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**TECHNICAL WORKING GROUP REPORT
ON
REVIEW AND PLANNING OF FOOD GRAIN PRODUCTION
TECHNOLOGY VERIFICATION PROJECT
(29-31 MAY, 1991)**

Ouagadougou, Burkina Faso

Supported Through the Financial Assistance of the African
Development Bank

SEMI-ARID FOOD GRAIN RESEARCH AND DEVELOPMENT

SAFGRAD COORDINATION OFFICE
01 B.P. 1783 Ouagadougou 01
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CONTENTS

I. OPENING SESSION

- 1.1. Attendance
- 1.2. Opening Remarks by International Coordinator of SAFGRAD
- 1.3. Purpose and Objectives of Food Grain Production Technology Verification Project
 - 1.3.1. Discussion of paper Given by SAFGRAD Director of Research

II. REVIEW OF 1990 ON-STATION AND ON-FARM VERIFICATION TRIALS IN VARIOUS COUNTRIES

- 2.1. Report on Sub-project Activities in Cameroon
- 2.2. Report on Sub-project Activities in Senegal
- 2.3. Report on Sub-project Activities in Burkina Faso
- 2.4. Report on Sub-project Activities in Niger
- 2.5. Report on Sub-project Activities in Togo
- 2.6. Report on Sub-project Activities in Ghana
- 2.7. Report on Sub-project Activities in Mali
- 2.8. Report on Sub-project Activities in Nigeria

III. PLANNING SESSION

- 3.1. Standardization of Verification Trials
- 3.2. On-Station Agronomic Verification Trials
- 3.3. On-Farm Verification Trials
- 3.4. Seed Production
- 3.5. Periods When Trials can be Visited by Consultants in 1991
- 3.6. Deadline for Submission of 1991 Mid-year Reports
- 3.7. Annual Reports

IV. CLOSING SESSION

- Appendix 1. Purpose and objectives of Food Grain Production Technology Verification Project
- Appendix 2.1. Report on Food Grain Production Technology Verification Trials in Burkina Faso in 1990

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Burkina Faso

- Appendix 2.2. Report on Food Grain Production Technology Verification Trials in Cameroon in 1990
- Appendix 2.3. Report on Food Grain Production Technology Verification Trials in Northern Ghana in 1990
- Appendix 2.4. Report on Food Grain production Technology Verification Trials in Mali in 1990
- Appendix 2.5. Report on Food Grain Production Technology Verification Trials in Niger in 1990
- Appendix 2.6. Report on Food Grain Production Technology Verification Trials in Nigeria in 1990
- Appendix 2.7. Report on Food Grain Production Technology Verification Trials in Senegal in 1990
- Appendix 2.8. Report on Food Grain production Technology Verification Trials in Togo in 1990
- Appendix 3. List of participants at Meeting of Review and planning Technical Working Group on Food Grain Production Technology Verification Project held in Ouagadougou, Burkina Faso, May 29-31, 1991.

REPORT OF THE MEETING OF TECHNICAL WORKING GROUP ON FOOD
GRAIN PRODUCTION VERIFICATION PROJECT HELD IN SAFGRAD
COORDINATION OFFICE, OUAGADOUGOU, BURKINA FASO,
MAY 29-31, 1991

I. OPENING SESSION

1.1. Attendance

The meeting was attended by collaborating scientists from all the eight participating countries (Burkina Faso, Cameroon, Ghana, Mali, Niger, Nigeria, Senegal and Togo). The meeting, coordinated by SAFGRAD Director of Research, was also attended by other officials of SAFGRAD Coordination Office (SCO) Ouagadougou, one SAFGRAD Network Coordinator, and a NARS scientist who served as resource person. The names of these various participants are given in Appendix 3.

1.2. Opening Remarks by the International Coordinator of
SAFGRAD

The International Coordinator of SAFGRAD, Dr. Joseph M. Menyonga, welcomed participants to Ouagadougou in general and to the SCO in particular. He urged them to execute their respective sub-projects diligently, since their work could serve as the bridge between research on the one hand and extension services/technology adoption on the other. While wishing participants fruitful

deliberations, the International Coordinator used the opportunity to inform them that a SAFGRAD Donors' meeting is scheduled for July 29-31 in Ouagadougou and that one of the USAID Evaluators of SAFGRAD II was at that time visiting the sub-region; he hoped that the Evaluator would find time to interact with participants later that week.

1.3. Purpose and Objectives of the Food Grain Production Technology Verification Project

This was presented as a written paper by the SAFGRAD Director of Research, Dr. Taye Bezuneh (see Appendix 1 for full text of the paper).

The purpose of the Project, which is funded by the African Development Bank (ADB), is to accelerate the process of moving food production technologies beyond the fences of agricultural research stations. The major emphasis is to narrow the "yield gap" or the difference in performance of technology between research station and on-farm trials.

The specific objectives of the Project include the following:

- (i) to intensify food grain production through application of improved technology packages;

- (ii) to promote on-farm and on-station technology verification trials with a view to identifying suitable technologies that would enhance food grain production;
- (iii) to forge functional linkage between research and extension aimed at narrowing the gap between yields of on-station trials and those of on-farm trials;
- (iv) to facilitate the delivery of technology options that would minimize risks of crop failure due to environmental and socio-economic constraints; and
- (v) to improve on-farm research skills to enhance transformation of research results into extension recommendations aimed at increased food grain production.

Dr. Taye Bezuneh then reminded participants about the major decisions they made during their inaugural meeting in February 1990, with respect to the management of agronomic trials of the Project. Furthermore, he summarized very briefly the main activities of each of the nine sub-projects funded by the ADB.

Finally, the Director of Research outlined the tasks to be accomplished by the Working Group during the meeting. These included:

- (i) to review the 1990 results of on-station and on-farm verification trials;
- (ii) to discuss certain matters related to the verification trials, including especially how to:
 - (a) narrow the gap between yields of on-station and on-farm trials;
 - (b) develop strong links between research and extension through agronomic research;
 - (c) standardize on-farm verification trials; and
 - (d) determine the optimum duration of on-farm and on-station verification trials.

1.3.1. Discussion of the paper given by SAFGRAD Director of Research

The paper was discussed at length by the participants who unanimously congratulated Dr. Taye Bezuneh for his excellent paper. The following points emerged from the discussions:

- (a) The funding agency for the Project, the African Development Bank, attaches great importance to this type of work that could eventually result in enhancement of the socio-economic status of the African peasant farmer.
- (b) The importance of harmonious, functional, collaborative

linkage between research, extension services and the farmers was reaffirmed. It was agreed that an important yard-stick for measuring success of research is the level of adoption of improved technologies by the farmers. In this respect, participants gladly noted the existence of workable collaboration between researchers, extension agents and farmers in Burkina Faso.

- (c) With respect to the duration of on-station and on-farm trials, it was noted that it is difficult to be dogmatic on the issues, especially as different technologies are being evaluated in various countries. However, it was agreed that any one technological package should be tested for 2 or 3 years: where necessary, one year would be required for on-station validation of technology while 2 years would be needed for on-farm verification of the technology.
- (d) With regard to production of good quality seeds, it was agreed that researchers must ensure that they produce adequate quantity and quality of seeds for their trials (both on-station and on-farm). Wherever possible, the farmer should be encouraged to produce his own seeds of good quality provided that he takes special precautions in producing seeds of crops like maize. Given the magnitude and complexity of the whole question of seed

production at national levels, and noting that great difference exist in policies of respective national governments on the matter, the participants agreed that it was futile to go into further discussion of the subject.

II. REVIEW OF 1990 ON-STATION AND ON-FARM VERIFICATION TRIALS IN VARIOUS COUNTRIES.

To review the progress made in different countries towards the execution of the Project, reports were presented by participating scientists from the eight countries. These reports are listed below in the order in which they were presented during the meeting. Only the major highlights of the reports, as noted by the rapporteurs, are presented.

In Appendix 2, the objectives of the various sub-projects and the major findings only are summarized; these have been extracted from the written reports of participating scientists.

2.1. Report on Sub-project Activities in Cameroon.

The report was presented by Mr. M.T. Nga Ngoumou. His report dwelt on their studies of cultural practices (e.g. rate and timing of N fertilizer application, optimum plant populations, land preparation methods, weed control methods) required for optimum

production of early and extra-early maturity maize varieties in various ecologies in Cameroon.

(i) Timing of N Fertilizer Application. Application of N as topdressing 20-25 days after emergence gave the highest grain yields of early and extra-early maturing maize varieties. However, in soils of high clay or humus content, topdressing with N could be delayed to 25-30 days after emergence.

(ii) Plant Population Studies. Although there were differences between grain yields of plots planted at 80 x 25 cm and those planted at 80 x 20 cm, it was considered advisable to plant at the higher plant density in order to compensate for loss of plants by lodging or insect damage.

(iii) N x Plant Population Studies. The results suggested that the highest grain yields of early and extra-early maize varieties were obtained when they were planted at 80 x 20 cm and given N fertilization at the rate of 90-125 kg N/ha.

(iv) Weed control. Good weed control in early and extra-early maize was obtained either by two hoe-weedings (at 2 and 4-5 weeks after sowing) or by pre-emergence herbicide

application followed by one hoe-weeding at 4 weeks after sowing.

In answer to a question, Mr. Ngoumou explained that extension agents assisted the farmers in setting up trials that appeared complicated. But it was agreed that farmer-managed, on-farm trials should ideally not be complicated so that they would be truly farmer-managed.

2.2. Report on Sub-project Activities in Senegal

There were two reports from Senegal.

2.2.1. Report by Saliou Diangar.

Mr. Diangar presented results of two trials.

- a) Comparison of two improved millet varieties and improved cultural techniques with the local farmer's variety and farmers' traditional cultural techniques: The two new varieties have been selected on the basis of their zone of adaptability: variety Souna 3 in the Central South and IBV 8004 in the Central North.

Six farmers were involved in the study. Generally, the varieties grown with improved cultural techniques gave

better yields. However, the local variety also gave substantial yields when grown with improved cultural techniques.

- b) Millet/Cowpea intercropping trial: This trial was conducted on-station in off season and in the rainy season. The millet variety Souna 3 and the cowpea variety Bambey 21 were used. Under irrigated conditions, intercropped millet appeared to be more productive than sole crop millet while yields of millet under the two systems were similar during the rainy season.

2.2.2. Report by Samba Thiaw.

Mr. Samba Thiaw presented report of the work done by Ndiaga Cisse to compare the performance of a cowpea variety IS86-275 with 3 varieties: 58-57, Ndiambour and Bambey 21. Five villages were involved, representing 25 farmers in 4 administrative regions. The overall yields were low. It was reported that 1990 was a particularly dry one and pests attacks were severe. However, the recommendations on density, phytosanitary treatments and storage in tanks were highly appreciated by farmers that took part in the trial.

The new variety IS 86-275 (resistant to bruchids, mosaic virus

and bacterial blight) was the highest yielder across the sites.

2.3. Report on Sub-Project Activities in Burkina Faso

Mr. Jeremy Ouedraogo started his report by presenting their methodology for conducting on-farm trials. This involves holding planning meetings with the Research/Development Office leaders of the 12 Regional Agropastoral Development Centers. These officers are the links with farmers. In 1990, 197 sites were established in order to assess the performance of three new varieties: KVx 61-1, TVx 3236 and KVx 396-4-4. These new varieties were compared with checks which were either KN-1 or Gorom (improved varieties already released) or some other local varieties. The second objective was to determine the zones (if any) in cowpea growing areas where insecticide application would not be needed for producing high-yielding varieties of cowpea. In spite of climatic (rainfall deficit, sand blast) and biotic (insect pests, diseases, Striga) constraints, which depressed yields in some cases, the overall results were satisfactory. Although after one year of trials, a reliable conclusion cannot be drawn, KVx 396-4-4 appeared to be the most promising variety accross the ecological zones. The data obtained from insecticide evaluation suggested that in some Western and Northern zones it is not indispensable to apply insecticide in order to produce a good crop of cowpea.

The impact of trials was so positive that this year (1991) 535

farmers have already received seeds to conduct trials.

2.4. Report on Sub-project Activities in Niger

There were two reports on the activities of the Project in Niger.

2.4.1. Report by Mr. Maman Nouri.

Mr. Nouri reported on the results of millet/sorghum intercropping trials in Sudan savanna zone of Niger.

Five intercropping practices were tested on station (at Tara) and on-farm (at Sokondji Birni):

- Traditional practice
- Traditional practice with fertilizer application
- Improved package of practices without fertilizer
- Improved package of practices with phosphate fertilizer
- Complete set of improved practices.

From the data obtained, it was concluded that optimum yields of sorghum or millet could be obtained by use of optimum plant populations and application of fertilizers (20 kg P₂₀₅ + 46 kg N per ha).

Millet/sorghum intercropping increased production per unit

area by 50 to 75%, on-station as well as on-farm.

2.4.2. Report by Oumarou Cherif Ari.

Mr. Ari reported on their work in millet/cowpea intercropping. The objective was to verify on-farm in three villages three millet/cowpea intercropping strategies developed on-station. In effect the trials failed; for example cowpea produced zero grain yield in all sites. The failure of the trial was attributed to the lack of follow up by the officer in charge of the project implementation.

The failure of the trial caused a lengthy debate since the causes could not be explained by the scientist. It was suggested that in future the trial should be monitored closely to identify causes of crop failure so that these could be given adequate research attention, provided the failure is not caused by avoidable human error/negligence.

2.5. Report of Sub-project Activities in Togo

The report on on-farm and on-station sorghum/cowpea intercropping trials was presented by Mr. Toky Payaro. The study involved intercropping the sorghum variety, Framida, and the cowpea variety, KVx 396-4-4, at various population densities.

Results revealed little depressive effect of cowpea on sorghum yields. Framida sorghum gave a good yield in Striga infested plots. Economically, sorghum/cowpea intercropping was more profitable than sole crop sorghum in the North and as profitable as sole crop cowpea in the South.

It was recommended to test maize/cowpea intercropping, in view of the limited acceptability of Framida sorghum for human consumption in Togo.

2.6. Report of Sub-project Activities in Ghana

The report was presented by Mr. L.O. Tetebo. Five different types of trials were reported:

(i) Maize, groundnut, sorghum/pigeon pea intercropping

Yields of maize were fairly satisfactory but the varieties tested in the intercropping with pigeon pea did not express their potentials.

(ii) Effect of phosphate fertilization under different land preparation systems on maize yields

Two phosphorus rates (0, 20 kg/ha P205) were combined with three land preparation systems:

- Planting on flat seedbed.
- Planting on ridges
- Planting on double ridges

Maize on double ridges with 20 kg/ha P205 gave the best yields.

(iii) Study of the feasibility of a third crop of millet crop in the sorghum/cowpea system

Sorghum was planted on the top of the ridges, cowpea at half way up the ridges and millet between the ridges. Yields were nil for sorghum and millet because of poor germination. There was no significant difference between cowpea yields.

(iv) Rotation of cereal/maize, cereal/sorghum intercropping with a legume (groundnut).

In maize/sorghum intercropping, maize gave the highest yield. Being in the first year, the trial has not provided data for drawing conclusion on the effect of the rotation.

(v) Sorghum/cowpea relay cropping.

Sorghum yields were nil because of poor germination. The cowpea variety Vallenga gave the best yields.

Participants mostly commented on the need to better orientate the research activities conducted in Ghana within the framework of the objectives of the Project to allow for judicious use of the funds allocated.

2.7. Report of Sub-project Activities in Mali

The report on maize variety adaptation trials for different ecological zones was presented by Mr. N'Tji Coulibaly. Three variety trials for maize of different maturity periods were conducted in five stations:

- At Sotuba and Kita stations, 13 early varieties were tested. The variety DMR.ESR-Y (which has several desirable characteristics such as high grain yields, earliness, resistance to mildew and to streak) will be included in on-farm trials in 1991.
- At Massantola and Katibougou: 13 extra-early varieties were evaluated. The varieties TZEY-Y and Early Comp. have a good levels of resistance to drought and will be

compared during next season with a local check in on-station and on-farm trials.

- At Sotuba and Longorola: 10 medium maturing varieties were tested. The variety EV 8422 SR is being recommended for release.

2.8. Report on Sub-project Activities in Nigeria

The report on three trials conducted in 1990 by Dr. K. Elemo and Dr. O.O. Olufajo was presented by Dr. Elemo.

- (i) On-station agronomic testing of appropriate variety for sorghum/millet/cowpea mixture.

The on station aspect of the testing of appropriate variety for sorghum/millet/cowpea mixture was concluded in 1990 season. Farmer's cowpea variety outyielded Kano 1696 and IT84S-2246-4, but produced grain yields that were statistically similar to those of Sampea 7. Cowpeas grown with KSV8 sorghum variety outyielded those cultivated under local farafara variety. No effect of millet variety on cowpea grain yield was, however, detected. Nevertheless, KSV8 sorghum outyielded farafara, while the grain yields of SE 13 millet and local Zango were not significantly different.

This trial is being taken on-farm in the 1991 season. The locations will be at Yandoto in Sokoto State, Malumfashi in Katsina State and Makarfi in Kaduna State – the first two locations being in the Sudan Savana and the last location in the northern Guinea Savana.

At each location, 20 farmers shall be selected to test KSV8 sorghum, SE-13 millet and Sampea 7 cowpea with their respective traditional varieties on plot sizes of about 0.2 ha per farmer. The trials will be farmer managed but the researcher will protect the cowpeas with insecticide and collect agronomic and socio-economic data.

(ii) On-station agronomic testing of improved varieties in maize/cowpea mixed cropping system

Maize varieties TZBSR (open-pollinating) and Ag-Kaduna (hybrid variety) were tested with four cowpea cultivars (IAR 339-1, Kano 1696, Sampea 7 and farmer's variety) in mixture on-station. The hybrid variety outyielded the open-pollinating variety in both sole and mixed crops. Grain yield of maize was not affected by cowpea, but maize significantly depressed cowpea yield by as much as 80%. None of the improved cowpea cultivars outyielded the local variety. This trial will continue for another

year on-station.

(iii) On-station agronomic testing of appropriate NPK fertilization for maize/cowpea mixture

Four levels of nitrogen (0, 75, 150 and 225 kg N/ha) using calcium ammonium nitrate as source, three levels of phosphorus (0, 40 and 80 kg P₂₀₅/ha) using single superphosphate as source were tested with two levels of potassium (0 and 60 kg K₂₀/ha) using muriate of potash as source, in all possible combinations on-station in maize (TZBSR) and cowpea (farmers variety) mixture. Maize grain yield in the mixture increased with N up to 75 kg N/ha while cowpea yield was consistently depressed by nitrogen application. For P, maize responded up to 40 kg P₂₀₅/ha while cowpea responded up to 80 kg P₂₀₅/ha. Neither maize nor cowpea significantly responded to K. The trial will be executed for another year on-station.

III. PLANNING SESSION

During the Planning Session participants agreed on the following issues as indicated below.

3.1. Standardization of Verification Trials

That since different technologies and varieties are being

tested in both on-station and on-farm verification trials, it may be difficult to standardize these trials with respect to the size of plots, treatments, number of sites, etc. However, the most important issue is that the designs for such trials should be simple with the minimum levels of factors so as to facilitate easy adoption of the innovations by farmers.

3.2. On-Station Agronomic Verification Trials

Members accepted the suggestion that since most of these technologies might have been tested extensively in the past at the on station, verification of their adaptability on the station before proceeding to on farm tests should not exceed a period of one year.

3.3. On-Farm Verification Trials

Members reached the consensus that since this project is a medium for introducing new technologies to farmers, with the strong participation of extension agencies, the assessment of each technology on the farm should not exceed a period of 2 years. Thus after this period, the researcher should be in a position to make available some new technologies for further on-farm testing. It was further agreed that after this 2-year period of assessment on on-farm, an interim report should be provided, which could constitute a phase of the project, for evaluation before further

funding could be asked for.

Members also agreed that using the inventory of available technologies provided by each country during the 1990 Planning Session held at Ouagadougou, a meeting at 1992 could use this document to assess the progress that has so far been made.

3.4. Seed production

It was accepted by members that each participant should make efforts within the available budget to produce adequate good quality seeds to meet their demands for their various on-farm testing activities. However, taking advantage of the resource of experienced personnel in their respective seed industries must not be over-ruled, as a means to achieve the above objective.

Participants, however, noted the possibility of private farmers participating in the various national seed production programs, to help overcome the problems of inadequate availability of good quality seeds for farmers in the various countries.

3.5. Periods When Trials can be Visited by Consultants in 1991.

The participating scientists informed the meeting about the best periods their trials would be in good conditions to be visited

by consultants during the 1991 rainy season. The suggested periods are given below.

<u>Country</u>	<u>Best period for consultant's visit</u>
Burkina Faso	Third week of September
Cameroon	No suggestion; Mr. Ngoumou left for home earlier
Ghana	3rd or 4th week of August
Mali	Last week of August to First Week of September
Niger	(i) Nouri's trial: 1st-2nd week of September. (ii) Ari's trial: 1st week of Sept.
Nigeria	Last wk of August to 1st Wk fo Sept.
Senegal	First or Second wk of Sept.
Togo	First wk of September

3.6. Deadline for Submission of 1991 Mid-year Reports

The participating scientists unanimously agreed that their respective mid-year reports should reach the Director of Research not later than October 15, 1991. It was agreed that participants should follow the format used by the Director of Research in the 1990 Mid-year Report.

3.7. Annual Reports

It was agreed that annual reports should be submitted to the Director of Research several weeks before the 1992 annual meeting. The scientists agreed that the annual meeting should be held before the commencement of the cropping season. In this regard, the scientists requested the Director of Research to convene the 1992 Annual Meeting some time from the last 10 days of March to the first 10 days of April.

IV. CLOSING SESSION

In his closing remarks the International Coordinator of SAFGRAD again emphasized the necessity for researchers to find means to ensure that their technologies reach the farmer, the ultimate beneficiaries of research efforts. He also urged participants to ensure full accountability of all funds given to them by the Project; this is one sure way of retaining donors' confidence and continued funding. Finally, the International Coordinator noted that the 3-day meeting took place without the services of simultaneous translators. He was pleased with the development and he urged scientists to make special efforts to acquire working knowledge of both French and English.

Appendix 1.

Purpose and Objectives of the Food Grain Production Technology Verification Project

By Taye Bezuneh *

Introduction

The foremost concern in sub-Saharan Africa countries is attaining food self-sufficiency and security. This calls for adoption of improved agricultural practices capable of accelerating food production in these countries.

Much has been written on the technical and institutional problems that continue to hamper the application of research results by African farmers. Over the last three decades, changes in agricultural technology in Africa in general and in semi-arid regions in particular have been very slow, with the exception of few crops in few countries. In fact, the production of food grain and other crops has either stagnated or declined in many countries, a situation that has been of serious concerns to both governments and donors. Some of the issues are related to agricultural policies of many countries; these countries devote less than 10% of

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their national budgets to agriculture which accounts for more than 50% of their gross domestic products, employment and foreign exchange earnings (5).

It is not intended to elaborate here the causes of inadequate agricultural production in sub-Saharan Africa, except to mention some of the inherent, interlinked problems. These include lack of motivation and incentives to farmers, extension agents and researchers coupled with limited access of technology to farmers due to ineffective linkage between research, on one hand, and extension and farmers on the other. In some instances, however, the technologies that farmers need simply do not exist. Where available, these technologies are often unprofitable, considering not only the meagre resources that farmers have to invest, but also the prevailing prices of inputs and of produce. How can one overcome this cycle of low production? Ideally, relevant research should lead to the development of appropriate technology that could fit into existing farming systems by minimizing risk and by meeting farmers objectives, while taking into consideration their economic resources (1,2).

Purpose of the Project

The purpose of this project is to accelerate the process of moving technology beyond the fences of agricultural experiment stations. This project encompasses "a research-extension inter-

phase" activity. The major emphasis is to narrow the "yield gap" or the difference in performance of technologies between research station and on-farm trials. In this regard, the agronomist is expected to play a key role by working very closely with breeders, soil-fertility and management scientists, plant protection specialists, etc., and concurrently liaise with extension agronomists for FSR field level activities. On-station verification trials need to focus on the testing of improved agronomic practices as well as on the identification of promising technologies. On-farm trials are expected to be simple in design, comprising few treatments, and to demonstrate to farmers the benefits of the technologies under consideration. These activities need to be carried out in close collaboration with extension agents and farmers.

Objectives of the Project

The main objectives of the project are:

- i) to intensify the production of food grains through application of improved packages of technology;
- ii) to promote on-farm and on-station technology verification trials and, thereby, identify suitable technologies that could enhance production of food grains;

- iii) to forge functional linkages between research agronomists and extension agents, in order to narrow the yield gap between on-station and on-farm food grain production;
- iv) to facilitate the delivery of technology options that would minimize risks of crop failures due to environmental and socio-economic constraints; and
- v) to improve on-farm research skills and, consequently, enhance the transformation of research results into extension recommendations aimed at increased production of food grains.

With regard to the management of agronomic trials, the 1990 Planning Workshop had agreed on the following (3,4):

- i) The need to integrate the production of food crops with that of cash crops, such as cotton, in order to enhance both technical and economic complementarities.
- ii) That on-farm verification trials should be simple, the main purpose being to demonstrate improved agronomic practices to farmers, i.e. the fewer the treatments in the trial, the more likely it is that farmers would adopt the technology.
- iii) The need for quality seed production.

- iv) That conventional research methods of replicated trials for on-station verification should be employed, with major emphasis on finished research results or promising technologies.

Project Activities

Initially, an Agronomic Planning Workshop was held from 19 to 22 February 1990, in Ouagadougou, Burkina Faso, to assess the status of improved crop cultivation practices in semi-arid areas of West and Central Africa. Some of the important results of the workshop were:

- (a) the identification of biotic and abiotic constraints to the production of food grains;
- (b) inventorization of available and potential technologies;
- (c) the exchange of technical information and experiences regarding the transformation of research results into extension recommendations and production packages; and
- (d) a review of proposals on on-farm verification trials.

Brief comments on the progress made towards the implementation of the Project in those countries that received financial assistance from the African Development Bank are given below (4).

In Burkina Faso, six improved cowpea varieties and certain agronomic practices were evaluated in crop associations and in mono-culture, using plant protection measures, in 13 districts in

collaboration with rural development centres and 120 farmers.

In Cameroon and Mali, the project emphasis has been to develop packages of improved agronomic practices for the adoption of early (80-90 days) and extra-early (75-80 days) maturing maize cultivars in the Sudan and Sudano-Sahelian zones. These short cycle maize varieties have drought tolerance characteristics which could enable the expansion of maize production in semi-arid zones with the possibility of filling gaps of food shortages (for green maize available within 65 days of planting) two to three months before the harvest of sorghum and millet.

In Senegal, the production of an improved cowpea variety (IS-86-275) was promoted in five villages since it has been accepted by farmers. The second sub-project support in Senegal aims at development of suitable production techniques for millet-based farming systems in three villages (Diourbel, Thies and Kaolack-Fatick). The on-farm trials included the evaluation of improved agronomic practices to maximize the yield of improved and local varieties of millet and cowpea.

In Ghana, on-farm verification trials were conducted in Birmilla district where fallow land (5-15 years) is still affordable. This practice has virtually disappeared in Wa and Nadowli districts due to population pressure on the land. The packages of technology being studied include cereal/cereal association with minimum doses of fertilizer; cereal/legume rotation; and the

promotion of improved cowpea varieties with seed characteristics acceptable to farmers.

In Nigeria, various technological options to enhance the performance and acceptability of improved varieties of sorghum, maize, millet and cowpea under different land preparation techniques, planting methods and fertility levels were evaluated.

In Niger, technology verification trials were conducted in three villages in the Maradi area, namely Kagadama, Tajaye and Takalmawa with 200, 150 and 450 families, respectively. Some cowpea and millet varieties were evaluated, with basal application of fertilizer, under different agronomic practices. The second sub-project in Niger is in Gaya area in Sokondii Birini village (in the Sudanian zone) involving close to 2000 farm families. Some agronomic practices were evaluated to develop appropriate inter-cropping (sorghum/millet/cowpea; millet/groundnut) systems as well as relay cropping systems, in combination with the application of minimum doses of inorganic fertilizer.

Task for the Working Group

The working group has the following three important tasks:

- a) to review the 1990 results of on-station and on-farm verification trials;
- b) to consider plans for the 1991 verification trials; and

- c) to discuss certain matters related to the verification trials including especially how to:
 - i) narrow the gap between yields of on-station and on-farm trials;
 - ii) develop strong links between research and extension through agronomic research;
 - iii) standardize on-farm verification trials; and
 - iv) determine the optimum duration for on-station and on-farm verification of any one set of production technologies.

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Appendix 2.1.

Report on Food Grain Production Technology Verification Trials in Burkina Faso in 1990.

(Sub-project executed by Jeremy T. Ouedraogo and Clementine Dabire)

Objectives: The trials had two main objectives: (i) to evaluate (under farmers' management practices) the performance of three new varieties (KVx 61-I, KVx 396-4-4 and TVx 3236) and that of two check varieties (KN-1 and Gorom) which have already been released for cultivation by farmers in Burkina Faso; and (ii) to evaluate minimum insecticide spray in different parts of the country to determine those areas (if any) where insecticide protection of cowpea is not required.

Results of Trial to Compare Performance of New and Already Released Cowpea Varieties.

The varieties were evaluated in 197 farms located in 11 administrative provinces of Burkina Faso. Results were obtained from 169 of these farmers, representing 86% success.

In the Sahel Province, Gorom was the check variety and the farmers chose to grow their varieties in monoculture. Gorom outyielded significantly the three new varieties among which KVx 61-1 yielded significantly lower than TVx 3236 and KVx 396-4-4, the yields of the latter two varieties not being significantly

different. There were significant difference among the total yields obtained by the seven farmers.

In North Province, KN-1 was included as a test variety (to evaluate its performance for fodder production). The varieties were grown in mixture with either sorghum or millet. KN-1 produced only 72% of the grain yield of the local variety which was outyielded by TVx 3236, KVx 396-4-4 and KVx 61-1 by 73%, 71% and 56% respectively. KVx 394-4-4 produced the largest quantity of fodder but it was closely followed by KN-1, TVx 3236, KVx 61-1 and the local variety, in that order. The cereals mixed with KVx 61-1 and TVx 3236 produced 53% more grains than those under the local variety while those under KVx 396-4-4 produced 45% more grains.

In Mouhoun Province, KN-1 was the check variety and varieties were grown in mixture with sorghum. The new varieties outyielded KN-1; KVx 396-4-4 outyielded it by 27%, compared to 13% and 12% respectively for KVx 61-1 and TVx 3236. The yields of sorghum when grown in mixture with TVx 3236, KVx 61-1, and KVx 396-4-4 were 72%, 90% and 134% of its yield when grown in mixture with KN-1.

In Central Province (mean annual rainfall = 700 mm), only TVx 3236 and KVx 396-4-4 were evaluated together with the local check. The average yields of KVx 396-4-4 and TVx 3236 were 891 and 606 kg/ha compared to 555 kg/ha produced by the local check.

In West-Central Province (average annual rainfall = 800 mm) the yields of KVx 396-4-4, TVx 3236 and KN-1 were not significantly different but only KVx 396-4-4 significantly outyielded the local check.

In East-Central Province (mean annual rainfall = 900 mm), KVx 396-4-4 and KN-1 produced significantly more grain yield than TVx 3236 (severely damaged by Striga) and the local variety. In fact, KVx 396-4-4 produced 210% more grain yield than the local check.

In South-Central province (annual rainfall = 700-900 mm) the local variety was outyielded significantly by KVx 396-4-4, KVx 61-1 and KN-1; however the yields of TVx 3236 and the local variety were not significantly different.

In North-Central Province, KVx 396-4-4 and KVx 61-1 outyielded the local variety by 73% and 52%, respectively.

In Hauts Bassins province (annual rainfall = 800 mm), the three improved varieties tested (KVx 396-4-4, TVx 3236 and KN-1) did not differ significantly with respect to their grain yields, but all of the three varieties yielded significantly more than the local variety which produce a mean grain yield of 440 kg/ha.

Results from the West-Central province showed again that the grain yields of TVx 3236 (706 kg/ha), KN-1 (703 kg/ha) and KVx 396-

4-4 (667 kg/ha) were not significantly different from each other while all three varieties out-yielded the local variety which produced a mean grain yield of 495 kg/ha.

Report of the Trial to Determine the Zones that Require
Insecticide Application for the Control Insect Pests of
Cowpea.

The tests were conducted in farmers' plots in the Sahel, East Central, Mouhoun and Hauts Bassins Provinces. In each village, 5-10 farms were used.

In the Sahel, the yields of the sprayed plots varied from 361 kg/ha for Pobe Mengao village to 2361 kg/ha for Bani village; while the yield of the sprayed plots varied from 528 kg/ha for Pobe Mengao village to 3653 kg/ha for Bani village. Thus, the additional grain yield due to insecticide application varied from 167 kg/ha for Pobe Mengao village to 1292 kg/ha for Bani village.

In Hauts Bassins Province, only in one of the 13 sites was there no advantage from insecticide application, the grain yields of sprayed and unsprayed plots being 818 kg/ha and 816 kg/ha, respectively. In the other 12 sites (villages), the benefit from insecticidal spraying, expressed as a percentage of the yield of the non-sprayed plot varied from 3.4% for Sarkadiala village to 51% for Kourouma village. However, in seven of the 13 villages, the

yield advantage of the sprayed plots was less than 25% of the yield of the yield of the unsprayed plot.

Appendix 2.2.

Report on the Food Grain Production Technology Verification Trials in Cameroon.

(Sub-project executed by M.T. Nga Ngoumou, H.T. Talleyrand, C. The, M.A. Ebete Mbeng and M. Wabi Katsala).

Objectives: The currently recommended agronomic practices for cultivation of maize in Cameroon are based on the requirements of medium and late maturing varieties. However, to alleviate the constraints imposed by low and erratic rainfall in Cameroon, some promising early-maturing varieties (Pool 16 DR SR, and DMR-ESR-Y) and extra-early varieties (e.g. TZEY-Y) have been identified.

The objectives of the ADB-funded sub-project are: (i) to determine the appropriate rate and timing of Nitrogen fertilization for these varieties; (ii) to determine the optimum plant populations for the varieties; and (iii) to determine the weed management practices for the varieties.

Results: The 1990 cropping season in the savanna ecological zones of Cameroon was in general characterized by a below average (and insufficient), erratically distributed rainfall. Drought occurred at the end of the second decade of September and contributed to increased risk of crop failure, particularly in areas stretching from the isohyete 700 mm Northwards where moisture stress occurred at the milky stage of grain development. Results of the various

trials are very briefly presented below; the trials were conducted in seven locations.

Trial 1: Time of Application of N Fertilizer. The results obtained in 1990 showed that accross various locations, the highest yields were obtained when urea N was topdressed 20-25 days after plant emergence of early or extra-early maize. However the difference between treatments were not significant. These results suggest that N topdressing may be given earlier for early or extra-early maize than the present recommendation for medium or late maturing maize in which N top-dressing is given 30-35 days after emergence.

However it appears that on some relatively heavier soils or those with a relatively high humus content, delaying N topdressing up to 25-30 days after emergence may be preferable to application at 20-25 days after emergence.

Trial 2. Effect of Plant Population an early and extra-early Maize Varieties. The differences in grain yields of plots sown at different densities were not significant. In general, however, yields were highest at the highest plant population tested (80 x 20 cm). Even when no differences existed, it would be advisable to plant densely so that in case of stand reduction due to lodging or soil insect damage, plant population would still be high enough to give a satisfactory yield. Apparently yield advantage at the highest population was associated with higher number of ears. An

inter-plant spacing of 30 cm in all the cases appeared to be too wide. Further investigation would study the effect of number of plants per hill.

Trial 3. N X Population Interaction in Early and Extra-early Maize

Four rates of N (0, 45, 90 and 135 kg N/ha) were tested at three intra-row spacings (20, 25 and 30 cm), the inter-row spacing being 80 cm in all cases. In most trials early and extra-early maize variety yields responded significantly to increased N and higher population densities. The highest grain yields were obtained at 20 cm intrarow spacing and at N rates of 90-135 kg N per ha. Trials in Soucoundou and Bokle had high C.V.s that probably explain failure to detect significant differences between treatments at the two sites. The N X plant population density interactions were not significant.

Trial 4: Effect of Land Preparation Methods.

A early maturing maize variety, DMR-ESR-Y, was grown in plots given different cultivation treatments, namely: conventional tillage (i.e. ploughing and harrowing), combined with simple or tied ridges; chiselling; and no-tillage. Observations showed that plants grown in plots prepared by conventional tillage, be it combined with tied or simple ridges, yielded the highest, yields being 6.6 and 6.0 t/ha at Djalingo area for tied and simple ridges, respectively.

Trial 5: Weed Control in Early and Medium Maturing Maize.

The differential response of an early maize variety, DMR-ESR-Y, and a medium variety (CMS 8501) with regard to different times and types of weeding was evaluated in 1990.

For the early maize variety, two hoe-weedings at 2 and 4-5 weeks after emergence, or herbicide application (Lasso GD at 41/ha) at planting time followed by one hoe weeding at 4 weeks after emergence gave high yields. For the medium variety, hoe weeding at 3 weeks after emergence or two hoe weedings at 2 and 4-5 weeks after emergence appeared to be the most appropriate weed management practices.

Appendix 2.3.

Report on the Food Grain Production Technology Verification Trials in Northern Ghana in 1990.

(Sub-project Executed by L.O. Tetebo and K.O. Marfo).

The aim of the sub-project activities in northern Ghana is to adapt technologies, developed at the agricultural research stations, to farmers' needs and conditions in order to help them increase and sustain their crop yields. In 1990, with the help of SAFGRAD funds for on-farm verification activities, the team extended their work on alley cropping from just one village in the Bimbilla district to 10, the number of contact farmers increasing from 10 to 35. Also the funds facilitated commencement of on-farm studies on inorganic fertilizer use, cropping patterns and tillage practices in the Upper West region. However, due to severe drought last year, sorghum yields were very poor and there was a wide variation among yields in the fields managed by the farmers.

On the whole, five trials were executed in 1990. Only the objectives and highlights of the results are reported below.

Trial 1. The Effect of Two Different Cropping Practices for Maize, Groundnut and Sorghum in the Bimbilla District.

Objectives: (i) to compare the yields of maize, groundnut and sorghum in the alleys of pigeon peas (Cajanus cajan) with those of

the traditional practice; and (ii) to evaluate alley cropping under the farmers own management.

Results. In general, plant stand and densities varied greatly in farmers' fields, although the ratio of the component crops depended on the preferred crops of the farmer. Due to the low and varied densities of maize planted by the farmers, their yields were very low. For example, the grain yields of alley-cropped maize varied from 1626 kg/ha (in Nakpa village) to 2032 kg/ha (in Binda village) while those of maize in farmers' fields ranged from 293 kg/ha (in Nakpa village) to 852 kg/ha (in Dabole village).

Sorghum yields, however, presented a different picture. Being the preferred food crop, the densities planted were quite adequate, although very little fertilizer was applied. Since 1990 was the first year of the study, neither the effect of rotation nor that of alley cropping was expected and sorghum in the farmers' practice out-yielded that in the alley cropping.

There were no significant differences between groundnut yields in the two systems in four of the five villages, the exception being Juanayili village where groundnut grown under farmers' practice significantly out-yielded alley-cropped groundnut.

Trial 2: Phosphorus Fertilizer Test Under Three Different Tillage Practices in the Upper West Region.

Objectives: (i) to evaluate effect of P level on grain yield; (ii) to determine the best tillage practice for incorporating P in Upper West Region; and (iii) to determine the availability of residual P for succeeding crops.

Results: Sorghum planted two weeks after the maize suffered from drought soon after planting. Germination was poor, despite efforts to refill the gaps.

However, crops grown on mounds yielded significantly more than those planted on ridges or on the flat. Due to the low amounts of rainfall last year, the addition of phosphorus had no significant effect on grain yield of any of the crops.

Trial 3. Testing the Feasibility of a Third Crop in an Existing Sorghum-Cowpea Mixture.

Objective: To assess the biological and economic feasibility of a third crop in an existing sorghum/cowpea mixture.

Results: There was poor germination of both millet and sorghum probably because of unfavourable weather conditions in 1990.

Two improved varieties of the cowpeas were used. The results showed no significant difference in yield of cowpeas grown under three different systems.

Trial 4: Cereal-legume Rotation.

Objectives: (i) to demonstrate a compatible cereal-cereal mixture; (ii) to demonstrate rotational effects on soil fertility maintenance; and (iii) to demonstrate effect of rotation on weed control.

Results: As 1990 was the first year of the study, there could not have been any effects of the rotations being studied in 1990. Consequently, grain yields of all the crops under the different practices were not significantly different from each other.

Trial 5: Cowpea-Sorghum Relay Trial

Objectives: (i) to demonstrate double cropping of a short duration legume with early to medium maturity sorghum; (ii) to introduce white seed coat variety of cowpeas and test its performance under farmers' conditions in the Upper West Region; and (iii) to assess the economic productivity of the system under the farmers' conditions.

Results: Again germination of sorghum was poor. The brown seeded Vallenga variety cowpea appeared to be more drought tolerant than the white seeded IT81D-1137.

Flower abortion reduced the yield of IT81D-1137 significantly but, with the farmers' preference for white varieties, the yields were still acceptable.

Appendix 2.4.

Report on Food Grain Production Technology Verification Trials in Mali in 1990.

(Sub-project executed by N'Tji Coulibaly)

Objectives: The sub-project was designed for execution in two phases with the following objectives:

- (i) The first phase consists of testing maize varieties under the conditions that exist in research stations and sub-stations in the zones suitable for maize production.
- (ii) The second phase consists mostly of evaluation of varieties (selected in the first phase) and production technologies under farmers' conditions.

Results. Trials conducted in the research station and sub-stations in 1990 evaluated maize varieties of three different maturity periods, namely:

- (i) extra-early maturity varieties (less than 82 days to maturity);
- (ii) early maturity varieties (90-95 days to maturity); and
- (iii) intermediate maturity varieties (96-120 days to maturity).

The 13 extra-early maturity varieties were evaluated at two locations (Katibougou and Massantola). At Katibougou (total rainfall in 1990 = 762.4 mm in 76 days), the three highest yielders, in descending order, were Kogoni (1.7 t/ha), CSP Early (1.7 t/ha) and TZESRW x GUA 314 (1.6 t/ha). The lowest yielders were TZEE Yellow Pool (0.7 t/ha) and Pool 30 x GUA 314 BC1F3 (1.0 t/ha). At Massantola, (total rainfall in 1990 = 591.5 mm in 41 days), the three best yielders were Across 8131 X TES X LEF3 (3.9 t/ha), TZEE W2 (3.4 t/ha) and CSP Early (3.2. t/ha). The lowest yielders were TZEE W1 (1.9 t/ha) and Pool 27 x GUA 314 BC1F3 (2.0 t/ha).

One local check and 13 early maturity varieties were evaluated at Sotuba and Kita. At Sotuba (total rainfall in 1990 = 827.2 mm in 57 days), Dr. Comp. Early, TZE Comp 3X4 F3 and Kamb 88 Pool 16 DR gave the highest yields of 3.64, 3.33 and 3.17 t/ha, respectively. The Local Check (2.6 t/ha) and DMR-ESRY (2.77 t/ha) yielded lowest. At Kita (total rainfall in 1990 = 766 mm in 51 days), the top yielders were DMR-ESRW (4.8 t/ha), Across 87 Pool 16 SR (4.77 t/ha) and DMR-ESR Y (4.63 t/ha); the lowest yielders being Across 86 Pool 16 DR (2.4 t/ha) and Across 88 Pool 16 DR (3.03 t/ha).

Ten intermediate maturity varieties were evaluated at Longorola and Sotuba. The best yielders at Longorola (total rainfall in 1990 = 997.9 mm in 86 days) were DR Synt IITA (5.8 t/ha), EV 84-28 SR (5.7 t/ha) and EV 84 28 SR (5.7 t/ha), while

TZPB (4.0 t/ha) and Tiemantie (4.1 t/ha) yielded least. At Sotuba, DR Synt IITA (4.7 t/ha) again yielded highest, being followed by EV 84 22 SR (4.3 t/ha), EV 84 28 SR (4.2 t/ha), and Tiemantie (4.2 t/ha). The lowest yields at Sotuba were produced by ABELEEHI (3.6 t/ha), Across 86 TZUTSRY (3.6 t/ha), and EV 84 44 SR (3.6 t/ha).

Appendix 2.5.

Report on Food Grain Production Technology Verification Trials in Niger in 1990.

(Sub-projects executed by Maman Nouri and Oumarou Cherif Ari)

1. Report on Sub-project Executed by Maman Nouri

Objectives: (i) To evaluate the performance of millet/sorghum mixture under various technology options; and (ii) to conduct on-station and on-farm trials in order to understand the difficulties involved in the transfer of improved technologies to farmers.

Results: Of the various yield characteristics measured, only the grain yields are compared below. In all cases, sorghum and millet were grown as a mixture.

In on-station trials, the grain yields of improved millet variety, CIVT, (in mixture with improved millet variety) and those of local variety (in mixture with local millet variety) were not significantly different when they were grown under the unimproved, traditional management practices (i.e. without any fertilizer). Similar results were obtained under the above conditions with improved sorghum variety, BKC, and the local sorghum variety. When grown with full complement of improved management practices (timely planting, optimum plant density, application of NP) the improved varieties of both sorghum and millet outyielded the respective

local varieties. The yield of CIVT grown without N and P fertilization was significantly superior to that of the local variety but the yields of improved and local varieties of sorghum grown under these conditions were not significantly different from each other.

In the farmers' fields, the local variety of millet (in mixture with local variety of sorghum) significantly outyielded the improved millet variety (CIVT), grown in mixture with improved sorghum variety, when they were grown under unimproved traditional farmers' practice. By contrast, improved sorghum variety under the above management conditions outyielded significantly the local variety of sorghum. When the mixture was grown with full package of improved practices, the grain yield differences between the improved and local varieties of both millet and sorghum were not statistically significant. On the other hand, the yields of improved varieties of both millet and sorghum grown under improved management practices but with only P fertilization were significantly superior to those of the same varieties grown without application of any artificial fertilizer but under other improved agronomic practices.

2. Report of Sub-project Executed by Oumarou Cherif Ari.

Objectives: (i) to evaluate the technology options for the production of millet/cowpea mixture (analyse the problems encountered

with application of the technologies in the farmers fields); (ii) to evaluate the adaptabilities and the performance of the technologies; (iii) to familiarize the extension services with these technologies.

Results: The trials were conducted in four farmers fields in each of three villages in the Maradi area of Niger. For all treatments in all farms in the three villages, the cowpea grain yield was zero. The researchers could not explain these unusual results, especially as the cowpea variety used (TN 5-78) was sprayed twice with decis and is known to possess good resistance to Striga. The researcher, however, thought that the cowpea crop was subjected to end-of-season drought and to damage by aphids.

In the three villages, the highest yields of the millet component of the mixture was obtained when it was grown with full agronomic inputs. The traditional management practices of the farmers gave the lowest yields. Accross all locations, the average yields of the full complement of management practices and the farmers' management system were 521 and 224 kg/ha of millet grains; the intermediate management practice yielded 350 kg/ha.

Appendix 2.6.

Report of the Food Grain Production Technology Verification Trials in Nigeria in 1990.

(Sub-project executed by K.A. Elemo and O.O. Olufajo)

Three separate trials were conducted in 1990 in parts of northern Nigerian with funds provided by the Project. The results are summarized below.

Trial 1. On-station Agronomic Testing of Appropriate Varieties for Sorghum/Millet/Cowpea Mixture.

Objective. The main objective of this investigation is to compare the performance and acceptability of improved varieties of sorghum, millet and cowpea with those of the traditional, local varieties of farmers.

Results. The farmers' local variety of cowpea gave the highest grain yield which was, however, not significantly higher than that of SAMPEA 7, an improved variety developed by IAR. The two varieties significantly outyielded Kano 1696 and IT 84S-2246-4 which yielded the least. Cowpeas under KSV 8 yielded more than under Farafara. All interactions were significant. Sorghum cultivar KSV 8 yielded significantly more than the local cultivar, Farafara but main effects of cowpea and millet varieties on sorghum grain yield were not significant.

Yields of local millet cultivar, Zango were not significantly different from that of improved cultivar, SE 13.

Trial 2. On-station Agronomic Testing of Improved Varieties in Maize/Cowpea Mixed Cropping Systems.

Objective: The main objective was to compare the performance of traditional cowpea cultivars with that of improved varieties when grown in mixture with maize.

Results. In both sole and intercrops, hybrid maize variety, Ag. Kaduna, significantly outyielded the open-pollinated variety, TZB-SR. The grain yield of maize was not affected by the associated cowpea. In intercrops, neither maize nor cowpea varieties significantly affected 100-grain weight and ear height of maize.

Intercropping cowpea with maize drastically reduced cowpea grain yield, relative to the sole crop yield, the mean reduction in cowpea yield being 81%. In both monocropping and intercropping, none of the three improved cowpea varieties tested significantly outyielded the farmers variety.

Cowpea yields were generally low due to abrupt cessation of rains in September and to attack by Alectra Vogelii. Moisture stress appeared to be particularly severe in intercrop plots where many cowpea plants dried up.

Trial 3. On-station Agronomic Testing of Appropriate NPK Fertilization for Maize/Cowpea Mixture.

Objective. The objective of the trial was to identify the appropriate level of NPK fertilizer for use in maize/cowpea mixture.

Results. Unlike Trials 1 and 2 (for which 1990 was the second year of on-station trial).

Trial 3 was executed in 1990 for the first time. The results showed that grain yield of maize increased with increase in N level up to 150 kg N/ha. Maize also responded significantly to P up to 40 kg P₂₀₅/ha. There was no response to K. All the interactions were significant for grain yield.

In contrast to the response of maize to N, application of N depressed the grain yield of cowpea significantly, Cowpea, however, showed a positive response to P up to 80 kg P₂₀₅/ha, the maximum rate tested. Application of K had no effect on grain yield, although it significantly affected 100-grain weight.

Appendix 2.7.

Report on the Food Grain Production Technology Verification Trials in Senegal in 1990.

(Sub-projects executed by Saliou Diangar, Ndiaga Cisse and Samba Thiaw)

The trials in Senegal in 1990 were executed by two independent scientists, namely, Saliou Diangar and Ndiaga Cisse; the report of the trials by the latter was presented at the meeting by Samba Thiaw who will execute the 1991 trials.

Report on Trials Conducted by Saliou Diangar.

Trial 1. On-farm Trials: Verification of Millet Production Technologies under Farmers' Conditions.

Objectives: (i) to compare the performance of improved varieties of millet with that of local varieties; and (ii) to compare the performance of millet grown using improved production techniques with that of millet grown using farmers' production techniques in different ecologies of Senegal.

Results: The trial was conducted in six locations in three regions of Senegal, namely Kaolack region, Fatick region and Diourbel region. The improved millet variety evaluated in Kaolack-Fatick regions was Souna 3 while that evaluated in Diourbel region was IBV 8004.

The results showed that in Soulkou Loyer in Kaolack region, the grain yield of the improved millet variety (Souna 3) was not significantly higher than that of the local variety when both were grown under improved agronomic practices. When grown using the farmers' management practices, Souna 3 yielded significantly more than the local variety. In the same location, both Souna 3 and the local variety yielded significantly more when grown with improved techniques than when they were grown with the farmers' management techniques. In Darou in the same region (Kaolack), the improved techniques gave significantly higher yields than the farmers practices but the yields of the improved and local varieties were not significantly different. However, Souna 3 yielded significantly more under improved management techniques than under the farmers' practices; the yields of the local variety under both management regimes were not significantly different.

In Difior (Fatick region), the mean grain yields of Souna 3 were significantly superior to those of the local variety of millet, under the two management systems; Souna 3 outyielded the local variety by 503 kg/ha, on the average. The improved management system also significantly outyielded the farmers' management system. Thus Souna 3 and the local variety produced 645 and 697 kg/ha more grain yields, respectively, under the improved management system than under the farmers cultural techniques.

In Niakhar (also in Fatick region), the improved millet variety, Souna 3, significantly outyielded the local variety under each of the two management systems. Also, the improved management system gave significantly more grain yield than the farmers' system. However, the yields of the local variety under the two management systems were not significantly different from each other.

In Taire in Diourbel region the improved variety IBV 8004 yielded lower than the local variety but the differences were not significant. However, the improved management practices gave significantly higher grain yields of both varieties than the farmers' cultural practices. In general, across all locations in the Kaolack-Fatick region the improved millet variety, Souna 3, outyielded the local varieties while both types of variety yielded more under improved management practices than under farmers' production techniques.

Report on Trials Conducted by Ndiaga Cisse.

The trials were conducted in five villages, namely Thilmakha, Sine Dieng, Gatt, Lampt Sarr and Sakal. The new cowpea line IS 86-275 was evaluated together with three cowpea varieties (58-57), Ndiambour and Bambey 21) in four of the villages while in Gatt Bambey 21 was replaced by the variety Mougne. The varieties were evaluated in five farms in each village, i.e., 25 farmers par-

ticipated in the trial.

The yield data reported were not subjected to statistical analysis. However, the means of the four varieties in the five villages are compared below.

In Thilmakha, IS 86-275 yielded highest, with an average grain yield of 757 kg/ha (range 622-850 kg/ha) while Bambeyi 21 yielded least with a mean of 451 kg/ha (range 376-520 kg/ha). Ndiambour (mean yield, 597 kg/ha) ranked next to IS 86-275.

In Sine Dieng, IS 86-275, with mean yield of 675 kg/ha, yielded highest while Bambey 21 (average yield, 244 kg/ha) produced the lowest yield; 58-57 with an average yield of 627 kg/ha ranked second in this village.

In Gatt, Mougne produced 441 kg/ha to outyield IS 86-275 (436 kg/ha), 58-57 (403 kg/ha) and Ndiambour (350 kg/ha). The highest yielder in Lampt Sarr was IS 86-275 (436 kg/ha); it was followed by 58-57 (296 kg/ha), Ndiambour (168 kg/ha) and Bambey 21 (135 kg/ha). In Sakal, IS 86-275, Ndiambour, 58-57 and Bambey 21 yielded 255, 273, 224 and 114 kg/ha of cowpea grain.

Accross the five villages, the mean yields of the four varieties were 512 kg/ha (IS 86-275), 410 kg/ha (58-57), 380 kg/ha (Ndiambour) and 236 kg/ha (Bambey 21).

Appendix 2.8.

Report on Food Grain Production Technology Verification Trials in Togo in 1990.

(Sub-project executed by Toky Payaro)

Objectives. (i) In view of the recommendation of the early maturing sorghum variety, Framida, for cultivation in Togo, to determine how well it is adapted in the region; (ii) to test the adaptability and acceptability of the new, white-seeded, early maturing variety of cowpea, KVx 396-4-4; and (iii) to demonstrate the productivity of sorghum/cowpea mixture using different parameters.

Since 1990 was the first year of the trial, it was conducted on-station in order to validate the technologies before conducting on-farm trials in subsequent years.

Results. Sole crop Framida variety of sorghum (62,500 plants/ha) produced a grain yield of 946 kg/ha while Framida intercropped with cowpea variety KVx 396-4-4 (50,000 plants/ha of sorghum + 25,000 plants/ha of cowpea) produced 906 kg/ha; the difference between the two yields was not statistically significant. By contrast pure crop cowpea (100,000 plants/ha) yielded 1164 kg/ha of grain compared to 583 kg/ha produced by cowpea grown in mixture with sorghum. The total land equivalent ratio (LER) of the sorghum/cowpea mixture was 1.46. The grain yield of cowpea in the mixture was virtually a bonus crop, since the LER for sorghum was 0.96 while

that for cowpea was 0.50.

When the cost-benefit analysis was done for the three systems (pure crop sorghum, pure crop cowpea, and sorghum/cowpea mixture), the highest net income (about 116,000 CFA per ha) was realized with pure crop cowpea which was closely followed by sorghum/cowpea mixture (about 108,000 CFA/ha). The sole crop sorghum gave the lowest economic return of about 54,000 CFA per ha. The calculations took into account the costs of insecticides, sprayers and batteries using in applying three sprays to cowpea.

Appendix 3.

LIST OF PARTICIPANTS AT MEETING OF REVIEW AND
PLANNING TECHNICAL WORKING GROUP ON FOOD GRAIN PRODUCTION
TECHNOLOGY VERIFICATION PROJECT HELD IN OUAGADOUGOU,
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