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## **Sustainable Agriculture Program: For the Intensification of Food Grain Production in Semi-Arid West and Central Africa**

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## **Sustainable Agricultural Program for the Intensification of Food Grain Production in Semi-Arid West and Central Africa Activity report July-December, 1999**

### **Executive Summary**

This report highlights the preliminary activities of the Sustainable Agricultural Development Program for the intensification of food grain production in Semi-Arid Africa. Ten countries will benefit from this program.

The main goal of the program is to intensify the production of food to meet the challenges of food security through the delivery of technology options that minimizes environmental degradation. Because the ADF Grant was received in September 1999, and to take advantage of the season, SAFGRAD prefinanced to start program activities in Burkina Faso, Mauritania and Niger. This report covers program activities undertaken (July-December 99) in these countries. It is anticipated, in the long run, that this program will generate income and employment for improving the livelihood of millions households in Sub-saharan Africa.

In Niger, 103 farmers participated in the testing of four maize varieties suitable as green maize. It appeared that P3 Kollo and EV 84-SR were identified and preferred by farmers across all four regions. For cowpea, 30 farmers were involved in the on-farm trial. Strong positive reaction of farmers to the introduced varieties sparked seed multiplication in order to meet farmers' demand.

In Mauritania, both maize and cowpea varieties were tested under dryland and irrigated conditions. The technical data is being analyzed.

In Burkina Faso, 24 producers experimented integration of legumes in their cropping system as well as small ruminant fattening. The cultivation of improved cowpea cultivars generated return to farmers of about 80 000 CFA/ha. But, the combination of cowpea production and fattening of small ruminants improved the return of income to more than 195 277 CFA. Meanwhile, cowpea/cereal rotation improved yield of the latter by up to 30%.

## 1. Introduction

The goal of the program is to enhance food security while mitigating environmental degradation due to human exploitation of land resources, and the physical change of the environment. The program has two main components:

- i. On-farm resource management : This involves the integration of on-farm sub-components such as crops/livestock, trees, soils, etc. to improve agricultural productivity and complementarity in use and recycling of resources, and the diversification of income by farmers.
- ii. Verification of food grain production technologies : This aspect of the program is tailored to strengthen small National Agricultural Research System (NARS) capabilities in the evaluation and screening of more productive food grain production technologies through agronomic trials.

The food grain production technology verification program involves 6 countries : Niger, Mauritania, Togo, Benin, Cameroon and Cap Verde. The on-farm resource management component of the program will be implemented in 4 countries : Burkina Faso, Ghana, Senegal, and Nigeria.

Operationally, the program seeks to promote the participation of all stakeholders including farmers, extension agents, researchers, NGOs, the public and private sector in the development of sustainable agricultural production systems.

This report highlights activities of the program and findings between July to December 1999.

## 2. Program Activities

To take advantage of the 1999 growing season, program activities were prefunded in three countries (i.e., Burkina Faso, Mauritania and Niger), since funds for the program support from ADF were received after the cropping season.

### 2.1. Verification of food grain production technologies

Based on the needs of participating countries, on-farm testing of improved maize and cowpea

varieties was undertaken. NARS of Mauritania and Niger, the maize and cowpea networks have served as important sources of the varieties and agronomic practices evaluated.

#### 2.1.1. Niger

##### On-farm verification of improved maize varieties

This project had two sub-sections: the on-farm testing of improved technologies and the production of green maize under irrigation around Niamey. **The purpose of this program is to fill the hunger gap before the main crop millet is harvested.**

The on-farm testing of maize production technologies was implemented in four regions: i) Kollo and Niamey, ii) Tillaberi and Lossa, iii) Gaya and iv) Konni. The sites were chosen in collaboration with farmers and other partners of rural development (extension, etc.). The objectives were: to conduct on farm testing of performing varieties available with the program; to train farmers in the production of seed (seed increase), and finally to ensure production of foundation seed. Improved maize varieties EV 84 SR, TZE Y SR, and CET a variety developed by INRAN, and a traditional variety, P3 Kollo were evaluated. A total of 28 farmers were involved in the trials. But more than 103 farmers had access to the trials and participated in the evaluation of the varieties.

The design used for maize on-farm testing allowed real participation of the farmers in the selection of the variety. Furthermore, monitoring of trials by farmers was done during the growth stage and also at harvest. During the field visits that were organized, farmers were given explanations on the objectives and aims of the project, the origin of the varieties tested, and their characteristics. This facilitated the contribution of farmers in rating the varieties themselves (Annex 1).

The initial results show that, farmer preference for varieties varies by regions, and that maize is appreciated by the farmers in Niger. It can be said that P3 Kollo and EV 84-SR are the most favored varieties across all four regions. TZEY SR (an extra early cultivar) was ranked last by the farmers. Some of the criteria important to farmers are the taste of the green maize coupled with the number of cobs per plant. Grain yields were higher in the Gaya region where rainfall and environmental conditions are more favorable for maize production.

A total of 705 kg of seed was also produced in anticipation of the farmers' demand for the coming growing season. It consisted of 50 kg of the variety P3 Kollo, 20 kg each of CET and EV 84 SR, 15 kg of TZEY and 600 kg of EV89 TZEZ.

#### Off-season production of maize

Green maize is highly appreciated around big cities in West and Central Africa where it is consumed either grilled or boiled. While vegetable gardening is the major activity during off-season, their commercialization is not always easy due to high supply. Production of green maize could be an alternative for diversification and also generate income to the small producers. The activity undertaken was to assess the feasibility of green maize production and commercialization around Niamey, particularly at Kollo. The maize was planted in areas no more than 400 m<sup>2</sup> per participating farmer which were selected at locations where irrigation is readily available. These small holder farmers are poor but, are able to make ends meet by producing 2 to 3 crops per year. The variety used was P3 Kollo which is appreciated for its sweet taste. Planting was done in November, 1999. After successive harvest, each farmers was able to sell their maize for an equivalent of 104 800 CFA, for a net return of 84 800 CFA. While the activity is labor intensive, the return is highly appreciable.

#### On farm verification of improved cowpea varieties

Niger is second only to Nigeria in cowpea production in the subregion. The objective of the on-farm verification trial was to identify improved disease resistant and high grain yielding varieties. Farmers benefiting these activities usually grow cowpea in traditional conditions i.e. intercropping

with cereals, and zero to little application of fertilizers. Furthermore, the local cowpea varieties are less and less adapted to the rainfall, pest and disease.

The following varieties were evaluated: K VX30-309-6G, TN27-80 in the Konni region; IT90K-372-1-2, TN27-80 in the Kollo region (30 km south East of Niamey). Agronomic practices, i.e., planting date and density, fertilizer, and insecticide application of Delthamethrine (2 l/ha) were used. In each region, five villages cooperated, with three farmers per village. A total of 30 on-farm tests were implemented, and more than 100 farmers had access to each test. Rainfall at the test sites varied between 400 and 500 mm.

Performance of the varieties were significantly different in Kollo for grain and vine yield and flowering dates. At Konni, however, varieties tested differed only for vine yield. Yield in Kollo were generally low (average 205 kg/ha) for IT90K-371-1-2, 166 kg/ha for TN27-80 and only 42 kg/ha for the local check.

At Konni, average yield was 843 kg/ha for K VX30-309-6G, 770 kg/ha for the local check and 586 kg/ha for TN27-80. 5 out of 9 farmers preferred K VX30-309-6G for its earliness, yield and seed color. Two farmers each preferred, however, the local variety and TN27-80. This initial interest and expectations of farmers led to the increase of seed of the introduced cowpea cultivars to make available to farmers the subsequent season. Seed multiplication on research station was undertaken for K VX30-309-6G (156kg), IT90K-372-1-2 (209 kg) and TN27-80 (38 kg) cultivars. A spill over is already been observed as farmers have volunteered for testing IT90K-372-1-2 at Filingue where rainfall is less than 400 mm per annum.

### 2.1.2. Mauritania

#### On farm verification of improved maize varieties

Agriculture in Mauritania is hampered by irregular rainfall and low productivity. Local maize varieties have low yield due to harsh climatic conditions. On the other hand, maize has increasingly become a very important crop in the diet of Mauritians. Furthermore, the cultivation of early and

extra early maize cultivars can enhance food security. The aim of this program is to identify varieties suitable under irrigated or dryland conditions, the two main types of agricultural production systems in Mauritania.

To this effect, three improved varieties (97 TZEE-W3 C1, Kamboinse 88 Pool 16 DT, and CSP- SR BC5) including a local variety (CDK) were evaluated on farmers' fields. Trials were conducted at Gorgol and Guidimakha in southern Mauritania. Nevertheless, irrigation is available in the region. At all farms, maize grain yield was low, generally less than 2t/ha.

Kamboinse Pool 16DT had higher grain yield although no significant difference exist among varieties tested. Technical data is being analyzed and will be discussed during the forthcoming technical working group meeting of the program.

#### *On farm verification of improved cowpea variety*

The cowpea crop is an affordable source of proteins for both human and animal nutrition. Moreover, cowpea intercropping and rotation with cereal not only improve the yield of the cereal and also the fertility of the soil. The development and/or introduction of dual purpose, drought and pest tolerant cowpea varieties are among the objectives of the program. Through the support of this program, cowpea varieties: TVX 32-36, K VX 61-1, IAR 7/180-5-5-1, K VX 414-22-72, K VX 414-22-2, K VX 396-4-5-2 D, from Burkina Faso, Nigeria and International Institut of Tropical Agriculture (IITA) were introduced. The trials included also local cultivars (Mougne) and pest control measures.

These cowpea varieties were evaluated at Ganky and Seyenne under rainfall conditions and R'Kiz (south of Nouakchott) and Keur Macene under irrigation.

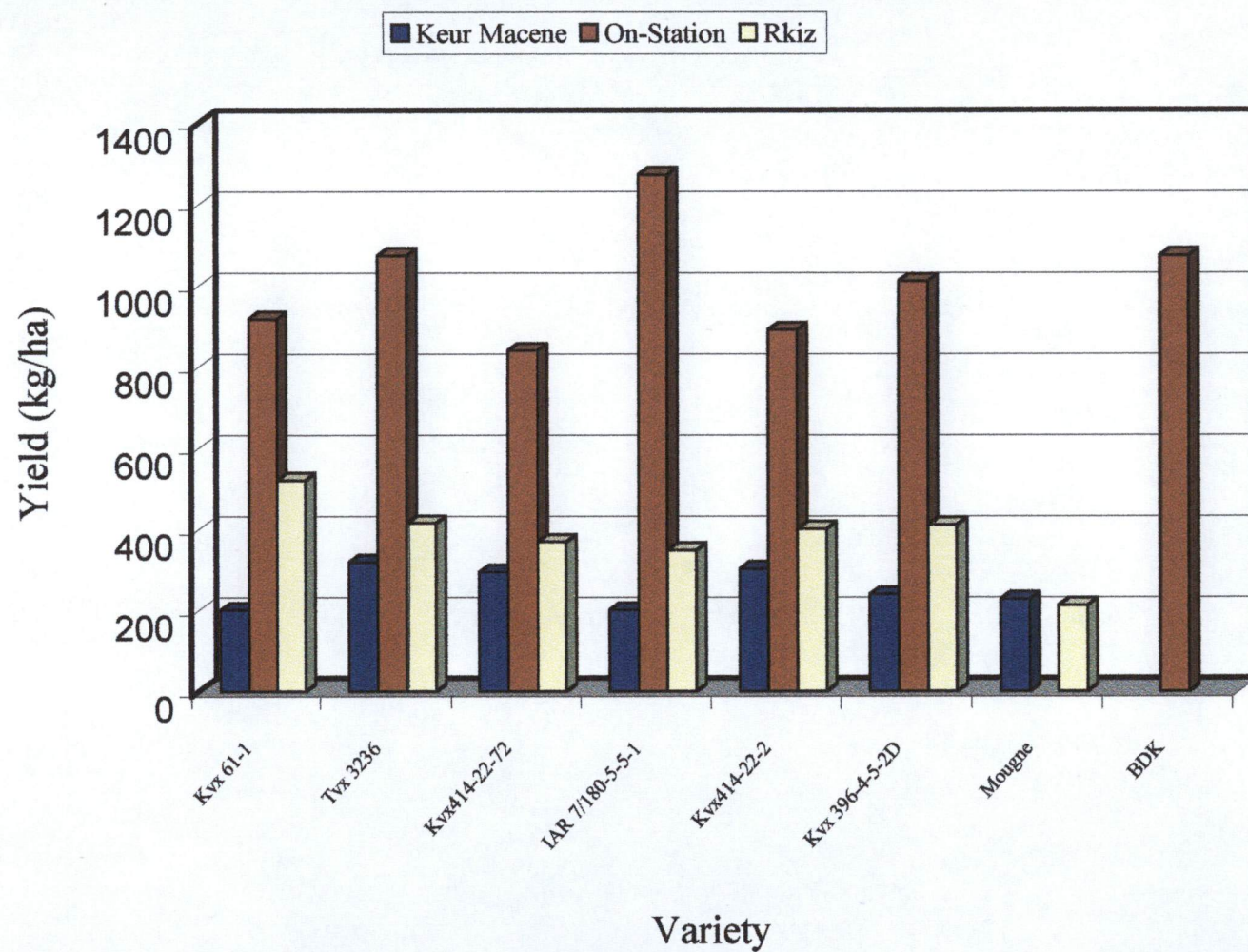
Rainfall in the site started late and was characterized by drought spells sometimes more than 20-25 days. Furthermore, under dryland condition, complete crop failure was observed. At R'Kiz, flowering occurred between 39-48 days in all varieties tested. TV3236 was the earliest and Mougne the latest. Pod and grain yield were the highest for K VX 61-1, 736 and 521 kg/ha respectively (Fig.1). It should be pointed out that the average grain yield of 382 kg/ha is far below the



expectation of these varieties which under favorable environment can yield more than 1t/ha. High insect pressure contributed to this low performance.

At Keur Macene, however, a new location developed by the authorities, grain yields were lower, with an average of 247 kg/ha. This site has high salt toxicity.

**Figure 1: Yield performance of cowpea varieties tested in Mauritania in 1999**



Farmers had a mixed reaction to the performance of these varieties since they prefer mostly varieties with white seed color.

On station trials revealed the high potential of the varieties with on average grain yield over 1000 kg/ha. This suggest the need of training farmers in improved methods of cowpea production.

## **2.2 On-farm Resource Management in Burkina Faso**

The on-farm resource management program was implemented only in Burkina Faso. The activities of the program complements the USAID funded Technology Transfer and Commercialization project activities. This program enhanced the integration of livestock particularly the raising of small ruminant with the production of legumes and cereals in the Central Mossi Plateau. For the first year, the technology consisted of improved animal fattening technology, combined with legume cropping for improving income and restoring soil fertility.

The program was started in the Central Plateau of Burkina Faso, some 35 km north of Ouagadougou, where farmers are experimenting the integration of small ruminant fattening and legumes production.

Forging partnership of stackholders is the key strategy of this program. The integration of small ruminants and cropping systems in Burkina Faso involved NARS : Institut de l'Environnement et de Recherche Agricole (INERA) as the producer of technology, (technology package for animal and also modern cowpea production), animal extension organization : Service Provincial des Ressources Animales (SPRA), a public organization in charge of extension of animal production technology, which monitored all aspects of animal production (choice of the small ruminants for fattening, amount of feed supplied, health management etc.); and the beneficiaries themselves i.e. 24 farmers. These farmers are members of the farmer association Association Song-Koodba (ASK). In the scheme used, farmer produce cowpea for its grain and fodder which is used for animal feed in combination with concentrates recommended by the Department of animal production of INERA. Under the program, participating farmers were assisted to improve housing (Fig. 2), and purchase small equipment, such as feeder and drinking trough and provide animal health care. However, participating farmers bought their own sheep for the fattening trials.

Prior to the start of activities, 25 farmers benefited of a two days intensive training in

management of animal production. During a second training, farmers were taught on the use and storage of natural fodder.





**Figure 2:** Participating farmers used local materials to build improved housing for the small ruminants. Fodder of cowpea, groundnut and cereal crops residues are usually stored on top of the shed, providing shade for the animals.



Cowpea production is already well established in the region at the onset of this project. However, to enhance the integration of small ruminants, farmers were advised to use dual purpose cowpea cultivars such as IAR7/180 for both grain and fodder production.

The integration of small ruminants (i.e. sheep) involved fattening using cowpea hay, cereal residues and concentrates (an improved animal feed). Two types of rations were used. The first ration included 30% concentrates while the second had 35%. Initial economic analysis showed there has been more return with using the improved ration up to 35% concentrates. The combined cowpea and small ruminant fattening enterprises gave high gross returns to farmers (195 277 FCFA).

Furthermore, cowpea/cereal rotation improved the yield of cereal by up to 30%. While immediate economic impact of this integration small ruminant/cowpea can be felt at the farmer level (increase in revenue, diversification of the source of income), the effect on the soil fertility management is slow to be perceived and will be monitored in the upcoming season. This will be also coupled with training of farmers on the composting of animals and crop residues and the rotation systems to be implemented.

Annex 1. Farmer participation in the evaluation of maize varieties in Niger, 1999

Locality	Variety	Maturity length (Days)	Number of participating farmers	Yield kg/ha	Preference of variety by farmer *	Criteria of choice
Tillaberi	P3Kollo	48	15	1755	7	Sweet corn taste, Number of cobs/plants and total number of cobs
	EV-84 SR	44	15	1994	3	Number of cobs per plant and size of cobs, plant vigor, and vitrosity of grain
	CET	43	15	2444	5	Sweet corn taste, size of cobs
	TZEYSR	43	15	2444	2	Earliness and sweet corn taste
Gaya	P3Kollo	49	29	2773	9	Taste, Number and size of cobs/plants
	EV-84 SR	46	29	4260	10	Size and number of cobs /plant, plant vigor
	CET	46	29	3906	7	Taste, number and size of cob/plant
	TZEYSR	43	29	2422	4	Earliness
Kollo	P3Kollo	52	35	1800	5	Sweet corn taste, number of cob/plant
	EV-84 SR	53	35	2816	15	Plant vigor and cob size
	CET	53	35	2714	3	Taste and number of cob per plant
	TZEYSR	49	35	2650	1	Earliness and sweet corn taste
Konni	P3Kollo	50	24	1694	7	Number of cob/plant, earliness and sweet corn taste
	EV-84 SR	51	24	2416	9	Plant vigor, 2 cob/plants and cob size
	CET	53	24	2516	6	Taste and 2 cob/plant
	TZEYSR	49	24	2524	2	Earliness

\*Number of times variety was scored first by participating farmers.

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