hydromorphis	1539	57	Bouake. CI
-Hydromorphic/Swamp	513	21	Suakoko, Lib.
2. Sahel (irrigated)	135	6	Fanaye, Ndiaye Sen.
3. Mangrove	189	7	Rokupr, S.L.

* Not included is low potential deep water rice

Of these classifications greatest potential is for the continuum group, especially for the hydromorphic/swamp category.

WARDA now includes in its operational repertoire the commissioning of special studies in important problem areas at selected centers of excellence in the region, or wherever outstanding expertise exists, if such a program (or scientist) has a comparative advantage over WARDA (ala CIP).

SAARFA support to WARDA:

The SAARFA grant for \$1.4M was intended to provide support to WARDA to allow continuing the Mangrove Swamp Rice Research Project until institutional reorganization was completed in 1989. However, the project was approved late and support was not activated until the end of 1987. Therefore, WARDA has requested an extension of time until 12-21-90 to complete the transfer of budget allocation. However, this does not imply an increase in the original grant. The project carries 1 senior staff member (Sampong) plus 5 junior scientists, operation of equipment/vehicles, supplies, and other recurring expenses. It is, moreover, "the only research project of consequence in all Sierra Leone".

Outlook: This reviewer, by virtue of long acquaintance with the DG of WARDA, the extensive organizational and structural changes occurring to that center, and the potential for impacting on development in Sierra Leone and four other countries in West Africa, strongly supports this sub-project. Moreover, no less authority on rice improvement, Dr. Ronnie Coffman at Cornell, has stated that WARDA's mangrove swamp rice breeding program has made more progress than any other research activity at that center. Therefore, SAARFA support be continued until the end of 1990. This extension will not require additional funding beyond the original grant of \$1.4 million. A request for extension has already gone forward from SAARFA to AFR/TR.

III. FACULTIES OF AGRICULTURE AND OTHER SAARFA ACTIVITIES:

Contact was made with three faculties of agriculture - one each in Kenya, Rwanda and Uganda. In addition visits were made to some non-networking SAARFA projects and peripheral activities. These are briefly discussed below:

A. East African Faculties of Agriculture:

1. Edgerton University - Kenya

This semi-private institution has advanced steadily from its early 1970's status as a teacher's training college and mainly with USAID assistance. It is now filling an important gap as a dynamic and an effective training - cum-applied research institution. CIMMYT has proposed that Edgerton become involved in some of the long term training activities normally carried out in Mexico.

This proposal has considerable merit - particularly for wheat and maize crops and theoretical studies on these and other crops. However, the elevation at Edgerton exceeds 7000 ft. making it unsuitable for most tropical lowland crop species.

2. University of Rwanda at Bukare/UM

The faculty of Agriculture - UR is located in southern Rwanda. It received a grant of \$2,046 million on 9-30-87 which will terminate in September 1992 (LOP of SAARFA). The University of Minnesota is the principal partner institution assisting UR. Major activities include both training/teaching and research. The UR has the national mandate for rice improvement (24,000 ha), but other crop research may be added later. On the animal side, UR plans to focus on small ruminants and their nutrition - mainly on improving forages. Soil science, FSR and rural sociology will be included both as research disciplines and for training.

The UR plans a new 5 year program to replace the present 6 year course (first 2 years require common training while the last 3 years are for specialization).

At present the UR/FA has only 100 students and will graduate 21 ingenieurs per year. The major problem is lack of trained manpower. There are only 21 professorial staff members, but six members are studying abroad at present. Of the remaining 15 staff, 8 have Master's level training and 7 are Ph.D's - but of the latter 6 are expatriates. Eight additional staff members have been requested, but GOR has approved only four new positions. The present four departments (Agronomy, Animal Production, Engineering and Economics) will eventually increase and UR expects to double the student enrollment to 200.

The development of such an institution is important to the nation's future, but it is necessarily long term. There is no reason to assume that less than two decades will be required to reach institutional maturity (as in the case of Hassar-II University in Morocco).

3. Makerere University - Faculty of Agriculture

The faculty of Agriculture - MU was the premier institution of its kind in the late 1960's. At its zenith it attracted leading academicians from around the world and was training at the BSc, MSc and PH.D levels. Since the early 1970's, however, the University

went through a very difficult period for about 15 years, although the number of B.Sc students continued to increase from a student body of around 200 to about 400 at present (3 year course).

As a consequence of "the war" and economic hardship (continuing devaluation) the faculty lost two-thirds of its' teaching staff - from 60 down to 20. The teaching/research farm of 500 acres at Kabanyolo was all but abandoned. At the height of economic distress and even continuing up to the present, staff salaries remained at former shilling levels, but their value in terms of purchasing power declined to the point that even senior academicians received the equivalent of only a few dollars a month. This meant that all who stayed on had to moonlight (eg. cultivate their own shambas) to survive.

Fortunately, USAID began a Makerere rescue operation in the early to mid-1980's (on hold from 1981-1985) and the faculty is now well on the road to recovery. The faculty building on campus is being completely renovated, Kabanyolo Farm is 70-80% rehabilitated and new staff have been recruited. At present there are 54 senior staff, 38 of whom have Ph.D's - the rest have Master's degrees; and 14 new posts were recently created to and will bring the total teaching/research staff up to 75 (20 vacancies at present). There are now seven full fledged departments: Animal Science, Soils Science, Forestry, Crop Science, Agriculture Engineering, Agriculture Economics, and Extension. In 1989/90 a new department -Food Science will be started. Moreover, 15 graduate students will be registered in 1989.

Problems remain, like continuing political instability and the economic distortions, but if these are overcome, and the institutional support base can be broadened by increasing the number of external donors to pre-war levels, the FA could become the institution of choice for graduate training on the continent (or even outside Africa).

B. Other Non-Networking Subprojects Visited:

1. UA/FSR project at Rwerere, Rwanda:

The University of Arkansas Farming Systems Project located in an isolated, highlands area (2200m) of northern Rwanda has an expatriate staff complement of five scientists, including a plant pathologist/administrator, agronomist, soils scientist, socio-economist, and extension specialist. The project began in 1985 and terminates in 1990. The primary focus of the project is farming systems research emphasizing soil and water conservation, plant nutrient (fertility) problems, and plant disease/pest control. They are most enthused about alley cropping (IITA), but have reservations about ICRAF networking activities.

A major problem of the UA/FSR project is isolation from the Rwandan mainstream, nor have they been assigned national counterparts after nearly four years. There

appears to be difficulties with the project relationships with ISAR. Moreover, the number of networks and FSR activities in Rwanda may exceed both the availability of trained NARS scientists and resources. There are also three other FSR projects in the country with diverse goals and methodologies.

2. SESA-MOA/MSU - Kigale, Rwanda:

This food security project with Michigan State University participation has made several interesting findings through a number of farm level surveys. For example, about half of the commodities being marketed came through the country's leaky borders. They also discovered that sweet potatoes make up nearly a third of the food energy sources available to the poorest half of the population and 26 percent overall. Overall kilocalories production of other food commodities is as follows:

beans = 20%	bananas = 19%
maize = 10%	sorghum = 12%
cassava = 9%	Irish potatoes = 3%

Pole beans were found more important on smaller farms where cultivation is much more labor intensive. The SESA/MSU project also discovered a very wide (unacceptable) divergence between actual on-farm sampling and official (FAO?) statistics.

This is an interesting project, that could be profitably carried out elsewhere. The patterns of production - consumption are likely to be similar for adjoining highland areas, especially Burundi, eastern Zaire and southwestern Uganda.

3. Makerere Institute of Social Research:

The MISR located on Makerere Hill, Kampala is linked to the University of Wisconsin on a project to study land tenure in Uganda. The project focuses on the nature of land tenure like the breakdown of "milo-tenure" (large tracts of land originally awarded to tribal chiefs) and enforcement of the freehold land tenure law in 1975. They are also monitoring the population expansion around the national (game) parks and encroachment onto public lands.

The impact of land tenure on resource base conservation, long term investment in agriculture, and the national agricultural economy have become evident from these studies. It is interesting that there is an active, private land market in Uganda at present, although it often remains a sensitive issue both at the local and national levels.

IV. DISCUSSION AND RECOMMENDATIONS:

The SAARFA project as presently constituted is diffuse and includes several regional commodity networks, support to faculties of agriculture (only one), baseline studies, a variety of training activities, and other activities - some of which would be better

contribute to the overall objectives of SAARFA, it would be easier to manage and evaluate a more homogeneous group of activities. It is further suggested that AID establish a better defined and more rigorous procedure for selecting and prioritizing subprojects qualifying for support under the SAARFA rubric.

Commodity networks may easily become too large - 5 to 6 countries may be optimum in terms of ensuring full participation by all members, better service to the individual countries, more efficient management, and more homogeneity of agro-ecological and political conditions. A good example of such networking is CIAT's E&S Africa Bean Network with three separate, but strongly linked networks in East Africa, Great Lakes region, and the SADCC countries.

The IARC's should attempt to delineate regional research from networking activities - though closely linking them. This will help reduce some of the misunderstandings with both NARS and donors, and contribute to increased efficiency of operations. It would also allow better access to genetic and other materials needed for regional distribution.

There appears to be little concern by the research establishment - both IARC's and NARS - for assessing the impact of the technology developed. This is attributed to the existing unreliable data base, lack of procedural methodologies for evaluating and quantifying such impact, and because this information is seldom included or stressed adequately among the outputs of funding grants. It is therefore proposed that IARC's including their network coordinators be put on notice to begin (if not already done so) documenting the impact of their respective technologies. Similarly, NARS applying for commodity research support should assume this responsibility for their countries. Of course, collecting the necessary information will usually require additional support and expertise. Of particular interest in this regard is the information obtained by SESU/MSU from farm-level surveys in Rwanda.

The CIMMyT "Farming Systems Research" network features training not research, and focuses on "on-farm research" not classical FSR. Nevertheless, this project is having a major impact on the attitudes and strategies of agricultural technology generation in the region it serves (ESA). This highly desirable development should now be extended to other regions, especially to West and Central Africa. However, excellent this net work and its declaration of commodity neutrality, it nevertheless is perceived to be biased in favor of CIMMyT's mandated crops (wheat and maize). Other IARC's would incur a similar problem. Therefore, this project might be better managed by an appropriate non-IARC contractor if transferred to another region.

Regional commodity networks are certainly the most effective means for validating and transferring technology to national research and production systems. While the present group of networks should be nurtured and continued for the foreseeable future, there are other opportunities and urgent needs if funds are available and/or included in Phase II of SAARFA. Three such high priority projects are briefly described below:

1. Sweet Potato Network:

Sweet potato improvement is in grave danger of being neglected for an undetermined period as CIP assumes international responsibility for this commodity. Nevertheless, IITA has in place an outreach activity which has already succeeded in carrying out several networking objectives, especially in the areas of germplasm transfer, national breeding activities, training and communications. Although these efforts were generally secondary to those on cassava, there have been some notable developments that need continuing support until they can be folded into the newly established CIP program for this crop. To ensure the minimum loss of existing momentum, a separate network for sweet potatoes coordinated and managed by CIP should be established as soon as possible.

2. Maize Research Network:

Maize improvement is a second area where networking could have an important impact. Although the breeding activities are reasonably well organized and advanced throughout east and south Africa, much could be done on maize-based production systems, and particularly on low input systems, plant nutrient recycling, intercropping, alley-cropping and integrated pest management. CIMMYT has the international mandate for East Africa, and IITA has the mandate for Central and West Africa maize improvement.

3. Banana/Plantain Improvement Network:

A very important but largely unrecognized and neglected primary dietary staple throughout the sub-humid and humid tropics is banana - both the sweet or dessert and cooking types. This species embodies most of the attributes desired for small-holder, manual production systems: (i) high yielding, (ii) nutritious energy source, (iii) year around fruit bearing, (iv) multi-purpose uses, (v) conserves the resource base, and (vi) does not require onerous and debilitating primary tillage each season. Unfortunately, the improvement of this crop has been largely neglected on account of its "genetic intractability". Moreover, some serious diseases and pests like Black Sigatoka Disease now threaten this important and ubiquitous crop. However, breeding techniques based on "conventional" principles have now been worked out by FHIA - Honduras and several major advances are in the offing. Further developments may also be forthcoming through biotechnology research over the next five years. IITA has the international mandate for bananas in Africa.

The pending danger to bananas coupled with breakthroughs in its genetic improvement strongly mitigate in favor of supporting IITA in developing a continent wide improvement network.

An interesting question may be raised on the optional model for networking as the six IARC's have developed their outreach activities somewhat differently despite the similarity of objections. However, it may be premature to select a prototype network as a model for the future, although CIAT's bean network is attractive. The East Africa bean network comprises only four countries and is closely linked to the other two bean networks in central (Great Lakes) and southern (SADCC countries) Africa. The three sub-networks are linked by an institutional coordinator and share expertise. This allows a broader range of disciplines in residence on the continent and less reliance on expertise from the home institution in Colombia, S. A.

Finally, it would be interesting to determine how the six networks compare relative to each other. Although the evaluation was much too limited and superficial, the following "preliminary" ratings on effectiveness in the region:

EFFECTIVENESS RATING *

ASPECT	CIAT BEANS	ICIPE INSECTS	CIMMyT OFR/FSR	CIP POTATO	ICRAF FORESTRY	IITA ROOTS
1. Research	5	4	N/A	3	1	3
2. Training	4	3	5	4	1	2
3. Communications	4	2	4	4	2	3
4. Institutional- ization	4	3	4	5	2	2
5. Impact on Policy	3	2	5	3	2	2

* 5 = highest rating; 1 = poorest

Two additional concerns with broad relevance to the SAARFA project, but which do not fall under the purview of this evaluation are briefly discussed in outline form as "Extraneous Notes" on Technology Transfer (Annex "C") and Impact of Technology on African Agriculture (Annex "D").

V. CONCLUSIONS:

The SAARFA project may have the greatest potential of all conceivable activities for effecting desirable change and progress in its target region and countries: Nevertheless, this is a long term activity which may not produce significant economic gains for at least ten years. On the other hand there are beginning to be some tangible results in different areas and commodities; and the beginning of change in attitude and approach to the technology process. The CIMMyT-II OFR/FSR training network has already had a major impact on changing strategies among administrators, researchers, and technicians.

Although measurable economic gains accruing directly from SAARFA networking are still in the future, this project will be perceived as the most profitable investment in Africa by the turn of

the century. It must, however, be sustained by external support for the foreseeable future - or at least for another 20 years. This will ensure that the excellent cadre of scientist and net-workers - both at the IARC and national levels - will continue their current activities with enthusiasm and vigor.

TRAVEL/DAILY ACTIVITIES REPORT
 SAARFA EVALUATION: 1988-89

K. O. Rachie - Agronomist

DATE	TIME	ACTIVITY
12-13-88	Dep. 7:30 hrs Arr. 13:00 hrs	Travel from Hot Springs to Little Rock (AR) and Washington, D.C. for briefing on SAARFA evaluation
12-14-88	All Day	Planning/organizational meeting on SAARFA project evaluation
12-15-88	All Day	Planning meeting on SAARFA evaluation
12-16-88	Dep. 7:30 hrs Arr. 17:30 hrs	Travel from Washington, D.C. to Hot Springs Village, AR
1-6/7-89	All Day (2)	Preparation for travel to Africa; perusal of documents/reports
1-10-89	Dep. 12:05 hrs Arr. 16:00 hrs	Travel from Clermont, Fla. to Orlando and Washington, D.C. for pre-departure meeting on SAARFA evaluation.
1-11-89	All Day Dep. 20:00 hrs	Attend meeting on SAARFA evaluation; depart from Dulles AP for Nairobi
1-12-89	All Day Arr. 24:00	Travel to Nairobi
1-13-89	All Day	Nairobi USAID-REDSO (McColough); Met with Director of the Kenya Agriculture Research Institute or KARI (Wapakala/Matata)
1-14-89	All Day	Nairobi: discussions with REDSO/ESA (McColaugh/Masamba)
1-15-89	All Day (Sunday)	Nairobi: Met with Network Coordinators at McColaugh's home: IITA (Alvarez), CIP (Nganga), CIAT (Kirkby); also IPRAF and ICIPE
1-16-89	All Day	Nairobi: Meeting with CIMMyT (Ananda) KARI (Matata), Edgerton University officials and REDSO
1-17-89	Dep. 10:30 hrs Arr. 12:30 hrs	Traveled from Nairobi to Kigale, Rwanda; briefing by USAID (Crawford and Graham)
1-18-89	All Day (Rawanda)	Traveled to Ruhengiri (North) and met with PRAPAC/CIP project (Kloos and Pierre); proceeded to ISAR-Rwerere to

visit University of Arkansas Farming
Systems Project (Yamoch and Colleagues)
Returned to Kigale

1-19-89	All Day (Rawanda)	Traveled to ISAR headquarters at Rubono to meet with the Director (Gahamanyi); and to the University of Rawanda at Bukare to meet with the Dean, Faculty of Agriculture (Bara Bwiliza) and University of Minnesota (Hanagreeef).
1-20-89	Morning Dep. 12:30 hrs Arr. 14:45 hrs	Met with SESU/MSU project in Kigale (Loveridge); traveled from Kigale to Kampala; briefing by USAID (Agard/Lyvers); and met with CIAT bean researchers (Wortmann/Grisley)
1-21-89	All Day (Uganda)	Visited Kawanda research station with Wortmann to see CIAT bean network program and research facilities; traveled to Makerere University Farm at Kabanyolo to observe the rehabilitation of that facility (Kasenge/Simmons)
1-22-89	Sunday (Uganda)	Holiday - Studied reports
1-23-89	All Day	Meeting with USAID (Lyvers/Agard/Lucas); visited Namulonge Research Station to meet with national root crops program (Mwanga) participating with the IITA Root Crops Network. Afternoon meetings were held at Makerere University with the Makerere Institute of Social Research (Mudola); and with the Dean of Faculty of Agriculture (Mugerwa) and his heads of departments.
1-24-89	Morning Dep. 15:30 hrs Arr. 17:00 hrs	Kampala: briefing with the USAID Director (Podol); meeting with the National Potato Research and Development Program affiliated with CIP (Akimanzi) and the AFRENA (agroforestry) representative located at Kabale and affiliated with ICRAF; and had a luncheon meeting with MOA officials in Entebbe (Mukiibi/Mugerwa/Fenster). Departed Entebbe for Nairobi at 3:30 p.m.
1-25-89	All Day	Visited the Plant Quarantine Station at Muguga (Okioga) partially supported by CIP. Met with the National Potato Research Center and CIP Potato Breeder (Njoroge/Kidanemariam) and with the

CIMMyT-II On-Farm Training Network
Coordinator (Anandajaya Sekaram) in
the evening.

1-26-89	All Day (Kenya)	Traveled to Mbita Point, the ICIPE Field Station on Lake Victoria (Saxena) and the on-farm development at Oyugis with ICIPE researchers, including meetings with three small farmers collaborating with ICIPE in practicing recommended (low purchased inputs) maize/beans agronomy. Returned to Nairobi by air in the evening
1-27-89	All Day (Kenya) Dep. 23.25 hrs	Visited the ICRAF Field Station at Machakos (Rao/Kurira) to observe agroforestry plots. Held meeting with REDSO for debriefing with the Director (Shah/McColaugh) in the afternoon. Departed Nairobi for the U.S. at midnight.
1-28-89	Arr. 21:30 hrs	Travel to US via Amsterdam, London, Orlando
2-6/10-89	All Day (5)	Florida: Study documents and preparation of report
2-9-89	Dep. 6:30 Arr. 10:00	Travel: Clermont, Fla. to Washington to attend a review and planning meeting on SAARFA evaluation
2-10-89	All Day	Washington, D.C. attending a review and planning meeting on SAARFA evaluation
2-11-89	Dep. 7:40 Arr. 11:00	Travel: Washington, D.C. to Florida
2-13/14-89	All Day (2)	Florida: Preparation of report
2-22-89	Two Hours	Dakar, Senegal: Discussions on Mangrove swamps rice with Dr. E. R. Terry - DG of WARDA
<u>Est</u> 3/21-23/89	All Day (3)	Florida and/or Washington - reviewing reports and wrap-up meeting.

Estimated days worked: 32 - 35

Annex D
PRINCIPAL CONTACTS INTERVIEWED
DURING
SAARFA EVALUATION TRAVELS IN AFRICA

(K. O. Rachie and R. Newberg)

KENYA

USAID

Monica Sinding	-	Evaluation Officer	-	REDSO/ESA
Satish Shah	-	Acting Director	-	REDSO/ESA
Robert McColaugh	-	Chief, Agricultural Div.	-	REDSO/ESA
David Gibson	-	Reg. Forestry Advisor	-	REDSO/ESA
Robert Edwards	-	Development Officer	-	REDSO/ESA
L. A. Arao	-	Development Officer	-	REDSO/ESA
Hudson Masambu	-	Project Manager	-	SAARFA/REDSO/ESA
J. C. Sentz	-	Agriculture Liaison Officer	-	IITA/USDA/USAID

KENYA NATIONAL PROGRAMS

W. W. Wapakala	-	Director of Research	-	KARI
J. B. Matata	-	Asst. Director	-	KARI
R. Milikau	-	Biometrician	-	KARI
D. Okioga	-	Director, Plant Quar. Sta.	-	KARI
Isaiah Njoroge	-	Director, Potato Res. Ctr., Kigoni	-	
G. M. Karanja	-	Agronomist, Reg. Res. Ctr., Kisii	-	
S. N. Maobe	-	Agronomist, Reg. Res. Ctr., Embu	-	

IARC NETWORKS

P. Anandajayasekaram	-	Regional Economist	-	CIMMYT-II
F. Palmer	-	Maize Agronomist	-	CIMMYT
R. A. Kirkly	-	Bean Regional Coordinator	-	CIAT
S. Nganga	-	Potato Regional Coordinator	-	CIP
H. M. Kidanemariam	-	Regional Potato Breeder	-	CIP
M. N. Alvarez	-	Root Crops Regional Coord.	-	IITA
K. N. Saxena	-	Leader, Plant Res/Insects	-	ICIPE-MP
K. V. Seshu Reddy	-	Applied Ecology	-	ICIPE-MP
M. O. Odindo	-	Biological Control	-	ICIPE-MP
P. M. Arrumm	-	Protocol Officer	-	ICIPE-N
L. Ngode	-	Ext. Proj. Leader	-	ICIPE-Oyugis
Mama Murita	-	Farmer, Oyugis	-	ICIPE, proj.
Mathayo Rapemo	-	Farmer, Oyugis	-	ICIPE, proj.
M. R. Rao	-	Researcher	-	ICRAF, Machakos
Peter Kurira	-	Farm Manager	-	ICRAF Station at Machakos

RAWANDA

USAID

J. A. Graham	-	Director	-	USAID (Kigale)
P. R. Crawford	-	ADO/USAID	-	(Kigale)
Valens Ndoreyho	-	Agriculture Project Officer	-	USAID
Paul Hanagreeff	-	U of Minnesota/U of Rwanda	-	(Bukare)

RUHENGARI (Potato Center)

Jeroen P. Kloos - Coordinator - PRAPAC/CIP
Tegera Pierre - Director of PNAP/ISAR

RWERERE (Agroforestry)

James R. Burleigh - Leader/Plant Pathologist, U of Arkansas
Val Eylands - Agronomist U of Arkansas
Charles F. Yamoch - Soils Scientist U of Arkansas
Serigne N'diaye - Rural Sociologist U of Arkansas

RUBONO/BUKARE

Leopold Gahamanyi - Director of ISAR
Runyinya Bara Bwiliza - Dean, FA Natl. Univ. Rwanda

SESA/MSU - Kigale

Scott Loueridge - Food Security Project, Mich. St. Univ.

UGANDA

USAID

Richard Podol - Director, USAID Mission
Ken Lyvers - ADO/USAID, Kampala
Al Aberg - Agriculture/USAID
Ernesto Lucas - Agriculture/USAID

KAWANDA RESEARCH STATION - BEANS

Charles S. Wortmann - Bean Agronomist, CIAT
William Grisley - Bean Regional Economist, CIAT

KABANYOLO FARM (MAKERERE UNIVERSITY)

Valentine Kasenge - Farm Manager, Kabanyolo
Ch. Simmons - Manpower for Ag. Dev. (MFAD), USAID

NAMULONGE RESEARCH STATION (ROOT CROPS/MAIZE PROGRAM)

Robert Mwanga - Plant Breeder-Root Crops, NARO
Ruth Kabanyoro - Maize Agronomist, NARO
J. J. Hakiza - Leader, Maize Program, NARO
Gadi Gumiseriza - Grain Legume Program, NARO

MAKERERE UNIVERSITY

Don M. Mudola - Prof. of Political Science, MISR
W. Kisamba - Mugerwa - Sr. Research Fellow, MISR
John Mugerwa - Dean, Faculty of Agriculture
Julius Zaki - Prof. and Head, Soil Science
Trevor Arcscott - Chief of Party, MFAD/USAID

NATIONAL AGRICULTURE RESEARCH ORGANIZATION

John Mukiibi - Secretary for Agriculture, NARO (Entebbe)
John Okorio - Research Officer, AFRENA/ICRAF
Deo R. Akimanzi-Potato Research/Development, NARO (Entebbe)
William Fenster-Research Advisor, MFAD/USAID

SOME EXTRANEEOUS NOTES ON SAARFA EVALUATION:
 A Primary Constraint To The Technology Process -
 The National Agriculture Extension Services

Translating research advances into on-farm improvements is difficult at best given the prevailing compartmentalization of key elements of the technology process especially research and extension. Extension services in many LDC's seldom function effectively in technology diffusion nor are they adequately equipped to do so. Moreover, the NAES often act as a buffer between researchers and the farmer - a situation many scientists all too readily accept. Therefore, it is surprising when technology is designed specifically for farmer use and actually diffuses through the barrier. Further aspects of this problems are discussed below.

A. The Problem With NAES:

1. Buffer researcher contact with farmers
2. Almost universally ineffective in disseminating technology in LDC's.
 - a. Lack of good technology to extend
 - b. Lack of budget and facilities (esp. transport)
 - c. Burdened with other duties

B. Possible Solutions:

1. Reorganize part of NAES along commodity lines
2. Vertically integrate research/validation/diffusion (re. commercial seed companies)
3. Provide farmer-to-farmer incentives to multiply transfer of technology components
4. Eschew the cavalier attitude toward farmers by the research/extension/political establishment (eg. farmer determines which technology components he wants)
5. Strengthen the seed industry and input distribution networks
6. Ensure final testing of technology components over entire growing region (perhaps 10 to 100 x at present)

C. Intranational Network Model - A Discussion:

The ultimate model of effective networking would be to utilize these principles at the national level - that is in close concert with its' ultimate client, the farmer. Until there is complete integration of the three major phases of development (technology, generation, validation, and diffusion) and researchers come into intimate contact with farmers and their problems, progress will be unnecessarily slow. Recognizing this persisting impediment several interesting new models are being explored, such as: (i) the ICIPE on farm validation project at Oyugis, Kenya; (ii) minikit trials of cowpea varieties and practices in Senegal (bean/cowpea CRSP/USAID/UCR), and (iii) commercial seed industry in the Western Hemisphere, Europe and Asia. It is suggested that a successful, intranational, vertically

integrated commodity network have the following attitudes and functional characteristics:

- (1) Assume that individual farmers are both rational and motivated by a complexity of factors. In any event, they have full autonomy to accept or reject technology, and sometimes for undetermined reasons. It further assumes that farmers do not have to be convinced to accept good, useful technology, but will subscribe eagerly once they see its benefits.
- (2) Agriculture technology is more likely to be evolutionary than revolutionary - especially on rainfed areas and in stressful situations. That is, progress occurs in incremental steps and more deliberately over time. Nevertheless, breakthroughs are possible especially when unusual events occur (such as drought, change in economic conditions, presence of devastating diseases or pests), if the research "lucks out".
- (3) Technology generation is directly focused on real farm problems, and is carried out in close concert with farmers/clients. This approach necessitates much more on-farm testing than at present to better represent the agro-ecological conditions being served, and a broader range of farmer's conditions and requirements. These tests need not be complex, but can be as simple as plus and minus effects. It is further suggested that simple validation trials can, if widely replicated, even replace demonstrations. This will also raise the "plane of expectations and participation" to the more-interesting and dynamic level of experimentation and innovation rather than the routine with demonstration which everyone is familiar.
- (4) Vertical integration of the technology process including all aspects of generation, validation and diffusion in such a way as to ensure relevance of the research and continual feedback from growers needed to fine tune the design. In this way the ultimate client (the farmer) can participate in all phases of the process including on farm testing. It is further suggested that farmers can participate directly in carrying out simple trials on other farms, if properly trained and given incentive. Moreover, they will also find it profitable to distribute improved seeds, planting stocks and animal breeds, especially if networks of commercial input suppliers have not yet become established.
- (5) There are at least two models for final validation trials and diffusion of technology:
 - (i) Nucleus estate or "mother farm" which is strategically located and willing to

serve a number of nearby smaller farms. Perhaps it already services other inputs and purchases produce from its neighbors. On-farm trials can be conducted, seeds increased and distributed from this "mother farm".

- (ii) Farmer-to-farmer networks or "pyramids" in which farmers are trained and provided incentives to carry out simple trials on their neighbors fields. This scheme will accomplish the distribution of improved genetic materials, but usually not other inputs (equipment, tools, fertilizers, pesticides).

It can be concluded that the technology process from generation to diffusion is highly inefficient as currently practiced. However, weakness in the system are recognized and new models are beginning to emerge. These may be improved further if suitable opportunities arise in countries or "regions ready for change". Ultimately, such new models could benefit most from emulating the best features of commercial seed companies in developed countries. What is needed is the courage to change and support for experimenting with these models in small holder production systems.

SOME EXTRANEIOUS NOTES ON SAARFA EVALUATION:
Proposed Study on "The Impact of Technology on
Agriculture in Africa"

A continuing concern of administrators is ensuring long-term support for the technology process in Africa as a consequence of the prevailing notion that technology has had little or no impact on agriculture in the continent, and particularly on the improvement of food crops, and production by small farmers. This misconception is exacerbated by the lack of reliable production statistics and/or continuing documentation of the impact of technology in different regions, areas and systems. One possible approach to this problem is outlined below.

A. Justification:

1. Justify resources expended/committed.
2. Focus public concerns and interest in African problems.
3. Help coordinate donor support.
4. Establish a baseline for future study and evaluation.
5. Change/modify attitudes and thinking of administrators, researchers and developers (eg. need to begin immediately in assessing impact of technology).

B. Some Proposals on an Impact Study:

1. Organize a World Conference for about 10 to 14 days, not less than 2 years nor more than 5 years from initial planning date (eg. 1992-95).
2. Seek participation by all national governments (tropical Africa) and donors of record in the collection of information and costs.
3. Designate an independent organization (contractor) to do detailed planning, organizing, assembling information, carrying out the logistics, and publishing.
4. Provide support to improve the data base (official production statistics) through verification techniques like:
 - a. Independent experiences and judgement of knowledgeable persons:
 - Government officials
 - NARS researchers
 - Marketing groups
 - International networking coordinators
 - Statistics departments
 - b. Independent production/yield sampling (eg. MSU/SESU project).
 - c. Food consumption sampling.
 - d. Landstat mapping data.
 - e. Combinations of the above.

C. Commission Topical Papers for Advance Preparation: *

1. Two parts:
 - a. Part I: pre-independence with focus on cash/export crops to the early 1960's (broad summary)
 - b. Part II: early 1960's up to the present with primary focus on food crop research
2. Structure conference in three sections:
 - a. Section A: papers on specific commodities and problem areas
 - Food grains: maize, sorghum/millet rice
 - Root crops: potatoes, cassava, sweet potatoes, yams, bananas
 - Grain legumes: cowpeas, beans, pigeon peas, others
 - Horticulture and other crops
 - Animal science: large ruminants, small ruminants, poultry, swine, other
 - Fisheries and aquaculture
 - Animal health
 - b. Section B: consolidation/over view papers: *
 - Synthesis of materials presented in Section "A" and broad conclusions:
 - + cash/export commodities
 - + food grains/root crops
 - + legumes/horticultural crops
 - + animal production/health
 - + fisheries/aquaculture
 - Neglected crops and future needs
 - Demographic trends
 - Priority areas and prospects for the future
 - Investments needed to make the required changes
 - c. Section C: study groups on recommendations for the future.
3. The Product:
 - a. Proceedings to be published in two volumes.
 - b. Newsletter on the progress of technology (2-4 x per year)
 - c. VCR tapes on problem areas and technology breakthroughs.
 - d. Other communications.
4. Plan a second international conference after 10 years.

* NOTE: It is widely acknowledged that productivity levels have declined over much of tropical Africa as a consequence of degradation of the resource base: eg. increased pressure on the land, increasing cultivation of marginal lands, shortening the fallow period, rapid rise in cost/unavailability of inputs and rapid build up of pests and diseases in more intensively cropped areas. Therefore, due attention must be given not only to measurable improvement in yield levels; but also to those technologies responsible for slowing the production decline, to developments contributing to the efficiency of production-especially when manual or animal draft cultivation methods are used, and especially when technology breakthroughs allow intervention of catastrophes. Examples of the latter

include: (i) discovery and rapid (air) dispersion of the parasite controlling the disastrous cassava mealy bug; (ii) streak-resistant maize varieties and (iii) multiple disease/pest resistances of rice, wheat, cowpea and other crops.