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Burkina Faso: the Zai Technique and Enhanced Agricultural Productivity

More than 90% of the population in the Sahel lives on agriculture. The fact that crop production has not kept up with population growth during the last two decades is attributed to land degradation and productivity decline resulting in increased levels of rural poverty, food shortages and chronic food insecurity. In response, since the 1980s, Sahelian farmers have experimented with various soil and water conservation techniques to restore, maintain or improve soil fertility.

One of the most appreciated techniques by farmers in northern Burkina Faso was the plant-pit system (demi-lunes) or “Zai” in the local language. The technique originated in Mali in the Dogon area and was adopted and improved in northern Burkina Faso by farmers after the drought of the 1980's.

The Zai technique

Farmers apply the Zai technique to recover crusted land called “Zippelle”. Zai is a planting pit with a diameter of 20-40 cm and a depth of 10-20 cm - the dimensions vary according to the type of soil.. Pits are dug during the dry season from November until May and the number of Zai pits per hectare varies from 12,000 to 25,000. After digging the pits, organic matter is added at an average, recommended rate of 0.6 kg/pit and, after the first rainfall, the matter is covered with a thin layer of soil and the seeds placed in the middle of the pit.

The excavated earth is ridged around the demi-circle to improve the water retention capacity of the pit. Zai fulfills three func-

tions: soil and water conservation and erosion control for encrusted soils.

The advantages of Zai are that it:

- (i) captures rain and surface/ run-off water;
- (ii) protects seeds and organic matter against being washed away;
- (iii) concentrates nutrient and water availability at the beginning of the rainy season;
- (iv) increases yields; and
- (v) reactivates biological activities in the soil and eventually leads to an improvement in soil structure.

The application of the Zai technique can reportedly increase production by about 500% if properly executed.

Genesis of the Burkina Faso Zai Program

As part of their objective to assist local communities to strengthen their local capacity by using their local knowledge, the World Bank program on

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Indigenous Knowledge for Development provided support to farmers for scaling up the dissemination of the Zai technique in three provinces in central Burkina Faso. The Association pour la Vulgarisation et l'Appui aux Producteurs Agro-écologistes au Sahel (AVAPAS) provided day-to-day guidance to farmers. Other local development actors (administration, extension workers, local authorities, community leaders) supported the initiative to ensure sustainability.

The campaign was carried on through the period 2002 – 2003. The farmers highly appreciated the technique especially since it increased productivity. Unfortunately, farmers did not always follow all the recommended steps so as to make a better profit from the technique. For example, the dimensions of the pits were not always as recommended, resulting in poor plant and stem development. Delayed digging of the Zai pits and inadequate application of organic matter (timing and quantity) can all contribute to substantial yield losses.

The team proposed a second season of implementation in order to make it possible for farmers to master the technique and to disseminate its application among other farmers. This was carried out in 2003 - 2004.

During the second campaign, farmers started to cultivate “common fields”. In the common fields, all the recommended steps were applied strictly and this became a demonstration site for the farmers of the sample as well as for the other farmers of the village.

Presentation of the zone of activities

The activities were carried out in 32 villages in the following six provinces of the central zone of Burkina Faso: Kadiogo, Bazega, Oubritenga, Kourweogo, Sanmatenga and Zoudweogo. Rainfall during this season was exceptional with only few dry spells.

Diffusion of the technology

The diffusion of the Zai technique in central Burkina Faso was organized in three phases:

- *Information and sensitization sessions* - During this phase, a discussion was organized with farmers on the strengths and weaknesses of their production systems. Farmers assessed their cropping lands and proposed solutions to the constraints they had identified. The AVAPAS team comple-

mented the list of solutions proposed by farmers, presented a complete description of the Zai technique and invited farmers to join the experiments.

- *Demonstration of the technique* - The technical team organized a demonstration session for farmers that included digging pits, organic manure application and provision of basic equipment. The equipment is used in rotation and organized by the farmers themselves.
- *Field trips* - During the growing season, follow-up visits reinforced the necessity to apply the entire technical package to achieve the highest impact.

Analysis of various operations during the adoption of the technique

Zai operations were implemented by farmers at different periods depending on the availability of labor, organic matter and the interest of each farmer. Farmers who participated in the earlier campaign were invested in the technique much earlier. For the most informed (earlier participants), work started at the beginning of June and extended until mid-July. For the others, the activities started at the beginning of July and finished end-July.

1. Digging Zai pits

The size of Zai pits varied by farmers during the first year. The objective was only to start with digging the holes. Those who had not followed the minimum dimension rule were obliged to restart the pits during the second growing season. By the 2002-2003 campaign, a clear mastery of the operation by farmers was noted. In fact, the size of the seed holes was according to recommendations, in part attributed to the availability of equipment provided by AVAPAS (drill, peck axes).

2. Application of organic manure

The unavailability of good organic matter was one of the constraints during the dissemination of the technique. Some farmers, in the absence of compost, applied fresh organic matter in the pits, resulting in seedling damage. It became apparent and essential that farmers needed to be better informed regarding this specific stage of organic matter application which is crucial for the success of the technique.

During the 2003-2004 campaign, the country had on skeletal grounds that are poorer than those in the central part of the country.

Vegetative Development of the Crop (Sorghum)

To monitor the vegetative development of the crops and especially to exchange views with the farmers, site visits were organized in collaboration with AVAPAS to address problems which arose during the growing season: the seedling stage, the flowering stage and during maturity. Farmers who encountered difficulties in the implementation of their activities were invited to visit plots of other participating farmers.

Seedling stage

Seedlings in the village of Niniogo in the department of Pabré did not survive in the Zaï plots. Farmers had just adopted the technology but did not yet have all the necessary experience to ensure the success of the technique. Zaï seeding holes were fertilized with manure freshly collected from the park and seeds sown only two days after that. Farmers attributed the loss of the seeds to the variety of sorghum used or to the lack of rain immediately after sowings.

Flowering stage

The vegetative development of Sorghum in Zaï fields was particularly appreciated by all farmers. In Korsimoro, one of the farmers made it known that the Zaï was the only technique that helped him recover land which he had abandoned for several years because of the hardened surface. One farmer's field became the subject of curiosity amongst his neighbours in the village who asked him many questions about the technique.

Maturity stage

Farmers noticed that the vegetative development of the crops in the Zaï fields was normal or better than in those in the non-Zaï plots. While the sorghum was stunting in the non-Zaï plots, the leaves were still green in the Zaï fields.

Sorghum yield

The yield for sorghum grain was evaluated in the Zaï and the non-Zaï plots during two growing seasons.

Data are from 16 villages in 2002 and 32 villages in 2003. The results show significant differences between the Zaï and

non-Zaï field. The findings are consistent with those from other studies on Zaï in other regions which show the effect of the practice on the yield of sorghum (Sawadogo, 2001, Dakuo, 2000, Bamboo, 1996, Kabore, 1991). The yield increase is attributed to a better use of rainfall and improvement of soil fertility as results of the application of organic matters in the pits.

Results and impact of the technique on farmers

- In the execution of this project, AVAPAS facilitated the transfer of local technology from a local development organization to the farmers on the one hand, and subsequently between farmers.
- More than 100 farmers in 32 villages benefited from this transfer.
- The NGO played a significant role in the knowledge transfer to and between farmers.
- The exchanges between farmers and follow-up visits from the AVAPAS team made it possible to reinforce the knowledge that farmers have acquired and to address concerns arising during the application of the Zaï technique.
- The application of organic matter remained one of the least adopted steps by farmers. The recommended quantity (i.e. two handles per seed hole) was not always followed which resulted in the appearance of Striga (bad bleaches on grass indicating the extreme poverty of the soil) in the plots. Chemical analysis of the organic matter could be used for designing an optimal production capacity.
- In the majority of villages, the surplus production realized by farmers in one hectare was higher than 0.5 ton. This validates the effectiveness of the technique in increasing the productive capacity of the plots.

It is especially worthy to mention that in the province of Yatenga (rainfall between 300 and 600 mm), Zaï remains the single technique that makes it possible to carry out agricultural performances on skeletal grounds that are poorer than those in the central part of the country

Conclusions and Recommendations

Overall, the Zaï technique seemed to have been mastered by farmers of the central region of the country. From the two years experiment, the following conclusions can be drawn:

- Farmers can master the entire technical package if the operations are well planned, as dictated by the seasonal requirements.
- The Zaï technique can increase crop yields and reduce the risks for food insecurity in rural areas.
- The technique does lead to soil improvement and recuperation of degraded lands.
- To scale up the benefits of this technique, some scientific work is necessary in (i) the chemical analysis of organic matters produced by farmers as well as the proper dosage to use during the application; and (ii) the testing of high productive cultivars in order to increase profits.

The concerned farmers welcome further support from all partners so that this technique can be mastered and implemented by the entire farmers' population of the region and elsewhere in the country.

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