Introducing Conservation Agriculture in the Quirimbas National Park of Cabo Delgado, Northern Mozambique

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Introduction

The Aga Khan Foundation-Mozambique (AKF-M) operates in Cabo Delgado province in northern Mozambique a Coastal Rural Support Programme (CRSP-M) involving different sectors of economic and social development such as agriculture and market access, water and sanitation, habitat, education and health. The multi-input area development activities are conducted with local communities, in collaboration with the provincial government. The project covers five districts that are either fully or partially located within the territory of the Quirimbas National Park (PNQ). The Park has wildlife including big game and rare birds as well as marine life whose welfare must be an integral part of the overall area development programme of AKF-M. Two districts (Ibo and Quissanga) are 100% within the park; two (Macomia and Meluco) are up to 50%, within the park, and one (Pemba Metuge) below 30%. Given the ecological and socio-cultural context of the Park, agricultural development strategies and production practices and techniques to be developed should take into account aspects related to conservation of Park resources. This is to foster sustainability of the inhabitants' activities as well as conservation of the flora and fauna existing in PNQ territory. Consequently, AKF-M decided to build its sustainable agriculture intensification efforts around the principles and practices of Conservation Agriculture (CA) as defined by FAO (www.fao.org/ag/ca).

Entry Points

During the 2008-9 rainy season, field demonstrations were mounted on the use of organic mulch as an effective alternative practice for weed control (without herbicides), for maximizing water infiltration into the soil and minimizing runoff, and maximizing the use of water reserves stored in soil. On-farm demonstration plots were set up with volunteer lead farmers in the five project districts. Establishment of these demonstration sites marked the beginning of a new crop production system approach to sustainable farming within the agriculture development programme of CRSP-M. The programme guides and assists 35,000 families in 135 villages to reach new horizons in terms of increased yields and production techniques based on CA principles. The aim was to establish CA systems adapted to local biophysical and socio-economic conditions.

During the next rainy season (2009-10) there were exchanges of the accumulated experiences with other organizations such as the Conservation Farming Unit (CFU, Zambia) and Envirotrade (Mozambique). This led to the design of a strategy to involve a larger group of farmers. For example, the permanent micro-basin technique that was being practiced in Zambia contributed positively to the introduction of the CA approach because it demonstrated that there was a better way to establish crops with reduced drudgery in the effort and less time spent in establishing crops. Using the micro-basin technique, only some 10% of the soil surface is disturbed, requiring much less time and physical work to establish the crops. Micro-basins are prepared three months ahead. The basins are established with the following dimension: 90 cm between rows, 70 cm between micro-basins. Each micro-basin is 15

cm deep, 35 cm length and 15 cm width. Alongside the use of permanent basins was the application of organic manure from cattle, goats and elephant depending on the availability. Later in the year, working with Envirotrade, legume trees *(Faidherbia albida* and *Moringa oleifera*) were introduced into the production system as a source of nitrogen. The positive results were not long in appearing. The process of dissemination of CA techniques began with the installation of 15.5 hectares of mulched fields in Ibo, Macomia, Pemba Metuge, Quissanga and Meluco districts involving 120 farmers, each with an average of 0.25 hectare. Farmers were formed into five groups, and each group was able to see the cycle of major crops (e.g. maize and cowpea as intercrops or in pure stands). During the following season (2010-11), the structure of the demonstration and training programme was expanded to include the demonstration and training on establishing CA-based cropping systems. Also, the farmer groups were now organized into Farmer Field Schools (FFS), and the curriculum included making an agro-ecosystem analysis of crops and of CA cropping systems in the different agro-ecological situations. FFS training included the following: demarcating the field; planning crop associations and rotations; preparing the soil for planting with minimum soil disturbance and organic fertilization; sowing and intercropping; developing permanent soil cover with cover crops (legumes) and dead organic mulch; planting trees (*Aziairachta indica*, *Moringa oleifera* and *Faidherbia aldiba*); extending the crop growing season; and initiating training on soil health and ecosystem functions and services.

Immediate Gains

With permanent soil cover, it was possible to control weeds, including reducing the time to weed by up to 75% with the use of green cover crops and by using mulch. In the CRSP area there is no problem to find grass for mulch cover, because there are no free grazing cattle. The only hazard is related to uncontrolled fires. In the traditional cropping systems, production fields are used only for one crop (either maize or cowpea or cassava) at a time or two crops as intercrops (maize/cowpea). In the CA production systems promoted by AKF-M, farmers can produce three to four crops in the same field in the following scheme for example with maize and mung bean as main crops planted first. Mung bean is then followed by sesame, and when the season has good rainfall maize can be followed by cowpea. Another cropping option is maize and cowpea and cassava in bands intercropped with rows of pigeon pea. Within the rotation, some portion of the land will have cover crops such as lablab and mucuna for the purpose of controlling weeds, improving soil structure, porosity and drainage, and increasing biologically fixed nitrogen and soil organic matter.

It was observed that soil cover prolonged the growing season because not only more water infiltrated into the soil but more was retained due to reduced evaporation from the soil. In Cabo Delgado, the rainy season is from January to May. However, because of the low soil organic matter and surface crusting, rainfall does not infiltrate easily and instead rain water flows along the surface as runoff carrying with it soil particles, organic matter, plant nutrients and microorganisms. Much of the little water that is absorbed by the soil is lost as evaporation because most of the soil surface is bare and exposed. It is also depleted by the abundant weeds that are in the continuous process of completing their life cycles and starting the next generation in very short time intervals. The use of mulch soil cover to minimize evapotranspiration and control weeds means that the soil water can be available for an additional one or two months which extends the season from 5 to 6 or 7 months and can accommodate another cycle of legume crop such as cowpea or mung bean.

Yields (t/ha) of crops in a CA cropping system over four years from farms in Pemba Metuge district are shown in the table below (average of 20 farm plots).

Table 1. Yields evolution on CA plots (t/ha)

Crops	Baseline	2009	2010	2011
Maize	0.8	1.2	1.8	3.2
Cowpea	0.6	0.8	1.2	1.7
Mung bean	0.4	-	-	0.6
Pigeon pea	1.2	-	-	Awaited

The farm families who are practicing CA have already begun to see a range of benefits offered by the system since it allows them to produce enough to eat and to sell the surplus using virtually the same plots. With the increase in land and labour productivity and output of maize there is now enough food to meet food security needs as well producing a surplus which can be sold at the local market. For example, in Novo Cabo and Litandacua villages, in Macomia district, 30 producers involved in the practice of CA had enough surpluses to cover their food needs during the entire dry season until the next harvest. However their average yield had reached only 2.5 t/ha and there was room for further increase in yield. The reason for successful intensification was the adoption of CA practices combined with the use of elephant dung for crop nutrition. These communities began practicing CA techniques in early 2009 and were the subject of technical evaluation visits by AKF and Government extension agents. With the application of a complete grass mulch cover alone, there was an effective control of weeds and excellent improvement in the soil moisture regime leading to increases in crop yields of maize (1.5 t/ ha from 0.8 t/ha), sesame (0.5 t/ ha from 0.3 t/ha) and cowpea (1.0 t/ ha from 0.5 t/ha). The rate is 1200 bunches of grass per hectare, each bundle of grass weighing between 15 to 20 kg (dry weight basis). Most of the species belong to the family Graminacea as *Panicum maximum, Eragrostis, Digitaria and Brachiaria.* The grass is laid on the soil before planting to allow sowings to be made after the first rains. The grass is cut in advance to minimize spread of grass seed and is dried in bunches in small piles.

Future Needs and Plans

(1) To have a stronger basis for supporting producer communities, AKF-M facilitators, who run the field operations and provide ongoing training to field staff, need access to diverse information on what is happening at the local, country and the world level with respect to experiences with CA. (2) There is a need to establish a collaborative extension network involving different organizations that are working on CA in Cabo Delgado, such as the QNP and WWF, Helvetas, the local NGO Kulima, the Bilibiza Agricultural Institute, and provincial and central governments. (3) There is a need to continue to train producer communities in CA principles and practices in order to reach the 35,000 households by 2016 proposed in the FSI (Food Security and Income) project, financed by CIDA Canada in which producer groups operate and are trained in FFS. Thus the project will continue to support the formation of new FFS. (4) Starting 2012, there will be FFS training in the integration of livestock (goats and poultry) into production systems as a way to connect to additional sources of income to enhance the sustainability of CA production systems. (5) CRSP-M will continue to work with Bilibiza Agricultural Institute as a source of dissemination of CA knowledge and practices through students. AKF-M is working towards CA being part of the curriculum, supported by the national law that allows 20% of the Institute's curriculum to be decided at local level.