THE FOOD GRAIN PRODUCTION TECHNOLOGY VERIFICATION PROJECT

PROJECT PROPOSAL (1997/99)

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I. PROJECTS HIGHLIGHTS

The technology verification project was initiated in 1990, through the financial assistance of the African Development Bank, to improve functional linkages between researchers and extension agents, as well as to narrow the yield gap between on-station and on-farm trials. The ultimate aim being to improve the level of yield increases on farmers' fields. Project activities have been carried out in Burkina Faso, Cameroon, Ghana, Mali, Niger, Nigeria, Senegal and Togo.

Over 32 technological options were evaluated in nearly 110 villages. Between 1990/92, the number of farmers who participated in the management of on-farm verification trials did increase from 400 to 1200. In the past three years, the number of farmers with access to demonstration trials, although varied from one country to another, more than 200,000 were exposed to the on-farm verification trials.

In Burkina Faso, on-farm verification trials were conducted in 12 regional agropastoral extension development zones. The results 1990/92 of on-farm trials enabled farmers to identify three new cowpea cultivars namely, KVx396-4-4, KVx61-1, and KVx30-309-66. Furthermore, the 1993/94 trials introduced three promising cowpea cultivars. The adoption of and the preference for these cowpea cultivars have been due to their attributes of good seed quality, high yield, earliness and for the production of fodder. Recognizing that the production of cowpea is almost impossible without insect pest control, a minimum level of insecticide spray schedule for the major ecological zones in Burkina was determined. For example, in the high insect pressure zone (including Central and Eastern zones), there was yield advantage (over unsprayed fields) from 68 to 133% for single and two insecticide sprays, respectively. In the low insect pressure zone(including Southern and Sahelian zones), the yield advantage (over usprayed yields) was 73 and 119% for single and two insecticide sprays, respectively. Studies without insecticide spray in 1993/94 also identified some promising cultivars.

The adoption of new cowpea cultivars by farmers is limited due to insect pests damage and lack of seed supply. The project, however, increased seed and made available to several thousand farmers during the last four years.

For lowland savanna zone in Northern Cameroon, improved agronomic packages (i.e., improved varieties, fertilizer, plant population, etc.) were developed for early and extra-early maize cultivars. Through the project assistance, two suitable early maturing maize cultivars namely, DMR-ESRY and Pool-16 DR-SR were released. These maize cultivars have short maturity cycle (90-95 days) and potential yield of 4 to 6.5 t/ha. These varieties are appreciated by farmers due to their earliness and for use as "green maize" (within 65 days from planting) during the hunger period, before sorghum and millet harvest. For market gardeners, the sale of green maize has also become a source of income.

Seeds of the above varieties were increased and distributed to more than 1500 farmers. The yield advantage of improved agronomic packages over traditional farming practice was about 40% more grain yield (1.3 tons/ha).

In Northern Ghana, various cropping systems were evaluated. For example in Bimbilla district, involving ten villages and 35 farmers, the grain yields of maize and groundnut under alley cropping system (including cereals/pigeonpea), increased by 188 and 54%, respectively, than traditional farmers'practices. Under favourable moisture conditions, in the Bimbilla district, alley cropping with pigeonpea (combined with cereal-legume rotation) sustained soil fertility and, thereby, crop productivity in the area. This will in turn reduce the need to clear virgin lands each year, an ecologicaly dangerous practice. In good rainfall years, both mounds and ridges impart good physical characteristics to the soil, which makes crops responsive to the application of phosphorous. Under poor rainfall conditions, mounds still improve crop yields. Cereal-legume rotation has been shown to improve crop yields by at least 30% over continuous cropping, due to its effect in maintaining soil fertility. Double cropping of legumes and cereals should be encouraged since this practice was shown to improve farmers' production without expanding the area under cultivation in the same year, especially in areas with well defined rainfall patterns.

In Mali, suitable maize varieties of high yeield potential were identified. These include: EV8422-SR (110-120 days), DMR-ESR-Y, early maturing (80-90 days), and extra-early cultivars TZEF-Y and TZESRW (< 70 days). In 1991 and 1992, these cultivars were compared to the local maize variety with similar cycles in farmers'fields in three different recommendation zones (South, West and Centre). EV8422-SR confirmed its yield superiority over Tiémantié and Tuxpeno n° 1, already released in this zone. The variety 22SR is streak resistant, whereas Tiémantié and Tuxpeno are susceptible, resulting in

reducing yields due this disease. DMR-ESR-Y confirmed its good yield performnce across the years and adaptation zones. This cultivar is very suitable for use as "green maize" because of its preferred taste and acceptance. TZEF-Y, on the other hand, is highly appreciated by farmers because of its earliness, particularly in zones of drought stress (3).

In Niger, the results of verification trials showed that:

- *The yield response of sorghum and millet to phosphate and nitrogen fertilizers was positive. Yield of these crops on farmers'fields both with local and improved cultivars either doubled or tripled.*

- *Intercropping of millet and sorghum or legume could also improve the productivity per unit area by 50 to 75%.*

In the Gaya region, millet/sorghum intercropping is a system which enables farmers to obtain not only two cereals productions, but also much fodder for their livestock. Two years of trials have revealed that yields of millet could be increased by, at least, 50% through slight modifications of the traditional agronomic practices.

In Nigeria, the project area covered the Sokoto, Kebbi, Katsina, Kaduna, Jigawa and Bachui States. The major cropping practices are Sorghum/millet/cowpea or Maize/cowpea mixtures. The verification trials comprised of improved cowpea variety SAMPEA-7, sorghum variety KSV8, and millet variety SE13, and in Yando-area gave yield (tons/ha) of 2.5 for sorghum 2.2 for millet and 1.3 for cowpea, respectively. These yields were 6-8 times higher than those recorded in Zogarawa area, leading to greater economic returns in Yandoto. However, the yield advantage of improved varieties over local cultivars was much higher in Zogarawa regiona than in Yandoto area. A total of 41 farmers participated in the operation in Yandoto (high rainfall, animal traction) and Zogarawa (low rainfall, manual cultivation) areas. Nitrogen application of 75 kg/ha increased maize yield (C.V. TZBSRW) from 545 to 3710 kg/ha. Further increase of nitrogen more or less depressed the yield of the crop. Maize also responded positively to phosphorus fertilization up to 40 kg/h P205 where yield improved from 2747 (without P) to 3160 kg/ha (with P application). Increased potassium (K) level up to 60 kg/ha K20, in fact decreased yield of maize from 3155 to 2890 kg/ha. In general, N application on cowpea depressed grain yield substantially. There was positive response to phosphorus application where cowpea yield improved from 386 (without P) to 508 kg/ha (with 80 kg/ha P205). Application of K only increased cowpea grain size.

In Senegal, the millet variety Souna-3 was compared to farmers'local variety under improved agronomic practices. With the addition of 2 t/ha of farm manure to a half dose of the recommended fertilizr rate, IBV8004, gave a yield of 988 kg/ha, 14% more than the full recommended rate of commercial fertilizer. The yield increase over traditional practice has been by more than 160%. With 5 t/ha,of farm manure and same level of mineral fertilizer application, the yield of Souna-3 was 159% more than that from traditional farming practice. The application of 2 t/ha farm manure alone produced 618 kg/ha for improved millet cultivars IBV8004 and 889 kg/ha for Souna-3 with 67% and 32% increase, respectively, over the traditional farming practice.

In Senegal millet-based cropping systems were evaluated in several regions. In Kaolack region, both yield and economic analysis revealed benefits from sole cropping of Souna-3, whereas-intercropping with cowpea (1:1 ratio) gave better results in Fatick region. In Diourbel and Thies regions, intercropping millet variety IBV8004 with cowpea variety Ndiambour (1:2 ratio) was more profitable than sole cropping. Several new cowpea varieties were evaluated under farmer management in 6 villages in the Northern and Southern ecologies of Central Senegal where cowpea is widely grown. Results indicated that the best adapted introductions were varieties IS86-275 (Mouride) and B89-504 (Melakh) with average yields of 552 kg/ha and 864 kg/ha, respectively.

In Togo, two improved sorghum varieties, Framida and Malisor 84-1, were grown in sol culture or in association with cowpea variety KVx 396-4-4 with fertilizer application of 100 kg/ha NPK (15:15:15) and 50 kg/ha urea. Under monoculture, sorghum produced 954 kg/ha, which was only 12% more than its performance when cultivated in association with cowpea. In contrast, sole cultivation of cowpea increased its yield three fold over mixed-cropping. Economic analysis of the mixed cropping systems showed revenue of 89,131 FCFA/ha, about 5% less profitability than cowpea sole cultivation. Sorghum cultivation alone (monoculture) generated a revenue of 62,462 FCFA/ha. Based on the results of the on-farm verification trials, mixed cropping with sorghum and cowpea varieties mentioned above is recommended to ensure food-security and generation of income at household level. In the cereal/legume mixed cropping system, suitable combination of early maturing cowpea cultivars such as KVx 396-4-4; and early to medium maturing sorghum cultivars i.e., Framida, and Malisor-84-1 red and white seeded, respectively, were identified.

Since 1990, four agronomic annual planning and review workshops were organized, where researchers from participating countries, regional and international research and development organizations exchanged technical information and experiences related to on-farm research and technology adoption. Furthermore, consultants were fielded, every other year to assess the implementation of project activities.

II. PROJECT PROPOSAL

By the year 2025, the population of Sub-Saharan Africa (SSA) is expected to reach about 1.3 billion. There will be nearly 800 million additional people to feed. Technology transfer systems in many countries failed to live up to expectations in transforming research results to level of food production to keep pace with population growth. Furthermore, rapid population growth has put pressure to resource base and land uses in SSA.

In the past three decades, on-farm research (OFR) has put more emphasis on the diagnosis of constraints to agricultural production, design and developing FSR methodology, while neglecting farmers' participative verification of technologies to transform research results into extension recommendation and production. As discussed earlier, this project did enhancce the delivery of a number of technological options to farmers in the eight participating countries. Lessons of the project experience in the past four years indicated that identification of suitable varieties of maize, sorghum, millet, cowpea, groundnut, etc. by itself could not substantially increase yield, unless the fertility of the soil is improved through building up of organic matter and legume-based cropping systems is established and appropriate water conservation agronomic practices are utilized.

Furthermore, the purchase of inputs, such as fertilizer has become beyond the resources of farmers due to renoval of subsides.

The goal of the project are to narrow the 'yield gap' of the performance of technologies between on-station and farmers' field; to enhance the development of sustainable agricultural production systems and to facilitate the participation of farmers (men and women) in the evaluation, transfer and adoption of food grain production technologies.

2.1. Objectives

The rational of the project is that efficient technology transfer by experiment station agronomists working with extension agronomists and farmers' would yield positive returns in terms of sustainable increases in food production and major improvements in the life styles of rural households. The project, thus, encompasses a "research-extension interphase" activities. The main objectives, of the project are:

- *To promote on-farm and on-station verification trials and thereby identify suitable technologies that could enhance production of food grains;*

- *To facilitate the delivery of technology options that could minimize risks of food grain production;*

- *To intensify food grain production through build-up of organic matter and legume-based cropping systems;*

- *To improve on-farm research skills and farmers practice to consequently enhance the transformation of research results into extension recommendation and production;*

- *To facilitate the exchange of technical information among researchers and extension workers through occasional workshops and field-level demonstrations.*

2.2. Technology Evaluation

The project focus would be to enhance the verification of suitable high yielding varieties and agronomic practices to enhance the production of maize, sorghum, millet, cowpea, groundnut, etc. in participating countries. Emphasis will also be made building-up of soil fertility through cereal/legume association/rotation, with particular reference to replenishing nitrogen and phosphorus; to enhance crop residue and compost management and judicious use of commercial fertilizers; to employ tied ridges and mulching based agronomic practices to minimize risk to drought stress and conserve soil moisture and depress weed growth and to introduce improved tillage practices, since the modification of the physical properties of the soil would improve yield. The on-going technology verification project activities in each participating countries would be further reviewed to

include the above mentioned technical components. Project activities of participating countries is outlined in Appendix 1.

2.3. Training/Seminars/Workshops

Short-term training, seminars and workshops lasting few days to few weeks will be organized in collaboration with national and international research and development organizations. Some of these activities include:

(i) Farmers-Extension-Research Networks Workshop

The workshop will involve farmers, extension agents, NGOs, and researchers from participating countries. The main objective of the workshop are:

- *To address on-farm technical and institutional issues affecting technology transfer and adoption;*
- *To facilitate exchange of experiences among farmers including success stories and failures of agricultural production;*
- *To establish dynamic linkages between stakeholders (such as bringing together farmers, researchers, extension agents, NGOs, policy makers to maximize the utilization of on-farm resources and address issues of the performance of adopted food grain production technologies.*

(ii) Improving Scientific and Technical Communication between and among Researchers, Extension Agents and Farmers.

The training will be developed to improve technical skills in communication between and among reserchers, extension workers and farmers. The main objectives of the course are:

- *To enhance the analysis and technical data interpolation of on-farm research results;*
- *To improve skills in scientific writing so that of the relevant information would be available to researchers and extension agents;*

- *To synthesize and document available technological options in order to facilitate the preparation of crops or livestock production guidelines; and*

- *To eventually enhance the preparation of technical leafets (also in local language) for farmers use.*

Participants

Initially, researchers and extension agents who have completed university education and worked for some years. The candidate for the course would be largely researchers and extension agents from project participating countries and institutions. The course would be organized in collaboration with NARS, IARCs and Universities.

The course would be organized by September/October 1997.

(iii) Annual Project Review and Planning Workshop

First, critical review of the on-farm trials results on the performance of technologies, seed production and farmers training activities would be reviewed. Second, the plans for the following season are critically examined for technical feasibility, potential socio-economic benefits and prevention of environmental degradation. The participation of those extension agents involved in the project implementation and occasionaly some farmers would be attending. The next programme review is scheduled to take place by April, 1997. Researchers, extension agronomists, annual and external consultants regularly participate in the annual review and planning workshop.

2.4. Expected Project Output:

i) To speed up the process for delivery of suitable crop production technologies to resource poor farmers in semi-arid regions;

ii) To strengthen technical linkages and feedback between on-station and on-farm extension research;

iii) *To improve on-farm verification skills and methods in order to enable participating national programmes evaluate and adopt technologies under their environmental and socio-economic conditions;*

iv) *To facilitate farmers' participation in the evaluation of technologies;*

v) *To enhance the development of sustainable agricultural production.*

The 1997/98 proposal is summarized in Table 1. The project proposal also calls for strengthening on-farm verification of food grain production technologies, in six new countries. New proposed project activities are in Chad, Côte d'Ivoire, Benin, Gambia, Mauritania and Guinea Conakry. About 74% of the budget allocation is proposed to national support to strengthen on-farm verification activities and to improve technical skills and for multiplication of technologies. Project supervision and overhead cost is about 12%, whereas budget allocations for travel and publication amounted to less than 4%. A total budget of $534,800 (five hundred thirty four thousand and eight hundred dollars) isproposed for 1997/98 to enhance on-farm agronomic verification trials in fourteen countries of West and central Africa. The 1998/99 budget proposal US$514,640 has slighty reduced activities in training and workshops.

Table 1. Summary of Budget Proposal 1997/99

	ACTIVITY	YEAR		
		1997/98	1998/99	TOTAL
1.0.	On-going eight countries technology verification project support.	180.500	181.500	362.000
2.0.	New projects-6 countries	96.000	103.000	199.000
3.0.	Annual project review and planning workshop	30.000	35.000	65.000
4.0.	Training	65.000	50.000	115.000
5.0.	Seminar/workshops	56.000	40.000	96.000
6.0.	Field-level project evaluation	12.000	12.000	24.000
7.0.	Technical Assistant	15.000	15.000	30.000
8.0.	Publication	13.000	13.000	26.000
9.0.	Travel	10.000	10.000	20.000
	TOTAL	477.500	459.500	937.000
10.0.	Project supervision overhead 12%	57.300	55.140	112.440
11.0.	GRAND TOTAL	534.800	514.640	1.049.440

Appendix 1. Food Grain Production Verification Project Activities.

Country	Project Emphasis
Burkina Faso	(1) Verification of cowpea production technologies: (i) Identification of suitable cultivars for mono and mixed cropping systems for the three agro-ecological zones; (ii) Determination of minimum level or no-insecticide treatment for cowpea production at on-farm level; (iii) Farmers and technicians training; and (iv) Seed increase of improved cowpea cultivars for farmers use. (2) Identification of maize cultivars suitable for the Sudano-Sahelian zones: (i) Evaluation of early and extra-early maize cultivars; (ii) Establishment of maize/legume-based cropping systems; and (iii) Seed increase of improved maize cultivars for distribution to farmers.
Cameroon Northern Region	Project activities include: (i) The development of agronomic packages for the production of early and extra-early maize cultivars; (ii) The establishment of cereal/legume-based cropping systems; seed increase of improved maize cultivars and (iii) Verification trials to identify high yielding sorghum and cowpea cultivars.
Northern Ghana	(i) Cereal/legume rotation systems; (ii) On-farm verification trials to identify high yield cultivars of sorghum, maize and cowpea; and (iii) Community seed production of above mentioned improved cultivars.
Mali	(i) Identification of suitable maize cultivars for South, West and Central regions; (ii) On-farm verification trials of cowpea to identify more productive technologies; and (iii) Training of technicians and farmers.
Niger	(i) Evaluation of improved packages of agronomic practices to enhance the productivity of millet based cropping systems; (ii) Evaluation of improved cowpea cultivars adapted for Sudano-Sahelian zones and (iii) Seed production of improved cowpea cultivars for farmers use.

Appendix 1. Continued.

Country	Project Emphasis
Nigeria	(i) On-farm trials to improve the production of sorghum, cowpea/and millet mixed cropping systems; (ii) On-farm evaluation of early and extra-early maize cultivars in low-rainfall areas; (iii) Cereal/legume-based cropping systems for semi-arid regions of Northern Nigeria and (iv) Training of farmers.
Senegal	(i) Increasing the productivity of millet based cropping systems; (ii) The effect of organic manure and mineral fertilizer on the yield of millet, groundnut, and cowpeas, (iii) Identification of suitable cultivars and improved agronomic practices to increase cowpea production and to develop storage technologies at on-farm level; and (iv) Training of farmers.
Togo	On-farm verification trials are carried out in Kara and savanna zones. (i) Verification of improved agronomic practices to enhance the productivity of sorghum/cowpea mixed cropping systems; (ii) Cereal/legume-based crops systems; and (iii) Identification of suitable cowpea and maize cultivars for Kara and savanna zones.
New country level project proposal (1995/97)	
Côte d'Ivoire	(i) The development of improved agronomic practices for the production of early and extra-early maize cultivars in Northern Guinea Savanna zone; (ii) Cereal/legume-based cropping systems and; (iii) Training of extension agents and farmers.
Benin	(i) On-farm verification trials to develop improved agronomic practices to increase the yield of maize, sorghum, and cowpea and; (ii) Cereal/legume-based cropping systems to enhance sustainable food grain production.

Appendix 1. Continued.

Country	Project Emphasis
Mauritania	(i) Improving the productivity of millet-based cropping systems; (ii) On-farm evaluation of early and extra-early maize cultivars (under irrigation and on residual moisture); and; (iii) Cereal/legume-based cropping systems for sustainable food grain production.
Gambia	(i) On-station and on-farm verification trials of elite maize, sorghum and cowpea cultivars; and cereal/legume-based cropping systems for sustainable food grain production.
Guinea-Conakry	(i) On-station and on-farm verification trials of elite maize, cowpea and sorghum cultivars; (ii) Cereal/legume based cropping systems for sustainable food grain production and; (iii) Training of research technicians and extension agents.
Chad	(i) On-farm verification trials to develop more productive technologies of sorghum millet and cowpea in Sudano-Sahelian zone; (ii) On-farm verification trials to identify early and extra-early maize cultivars adapted to Sudanian zone; and; (iii) Training of technicians and extension agents.

III. INSTITUTIONAL SETTING

In response to the devastating effects of the drought experience, especially in semi-arid Africa in the mid-1970s, and the urgent need for a concerted regional effort, African Heads of State and Government created SAFGRAD in 1977, following the resolution (Resolution 505 XXIX) adopted by the 1976 OAU Council of Ministers in St. Louis, Mauritius.

SAFGRAD initially started out with 18 member countries. This number soon increased to 26 to include the following OAU Member States in West, Central, East and Southern Africa:

Benin, Botswana, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Côte d'Ivoire, Ethiopia, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda and Zambia.

Organization and Management

As a research coordination unit of OAU, SAFGRAD derives its policy guidance, legal entity and administrative services from the OAU through the Scientific, Technical and Research Commission (STRC).

The felt need to involve more African scientists in decision-making and to develop indigenous manpower to assume greater leadership in directing and managing agricultural research, led, since 1987, to the establishment of the Council of National Agricultural Research Directors of SAFGRAD member countries. The Council meets biennially to review SAFGRAD activities and to provide policy guidance on technical matters.

A seven-member Oversight Committee serves as the management board of SAFGRAD. It is directly responsible to the Council of National Directors. It oversees the administrative, technical and financial affairs of the SAFGRAD Coordination Office and evaluates the performance of SAFGRAD activities. The Committee comprises eminent scientists, research managers and members of Agricultural Faculties of African Universities drawn from West, Central, East and Southern Africa.

The SAFGRAD Coordination Office, located in Ouagadougou, Burkina Faso, carries out the day-to-day activities of SAFGRAD, while serving as the secretariat from which policies and recommendations of the Council of National Directors and the Oversight Committee are implemented.

Major Objectives

The main focus of SAFGRAD has been to improve the quality and quantity of major food grains (sorghum, maize, millet and cowpeas), as well as to improve the resource base for productive agriculture in the semi-arid regions of sub-Saharan Africa. SAFGRAD's main objectives are to:

a. *coordinate agricultural research activities among Member States in order to avoid unnecessary duplication of efforts and to mobilize resources to foster dynamic inter-African research cooperation at regional and sub-regional levels;*

b. *promote and facilitate the dissemination and exchange of improved germplasm and technical information through regional trials, workshops, symposia and monitoring tours;*

c. *strengthen national agricultural research programmes through shorrt and long-term training, with special attention being given to enhancing indigenous research capabilities of member states;*

d. *promote the dissemination and transfer of technologies adapted to small poor resource farmers and also to strengthen institutional links between research and extension;*

e. *enhance integrated farming systems development.*

1997-01

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