

CHAPTER 4

Farmer benchmark-discovery process: A proof of concept for scaling

Based on the results of the pilot project, INERA and DVRD were able to establish a range of new findings regarding farmer-based discovery process and improved technologies as constituting the '*Proof of Concept*' to support the conclusion that the outcomes of the pilot project can be scaled up to promote the expansion of sustainable crop intensification in the moist savanna areas of Burkina Faso and more generally in similar African ecologies. The key activities and findings are as follows.

FARMER BENCHMARK-DISCOVERY PROCESS

The approach to develop and test technologies and to train farmers through farmer-discovery benchmark sites linked to Farmer Field Schools, which is coupled to monitoring and evaluation has proved to be efficient. Production technologies were introduced to farmers for testing and adaptation through a participatory process through some new ideas like CA practices with living fence were innovations introduced from outside the region. Selected farmers participated fully throughout the entire process of setting up field experimentation sites and managing the experiments (see Figure 8) including crop management, harvesting, recording of crop performance, post-harvest processing, preparing livestock feed and silage making and marketing.

A split-plot design to test the effect of tillage and no-till on crop performance and production was established in the maize-cotton system. Three treatments of cereal/legume crop combinations in association with cover crops and six treatments of cereal/legume rotation were laid out in the project benchmark sites. Fields were protected from damage by roaming livestock and other mammalian pests by planting close stands of living fences of *Acacia nilotica* and *Zyziphus mucronata* (see Figure 9) around the experimental field margin.

FIGURE 8
Farmers participating in setting up experimental benchmark field sites



FIGURE 9
Farmer-managed benchmark site with maize-cowpea-cotton-*Brachiaria-Mucuna* crops protected by a living fence from damage by livestock



INTEGRATED CROP-LIVESTOCK-TREE SYSTEMS IN CONSERVATION AGRICULTURE (CA)

CA was introduced into the PRODS/PAIA pilot project because FAO has shown conclusively in many countries with similar ecology that the adoption of this practice, especially by smallholder farmers, can promote significant increases in productivity of crops such as maize, soybean, vegetables and others. The practice of CA, which increases soil organic matter and soil



biota, improves soil structure, soil moisture and nutrient availability, and productivity, is based on several productivity enhancing principles, including:

- minimal disturbance of the soil, for example instead of tilling or ploughing the land, farmers plant crops directly into the soil to improve soil porosity, builds up soil organic matter and beneficial soil biota leading to improved soil health and productivity;
- providing soil cover with crop residues and/or cover mulch crops such as *Mucuna* to prevent loss of the top soil, suppresses troublesome weeds, while at the same time adding biologically-fixed nitrogen to keep the soil fertile; and
- crop rotation and crop mixtures, which involve farmers growing more than one sole crop in a mixed pattern, either in rotation or as intercrops.

These principles are applied simultaneous in order to achieve the best results, allowing farmers to produce improved yields of food and other biological products on a sustainable basis, save on labour and materials, and engage in revenue generating activities. Additionally, CA practices allow the integration of crops with livestock production in a mutually beneficial manner. This is because CA calls for crop diversification with high biomass crops including legumes to generate soil cover, fodder and crop residues, and improve soil fertility and nutrient cycling.

Minimum soil disturbance and no-till:

PRODS/PAIA activities related to minimum or no-till were established in cotton- and maize-based production systems with CA practices that included the following:



FIGURE 11
Direct seeder (animal drawn) imported from Brazil



- i. land preparation for planting using animal drawn trampling knife rollers which achieved the most minimal disturbance of the soil while flattening the vegetation and residues including from cover crops.
- ii. direct seeding using hand operated Brazilian made jab planters (*Cannes planteuses*) (see Figure 10) and animal drawn disc seed drills (see Figure 11) to minimize soil disturbance during seeding and to achieve more efficient plant spacing.

Crop diversification for multiple utility:

Burkinabe farmers traditionally grow a restricted range of subsistence crops, mainly the cereals maize, pearl millet, sorghum, and the legumes groundnut and sprawling variety of grain cowpea, locally called *niebe*. PRODS/PAIA project extended the range of crops in the cropping system to improve crop mix and crop rotations to raise farm incomes, enrich diets, improve soil fertility, and increase biomass for fodder and silage and for soil cover with cover crops and residues.

Technologies for crop diversification in the cotton- and cereal-based systems under CA practices included:

- (i) Diversification of cereal-legume associations (maize, sorghum, millet with long season grain cowpea) with improved cereals and four legumes – early maturing cowpeas, soybeans, dual-purpose cowpea and *Mucuna* for the following value added:
 - Early cowpeas (60 days) and dual purpose cowpeas (see Figure 12) for grain and fodder of higher nutritional value especially during the dry season, as well as a source of biological nitrogen;



FIGURE 12
Dual purpose cowpeas for grain and fodder



FIGURE 13
The 2+4 sorghum-cowpea crop component of the sorghum-early (60-day) maturing cowpea-goats/sheep systems developed by IITA and ILRI



- Integrated crop-livestock systems developed by IITA and ILRI (e.g., the 2+4 sorghum or maize-cowpea-goats/sheep system) (see Figures 13 and 14). The cowpea haulms from the first 60-day crop are used to feed confined goats and sheep (Figure 14) and the manure is returned to the cereal fields;

FIGURE 14

The livestock component (confined goats and sheep) of the integrated crop-livestock system based on the cereal-early maturing cowpea cropping developed by IITA and ILRI



- Soybean for vegetable oil, for which there is a high demand, and a source of fodder and feed concentrate, and of biological nitrogen;
- *Mucuna* as a cover crop (see Figure 15) to provide soil cover to prevent top soil loss, increase effective rainfall, suppress weeds and add biological nitrogen;
- Feeding livestock with locally processed *Mucuna* seed rations to increase meat and milk production, and improving feed rations with legumes for dry season feeding.

FIGURE 15

Mucuna surrounded by living fence in rotation with no-till maize and cotton



(ii) *Brachiaria* spp. (see Figure 16) plus local grasses for production of silage through pit silage method for livestock (see Figure 17, and next section for details), including salt-lick production; root masses of sown grasses

FIGURE 16

PRODS/PAIA introduced the high biomass grass, *Brachiaria ruzizensis*, to improve availability of livestock feeds during the dry season



FIGURE 17

Women managing pit silage making with *Brachiaria* and local wild grasses



also increase soil organic matter and keep soil surface protected (see Figure 18); this is particularly effective in the light-textured soils where building soil organic matter is so difficult.

- (iii) Introducing cassava as a 'new' crop (see Figure 19) in the cropping system for food security, and an energy source for food and feed rations.
- (iv) Integrating agro-forestry with crop production by planting living fences of fodder trees such as *Acacia* and *Ziziphus* to protect the crops and crop residues from livestock during the dry season (see Figure 20).

Furthermore, as a result of improved supply of better quality livestock fodder and feed (see next section), the range of livestock reared by farmers was

FIGURE 18
Soil cover with *Brachiaria* residues



FIGURE 19
Cassava (left), growing luxuriantly, is one of the new crops promoted by the PRODS/PAIA project to diversify crop production



expanded by the introduction of better management practices for cattle, sheep, goats, chicken and guinea fowls, through FAO's support to a companion activity – The Special Programme on Food Security.

INTEGRATION WITH LIVESTOCK PRODUCTION

Silage and salt-lick production:

Extensive cultivation of the high biomass grass, *Brachiaria ruziziensis*, was introduced to farmers in the PRODS/PAIA sites to encourage them to use this grass, among other locally available plants for silage production (Figure 16).

FIGURE 20

Integration of crop production with agro-forestry: Living fences surround farm of no-till maize and cotton after *Mucuna* soil cover



The production of livestock in the Oubritenga province of Western Burkina Faso, in particular, is precarious due to shortage of feeds and the prolonged severe dry periods when livestock, especially small ruminants experience high weight losses and in some cases, may even die. Although cotton seed is sometimes used to feed livestock to supplement available feeds, this has not been sufficient. Furthermore, farmers were encouraged to collect crops wastes of several leguminous plants including *Mucuna*, fodder cowpea, grain cowpea and soybean for incorporation into livestock feed rations during the dry season.

Despite these efforts, the dry season availability of feeds for livestock continues to constrain sustainable livestock production. Consequently, PRODS/PAIA introduced a silage production technology to farmers and further organized training for women farmer groups in silage production using locally available herbage, such as grasses, cereals and salt.

The silage production technology introduced by PRODS/PAIA is as follows (see Figure 17): Naturally growing wild grasses, mainly *Andropogon gayanus*, *Brachiaria ruziziensis*, *Digitaria ciliaris* *Echinochloa* and *Pennisetum pedicellatum*, are harvested at the early flowering stage when the moisture content is about 30 – 40%. Green cereals residues of poorly developing maize, rice, sorghum or millet crops are also harvested for use in silage production.

Silage pits measuring 3m x 1m x 1m are dug by hired male labour and harvested herbage is packed in 5 -10 cm layers into each pit which contain about 4 tonnes of herbage. The layers of herbage packed into the pit are compacted by rolling a 200 litre metal drum filled with water over them after which, common salt is sprinkled on the herbage. When the pit is full, it is covered with soil and thick black plastic sheeting and further compacted

to seal the pit watertight. The herbage is then left to ferment and cure for about 3 weeks after which it is ready and collected for feeding to livestock. Before using the cured silage to feed livestock, it is aired for 24 hours to allow noxious gases formed during herbage fermentation to escape, which could be poisonous to animals.

Sprinkling salt in the herbage during silage production produces salt-laden soil as a by-product, which constitutes salt lick which livestock love to eat. Further production of salt-licks is achieved by making the pit 20 cm deeper to accommodate a layer of fine sand or kaolin clay on which about 0.5 kg of salt is spread prior to placing the layers of herbage into the pit for silage production. When the silage is cured, this salt laden sand or clay is compacted into 40 x 20 x 10 cm wooden frames, and sun dried to produce 2.5 kg salt-lick blocks.

Through FAO/INERA collaboration, extensive studies in Western Burkina Faso showed that the opportunity cost of silage and salt lick production using this technology, is low with a cost-benefit ratio of 527%, and therefore highly profitable and beneficial to small holder livestock farmers. Feeding Azaouak cows on silage supplements resulted in a dramatic tenfold increase in milk production, while ewes fed on silage supplement maintained milk yields throughout the year.

Farmers quickly adopted this silage production technology not only to successfully feed livestock during the dry season but also as an income generating opportunity through the sale of silage and salt-lick blocks. To widely disseminate this now popular technology, PRODS/PAIA conducted group training courses in silage and salt-lick production in several villages not only to build farmer capacities to produce silage and salt licks, but also to facilitate promotion of farmer-to-farmer dissemination of the practice. Thus between year 2002 and 2003, the numbers of beneficiary farmers increased 120 (80 women, 40 men) to 537 farmers (352 women and 185 men). The technology has now spread by farmers to 12 farmer groups in 17 villages, each consisting of 50 – 80 farmers.

Thus through the introduction of forage technology for the production of livestock feeds, farmers successfully increased the levels of animal production and enhanced their farm incomes. Furthermore, farmers were encouraged to judiciously collect crop residues of several leguminous plants including *Mucuna*, fodder cowpea, grain cowpea and soybean for incorporation into livestock feed rations during the dry season, while leaving soils covered to protect them from erosion and to increase soil organic matter.

Mucuna seed processing for value added livestock feed:

The introduction of *Mucuna* as a cover high biomass crop to enhance soil and water conservation, improve soil fertility and minimize soil erosion and degradation was widely adopted by farmers who produced the cover crop on a

FIGURE 21

Sawadogo Salam Lassane, the proud Burkina farmer who developed the *Mucuna* seed processing technology



large scale. High production of *Mucuna* now posed the challenge of maximum utility of this crop, particularly the abundant seeds harvested from the crop.

One innovative farmer, Sawadogo Salam Lassane (Figure 21) at the Dande village community decided to experiment with several processing methods and successfully developed a *Mucuna* seed processing technology for the production of livestock feeds for cattle, sheep and goats. *Mucuna* seeds contain a heat labile toxin, so the use of fire wood for cooking the seeds, to enable seed use, may be a limitation for some farm families.

Feeding livestock with processed *Mucuna* seed rations was highly successful. Sheep fed on feed including boiled *Mucuna* seeds increased their weight by at least 35%, and milk production in goats was significantly increased. Through adopting this processing technique, farmers were able to significantly increase their farm revenue from the sale of fattened livestock as well as the production and distribution of *Mucuna* seeds to neighboring farmers.

BENEFITS AND OUTCOMES FROM PRODS/PAIA

According to the participating farmers, PRODS/PAIA project produced highly significant positive innovations and changes not only to the individual lives of rural farming families, but also provided new directions in the patterns of rural community life and development. The PRODS/PAIA project introduced farming technologies adopted by farmers that have enabled them to enhance the productivity potential of the land, achieve more sustainable increases in agricultural production, natural resources conservation and environmentally sound farming practices, improved food security, higher farm incomes which have contributed significantly to the attainment of better and sustainable rural livelihoods and to the fight the dehumanizing effects of rural poverty.

Case studies undertaken across the five participating farming communities, based on interviews of farmers, national partners and policy-makers, illustrated a range of benefits and outcomes resulting from the PRODS/PAIA project. Some of the highlights are as follows.

Case Study 1: Klesso Village

1. Planting *Mucuna* cover crop and cowpea improved soil fertility *Striga* control and gave significant increases in overall crop production; *Mucuna* leaves and other fodder were very useful for feeding livestock to increase family income
2. Crop yields were higher when legumes were rotated with cereals such as maize
3. The PRODS/PAIA technology introduced and adopted did not increase the cost of labour for crop production
4. By adopting PRODS/PAIA technologies, cowpea and maize production were increased to such an extent that we were able to store products and sell them at much higher prices to increase farm revenue. With increased farm income, there was an improvement in family livelihood.

Case Study 2: Karaba Village

1. Farmers learnt lessons in soil conservation, and in sustainable and increased agricultural production
2. After harvesting their cotton, farmers practiced crop rotation technology involving “dual purpose” cowpea and maize which helped to increase food and agricultural production
3. *Mucuna* cover crop was highly effective in soil conservation and controlling soil erosion which had been prevalent in their farms. *Mucuna* foliage and the transformed seeds were also useful as feeds for their livestock; *Mucuna* foliage was highly nutritious, giving rise to well developed and healthy animals that fetched higher market prices according to farmer consultations.
4. Residue from farm harvests were also used for feeding livestock
5. The introduction of living fences effectively protected their crops from damage by roaming animals and stealing of crops by intruders
6. Soybean production increased to the extent that the Karaba village farming group association won contracts to supply soybean seeds to a commercial soya processing company. This resulted in significant increases in farm incomes
7. Through participation and adoption of PRODS/PAIA technologies, two of their members, Mr Fankani Tini and Mr. Tiki won the annual National Merit award (*Ordre du Merite du developpement Rural*) in October 2005 for Excellence in agricultural production.



Case Study 3: Dande Village

- 1 Adopting zero tillage practices resulted in better and healthy growing plants than when crops are grown in ploughed fields
- 2 The Dande area is characterized by serious land pressure since the migrant/settler farmers there cultivate the same land for over 20 years resulting in low soil fertility. Crop rotation involving cowpea and maize, and the use of *Mucuna* cover crop, resulted in improved soil conditions, reduction of *Striga* infestation and consequently in higher cowpea and maize yields. Increased crop harvests translated to increased farm income for them and they were able to satisfy their domestic food needs and have surpluses for sale in local markets.
- 3 The successful development of *Mucuna* seed processing and utilization for livestock feed by one of their innovative farmers, Sawadogo Salam Lassane, opened up excellent opportunities for wide-scale increased livestock production in their locality. Livestock fed on 1kg/day of processed *Mucuna* seeds rapidly increased in weight, weak animals were quickly revived and milk production in dairy animals was drastically increased.
- 4 Because of the success farmers achieved with the *Mucuna* seed processing, they undertook extensive training of other farmer groups outside the project in *Mucuna* cultivation and seed processing for the general benefit of farmers in their country.

Case Study 4: Tanghin Kossodo Women Group. (*Groupement pre-coopertif feminin Song-Waoga de Tanghin Kossodo*)

The Tanghin Kossodo Womens Farmer Cooperative Group was formed in the Province de l'Oubritenga. The Group consisted mainly of 26 women but they admitted six men into the group. Three Action Groups, namely (i) Traditional Chicken Production, (ii) Small Ruminant Management and (iii) Cattle Fattening, had been established to promote village commercial enterprises.

Following participation of this group in PRODS/PAIA, the major activities undertaken on a large scale included silage production and livestock production. Through participating in the PRODS/PAIA project, the farmers achieved the following:

1. Adopted a silage production technology, with salt added to provide salt-lick as a by-product of silage production. The salt-lick is vital for rapid and full development of livestock. Farmers here now undertake continuous production of silage for sale to generate extra income to purchase more livestock for fattening and to educate their children. Consequently their economic standards have improved with additional financial resources now available to allocate for family expenses and to expand their agricultural production businesses

2. By feeding animals with the silage and salt-lick supplement, ewes maintain milk production throughout the year; Azaouak cows fed on silage and salt-lick supplement produced 10 liters of milk each day throughout the year
3. Silage production technology was now disseminated through publications and conducting regular training courses for farmer groups from surrounding villages. Furthermore, farmer Groups from other parts of Burkina Faso, from Ghana, Niger, Congo and Benin have undertaken study tours to the *Tanghin Kossodo Women Group* for practical experience in silage and salt-lick production
4. Following the outstanding success achieved with cattle production through the use of locally produced silage and salt-lick, the Cattle Fattening Action Group of this Tanghin Kossodo Women Cooperative has received supply contracts from entrepreneurs in Ghana for fattened cattle. The successful development and organization of this enterprise has significantly improved community life in the Oubritenga locality.
5. With improved economic status, several farmers have been able to build many more and better houses to accommodate their extended families

Case Study 5: Training and capacity building in integrated production intensification

With the adoption of sustainable agricultural production practices introduced by the PRODS/PAIA project, the rapid dissemination of these technologies and good agricultural practices were promoted through extensive participatory group farmer training and capacity building activities. Training was conducted in the following topics:

1. Participatory Community Planning – This was attended by 140 farmers (65 males and 54 females) from eight villages to assist farmers to identify training needs for agricultural production
2. Silage production – involving 2,000 farmers were trained in 30 silage production sites, to increase availability of livestock feed resources including salt licks
3. Use of conservation agriculture equipment – for six lead farmer trainers and four supervisors, to promote agricultural production in the context of environmental resources conservation application of chemical pesticides
4. Training in the processing of *Mucuna* seeds for livestock feed – involving 500 farmers from the five PRODS/PAIA sites to increase the availability of rich livestock feeds and salt lick as well as generate income through the sale of prepared silage
5. Use of *Mucuna* for soil fertility enhancement and *Striga* control; potential seed are for feed when boiled for several hours to eliminate toxins.



A CONVERGING PARTNERSHIP – A COMMUNITY OF PRACTICES (CoP)

In general, with the introduction of Conservation Agriculture practices and additional crops (e.g., forage and food legumes, grasses, fodder trees), there was an increased demand for capacity building for dissemination of promising technologies for biomass management and livestock feed delivery in integrated crop-tree-livestock systems. With training support for farmer capacity building and technology fine-tuning, the CA technologies, particularly minimum or no-till in crop rotation with cover crops, are ready for scaling of sustainable crop intensification that offers optimum productivity and greater competitiveness. Minimum or no-till as one of the components of CA to improve soil organic matter and the soil biotic activity it supports, as well as to improve soil porosity, is particularly suitable and convenient for planting early, for improving soil fertility and moisture availability, for extending the rainfed growing season, and for reducing energy requirement. Selecting cover crops, including live mulch and fodder crops such as *Mucuna* and *Brachiaria*, combined with main food crops will at times be necessary to ensure that soil surface remains covered with plant material all year including the long (5-6 months) dry season. One size does not fit all situations; knowledge and understanding choices are essential.

There is now in existence a converging partnership – a Community of Practices (CoP) -- in place requiring the inclusion of critical input and output technology supply elements to ensure cost-effective scaling and impact.

Since 2004, FAO, the Ministry of Agriculture, the Ministry of Animal Resources and the Institute of Environmental and Agricultural Research have accompanied the National Cotton Growers' Union (UNPC-B) in the promotion of Good Agricultural Practices emphasising IPM through capacity building (training of facilitators and farmers) in the complex cotton-cereals-livestock cropping systems of South Western Burkina Faso. So far, through a companion activity which has subsequently merged as of 2007, 35 FFS facilitators and 822 small farmers have been trained. The initial activities of this programme were funded by the Norway government. Since 2007, the programme has been funded by the sub-regional Integrated Production and Pest Management (IPPM) Programme through the Dutch government. The IPPM-FFS network in Burkina Faso is expected to expand to some 200 field schools. It is run by national institutions, facilitated by the FAO-guided project.

CHAPTER 5

Going to scale with farmer discovery process in Burkina Faso

The remarkable successes achieved by PRODS/PAIA pilot project in south western Burkina Faso clearly demonstrate how an FAO field project implemented with the extensive participation of national as well as regional and international development partners can significantly impact on the agricultural production and livelihoods of smallholder farmers in a moist savanna agro-ecological environment that can be difficult and hostile.

The PRODS/PAIA project successfully collaborated with other FAO projects in western Burkina Faso, especially, the Special Programme for Food Security (SPFS), the Sustainable Agriculture and Rural Development (SARD) initiative, and the Integrated Pest Management Farmer Field Schools (IPM/FFS). The PRODS/PAIA project introduced and adopted CA practices in cotton and maize production systems as an entry point. There was an outstanding impact at farm level as described by the participating farmers not only in all the project sites, but also amongst farmers in neighbouring communities who consistently demanded the technologies introduced by PRODS/PAIA.

The IPPM-FFS programme has trained facilitators and farmers in western, south western and eastern Burkina Faso, and the proposed process will extend its activities to these regions. The scaling process will promote on-farm farmer-participatory discovery and adaptation of promising pipeline technologies which will feed into FFS. Since 1996, FAO has introduced FFS in Burkina Faso through a rice-based initiative in the Valley du Kou and in several other locations involving cotton and vegetable production systems.

As a result of the pilot project outputs, INERA, DVRD and the farmers were able to establish the following outcomes, namely that:

- Technologies for crop diversification and crop and livestock intensification are ready for scaling. There is a great interest for soybean as vegetable oil;

- With training support for farmer capacity building and technology fine tuning, the Conservation Agriculture (CA) technologies, particularly minimum or zero tillage in crop rotation with cover crops, are ready for scaling (these correspond to NRM technologies in association with several crop commodities) and further adaptation. Minimum or zero tillage is more convenient for early growers, and for soil fertility and moisture management in the resulting extended growing season;
- There is an increased demand for capacity building for dissemination of the promising technologies for biomass management and livestock feed delivery in integrated crop-tree-livestock systems;
- There is in existence a converging partnership in place requiring the inclusion of critical input and output technology supply elements to ensure cost-effective scaling and impact. Recently, plant breeders have expressed their interest for fodder species for on-farm high biomass production, fodder quality management and seed access; and
- The integrated approach in place both to develop and test technologies and to train farmers (Benchmarks sites + Farmer Field Schools + Monitoring and Evaluation) in a participatory process has proved to be effective.

The above positive outcome from the pilot project, though anecdotal but confirmed from technical field visits, provides a strong justification for a follow-up ‘going to scale’ process that can strengthen the essential input and output supply chains in support of adoption and scaling up of the dissemination of promising technologies for crop diversification and intensification, CA for sustainability and intensification, and livestock feed delivery for optimal integration of crop-livestock relationships.

Consequently, a “Going to Scale in Burkina Faso” process is proposed, within the context of the current government’s policies for agriculture development, with the main focus on capacity building and empowering of farmers and local agribusiness entrepreneurs to promote the sustainable diversification and intensification of crop-livestock production systems based on Conservation Agriculture practices in the moist savanna ecology of Burkina Faso, with the ultimate goal of reducing extreme poverty.

Thus, INERA and DVRD, in collaboration with FAO, are jointly proposing to scale-up the effort to reach a meaningful number of farm families and impact. The integrated and participatory approach successfully applied by FAO-INERA-DVRD will promote proven technologies and practices. The scaling-up process includes on-farm farmer-discovery benchmark sites, Farmer Field Schools (FFS), “Community of Practices” and monitoring and evaluation protocol to assess the performance of the programme.



GOAL, APPROACH AND OBJECTIVES

Within the context of the current government's policies for agriculture development, the overall goal of the scaling-up process is: *to support the implementation of the Ministry of Agriculture's strategy to harness the agricultural productivity of crop-livestock systems in the moist savannas in Burkina Faso for livelihood and agribusiness development based on good agricultural practices.*

The integrated and participatory approach successfully applied by FAO-INERA-DVRD-DRAHRH, and linked to government agricultural development policies of promoting Good Agricultural Practices and farmer participatory empowerment through capacity building, is being proposed to promote proven technologies and practices. This approach will include an expanded network of on-farm benchmark sites as a generator of relevant and adapted technologies and practices for dissemination, Farmer Field Schools (FFS) process for participatory learning, the "Community of Practice" and Monitoring and Evaluation protocol to assess the ongoing performance and intermediate impact of the programme.

The scaling process has the following four major objectives:

Objective 1: The scaling up of adoption of CA technologies for intensification and fine tuning in benchmark sites of minimum or zero-till technology in crop rotations with cover crops and crop mixtures with legumes, grasses and fodder trees. This objective includes a component activity on strengthening the input supply especially for no-till direct planting equipment and knife roller technologies from local manufacturing or commercial importation.

Objective 2: The scaling up of adoption of new crop technologies for sustainable biomass and crop intensification (e.g., new crop mixtures with legumes, grasses and woody perennials), and for crop-livestock integration, diversification and intensification, including farmer-based seed supply systems for new crops and varieties such as early and dual purpose cowpea, *Mucuna*, soybean, pigeonpea, sorghum, *Brachiaria*, cassava and trees. The objective includes the activity for the introduction and testing the improved cereal-legume associations (e.g., the 2+4 cereal-cowpea cropping systems developed by IITA involving medium and short duration cowpeas with maize and sorghum, and the tree legume-cereal associations developed by ICRAF).

Objective 3: The scaling up of adoption of technologies for biomass management for mulch and soil cover, for livestock feed (fresh fodder and silaged, *Mucuna* seeds), and for livestock feed delivery for livestock intensification in integrated crop-tree-livestock systems (IITA/ILRI Sorghum/Cowpea/Confined Goat Technology). This objective includes the maximising

of biomass availability from grasses, cereals legumes (including dual purpose types) and trees with maximum BNF input, and feed from other sources such as fodder legume seeds, cassava, soybean, etc. The use of controlled grazing and technologies for silage-making to supplement quality fodder during the dry season will be a central component of livestock feed biomass strategy.

Objective 4: The consolidation and strengthening of the converging partnership or the “Community of Practice” for innovations dissemination with inclusion of critical national and international stakeholders for input and output supply services including credit, seeds, equipment, plant nutrients etc., to support the implementation of the scaling up strategy of the MoA. This objective includes the activities of advocacy and awareness raising as well as providing training for capacity building, through FFS and other mechanisms including benchmark sites network, to public and private sector stakeholders, including for strategic planning, supply and output delivery services, credit provisioning through the *warrantage* system and for enhancing participation of women farmers and entrepreneurs.

To deliver the above four objectives, the following programme strategies will be followed.

For Objectives 1: Dissemination of proven technologies and practices for diversification and intensification of the crop-livestock production systems will aim at the optimization of the crop rotations and the biological processes in the soil-plant-animal systems for efficient enhancement of economic productivity, biomass production, soil health and fertility enhancement, and of integrated pest management for efficient control of all pests including the use of botanical and biological pesticides. The application of the Integrated Production and Pest Management (IPPM) strategy will ensure that priority is given to alternatives to agrochemicals (i.e., botanical and biological pesticides or the enhancement of biological control agents). Agrochemicals will only be recommended when there is an evidence of the failure of these alternatives and under strict application of good agricultural practice and the use of certified safe equipment. Farmers attending FFS will select what is suitable to their physical and economic environment. Crop management training will include the management of climatic risks. For production and distribution of seeds, farmer-based seed supply systems will be promoted, including capacity building training.

For Objective 2: Dissemination of proven practices of minimum or zero tillage, protection of soil cover, enhancement of soil biota, soil organic matter accumulation and soil porosity development, integrated management of weeds, enhancement of rainfall infiltration and soil moisture holding capacity, and efficient storage, mobilization and uptake of plant nutrients will aim at a better soil-plant-nutrient-water system management. Training



will address capacity building in the use of Conservation Agriculture technologies. Through integration with livestock and compost making, it will aim at optimizing nutrient use efficiency. The IPPM strategy will promote alternatives to chemicals, (e.g., crop cover and residue management, mechanical and biological options) from the beginning. The dissemination of these technologies will be done directly through the IPPM-FFS network to reach a maximum number of beneficiaries. In the first year, attention will be paid to those CA technologies that are ready to be scaled through the IPPM-FFS network e.g., cover crops, high biomass legumes and grasses, residue management, weed suppression and depletion of seed reservoir, living fences etc. Alongside, in the first year, farmer-discovery bench-mark sites including larger on-station sites will be used to further evaluate these and other CA technologies, particularly minimum or zero tillage and direct seeding practices before they are introduced into the IPPM-FFS curricula. Living fences will be established in the IPPM-FFS as has been done successfully in the Bama FFS site.

For Objective 3: Dissemination of proven practices for biomass production and conservation strategy (silage, hay and cereal residue treatment with urea) for smallholder livestock producers in integrated systems will aim at maximising biomass availability from grasses, cereals and legumes (including dual purpose types) and trees with maximum BNF input. It will also aim at increasing the production of feed from other sources such as fodder legume seeds, cassava, soybean, etc. in order to give more options to farmers in relation to their own constraints and potentialities (land tenure for example). The use of technologies for silage-making to supplement quality fodder during the dry season will be a central component of livestock feed biomass strategy.

For Objective 4: Advocacy activities and awareness raising for policy support and other key stakeholders will be undertaken to consolidate the converging partnership or the community of practice to serve as a platform for innovations dissemination. Training for capacity building will be provided through FFS and other mechanisms to stakeholders including private sector for inputs (herbicide, equipment, seeds) and output supply chain services (linked to livelihoods of producers, output delivery service providers, consumers), for strategic planning and workshop facilitation, and for the provision of credit and consideration of *warrantage* system for accessing finance. Efforts will be made towards enhanced participation of women farmers and entrepreneurs.

The FAO coordinated IPPM-FFS regional programme has trained facilitators and farmers in western, south western and eastern Burkina Faso, and the proposed scaling-up process will extend its benchmark site activities to these regions. The on-farm farmer-participatory discovery and adaptation of promising pipeline technologies will feed into the FFS network. The scaling-up process will expand its benchmark site network to up to 10, and scaling will

be through at least 100 IPPM-FFS sites over a five year period, implemented at the rate of 10 IPPM-FFS (first year), 20 (second year), 30 (third year), and 40 (fifth year).

EXPECTED OUTPUTS AND OUTCOMES

Key outputs will relate to: (1) increased capacity building through the IPPM-FFS approach: increased number of trained farmers and increased farmer capacity to adopt and manage technologies for diversification and intensification in crop-livestock systems; and (2) strengthening farmer support system: increased number of service providers in the input and output supply chains.

Increased capacity building will relate to numbers of farmers trained and applying technologies in the following areas:

- Crop diversification and intensification for the market
- Marketing
- Livestock diversification and intensification for the market
- IPM for pest control
- Conservation Agriculture technologies for sustainable soil system management and crop-livestock intensification
- Equipment and its use, crop rotation, cover crop
- Farmer-based seed supply systems
- Silage making and biomass management for livestock feed
- Compost making and biomass management for soil fertility.

The strengthened farmer support systems will relate to numbers of agribusiness stakeholders trained and/or integrated within the “community of practice” (Platform for innovations dissemination) with the objective of delivering inputs and outputs services in the following areas:

- Inputs supply agribusinesses enabled to supply inputs and farm equipments etc.
- Outputs service agribusinesses enabled to process and deliver primary produce and processed products to markets
- financing.

Key outcomes will relate to absolute and percent change in livelihood, economic development and environmental benefits in terms of number and type of people affected including also from reduced labour requirement resulting from the adoption of CA practices, expansion of area under new practices, changes in agricultural productivity and primary and secondary biological output, and enhancement of soil productivity and ecosystem services, resulting from the above outputs. Quantifiable impact targets will be



defined to reflect expected changes in:

- Area and people under different crop and livestock diversification technologies and CA intensification technologies, including women, elderly farmers, and the physically weak:

We expect 5,000 participants in the 200 FFS that will be organized during the 5 years of the project. If each participant represents a household, then a total of 5,000 households will be directly affected by this project. The FFS convey hundreds of non-targeted farmers during field days. An average of 150 farmers is expected to visit each FFS. So a total of 30,000 farmers will be exposed to the new technologies and practices. One third of these farmers are generally female.

- Productivity and output of crop and livestock products:
Based on previous results in the cotton-based FFS, the expected yield increase is about 30% for cotton and 40% for maize. The gross margins with cotton will increase 2.5 times and that of maize 2.8. The cropping area for soybean and cassava is expected to double as there is a growing interest for these crops. Feed production will be integrated in the cropping systems and will be more accessible and available all year round.
- Food production, availability and nutrition dimension of food security:
Food production will increase by about 30%. With crop diversification, more food should be available all year round; nutrition and food security will be improved.
- Food marketing.
- Livelihood parameters, particularly income and social services being accessed, with emphasis on rural women:
The overall livelihood of affected populations will improve. The sources of rural women incomes will be diversified.
- Resilience of the production system to abiotic and biotic stresses, sustainability of the land resource base, and enhancement of ecosystem services:
Land management will be sustained through the dissemination of new adapted technologies (cover crops, legumes, fodder crops etc.). Conservation Agriculture technologies will impart greater climate change adaptability to the production system leading to: (a) improved soil moisture growing conditions, reduced impact of rainfall variability and droughts on yields, and reduced pest and disease problems; (b) improved rainfall infiltration, minimum runoff and soil erosion; (c) increased soil Carbon sequestration through higher levels of humic and non-humic SOM and soil biota, and improved aquifer recharge and stream flow.

THE WAY FORWARD WITH THE 'COMMUNITY OF PRACTICES'

One of the main strengths of PRODS/PAIA was the direct farmer participation, including the use of their farms as demonstration sites, farmer training activities and participation in field days for sharing of experiences and information exchanges between farmer groups within Burkina Faso and other countries in the West Africa sub-region. Many of the faced problems to improve agricultural productivity lie at the interface between productivity improvement, sustainable natural resource management, markets, policies, and institutions. Formal research and extension systems are stretched thin, farmers often lack access to necessary resources, and many stakeholders in agricultural value chains are left out of the innovation process development and dissemination. Policies and conventional practices have often skewed existing groupings and patterns of interaction so that innovation processes are not responsive to the welfare needs of the farmers.

The evidence from the Burkina Faso experience suggests that the most successful innovations development and dissemination have come about by bringing together all relevant stakeholders to co-design interventions, learn from one another, and change the norms and practices that comprise the institutional context. In other words, success is about the capacity of whole systems to innovate and integrate. Behavioural changes in all concerned stakeholders is necessary.

The term "Community of Practices" (CoP) is used to describe the context in which stakeholders interact. CoP is comprised of a set of stakeholders who are bound together by their individual interests in a shared issue, objective, challenge or opportunity, dealing with which will improve livelihoods, businesses and/or other interests. The leverage points for making a significant difference lie mostly in the interaction between the different components or actors in the system, rather than in strengthening any one component on its own. Strengthening interaction is largely a matter of bringing about institutional and behavioural changes. To improve agricultural productivity of the moist savannas in Burkina Faso by dissemination of proven technologies and agricultural practices will require a large partnership within the CoP.

To scale up the successes of the PRODS/PAIA, there is a need to strengthen the CoP through the building up of the capacity of farmers in the strategic practices e.g., IPM, soil fertility and biota management through Conservation Agriculture principles and practices, short-term and longer-term climatic risk management, and knowledge brokering and management, through the training of trainers (ToT) approaches being implemented in the FFS networks for capacity building. Such approaches including farm life schools and junior schools implemented within participatory community development initiatives can make farmers become 'experts' and self-confident. Such ToT approach in Farmer Field Schools has trained 3 million farmers in IPM principles and



practices in Asia, and with appropriate curriculum and field based training and testing it would be possible to train a large numbers of framers in integrated plant-pest-soil-water-nutrient management. Since 2001, 25,000 farmers have been trained in three countries in West Africa, and the second four-year phase now beginning aims to train 130,000 farmers. The focus is on the quality of training and the efficiency of the ToT approach, including self-sustainability through for example auto-financing schemes in which farmers hire extension agents through savings and microloans. Such scheme would be relevant in future expansion of the PRODS/PAIA approach in West Africa.

The extensive interest generated by the evidence of success of PRODS/PAIA in the five locations in Burkina Faso encourages farmers and national partners to request that this ‘Community of Practices’ in intensified integrated production systems be further strengthened and extended to many more sites in the moist savanna zone not only in Burkina Faso but also to other countries in West Africa with similar agro-ecologies. Such expansion and scaling up of the successful approaches can be achieved through support from international and regional donors and development partners which have established on-going community agricultural development programmes in West Africa. Other international donors can be brought into the stakeholder partnerships within the CoP to systematically promote the large scale intensification of integrated land and production management systems through participatory community development programmes across Sub-Saharan Africa. Various forms of market responsive Conservation Agriculture approaches and of farmer-based “innovation and learning” processes of knowledge generation and transfer would have a central role in different situations in such programmes.

The technology inputs from CIRAD, IITA, INERA and DVRD are already captured within the existing “Community of Practice” (CoP). Planning Unit of MoA, UNPC-B, Ministry of Animal Resources (MoAR), ICRAF, EMBRAPA, CIAT, ILRI, IFDC, AGRA and other partners from the private sector e.g., banks, rural engineering firms, agricultural input and service providers, will join the partnership initiative to support and facilitate the technology adoption and scaling up process, and input and output supply service for technology delivery such as credit, equipment, seeds, plant nutrients, produce processing and delivery, etc. Agrochemicals such as plant nutrients and herbicides may be required in the beginning for corrective action but subsequently any further use of herbicides and any other pesticide would be confined to a judicious minimum application only as part of the broader IPPM strategy in use in the FFS network.

The FFS model for knowledge dissemination and farmer learning has been adopted by the Ministry of Agriculture in Burkina Faso as the agricultural extension model for the future, and the Farmer Field School network is being expanded nation-wide. Also, the Direction of Extension

& Research-Development (DVRD) has established a unit dedicated to the promotion of good agricultural practices. Consequently, the proposed scaling-up process will fully embrace FARA's Framework for African Agricultural Productivity (FAAP) principles and guidelines for improving institutional arrangements for implementing Pillar IV of the Comprehensive African Agricultural Development Programme (CAADP). It also responds to the call for agricultural adaptation to climate change, which will be increasingly essential for smallholder livelihoods in the savanna ecologies of Burkina Faso and in West Africa. In all this, stakeholder involvement across public, private and civil sectors including AGRA, EMBRAPA, CGIAR System, IFAD, CIRAD, FARA must provide the driving force for R&D commitment and new knowledge for crop and livestock diversification, and for rehabilitating land productivity for sustainable agricultural intensification. Convergence with crop and livestock filed activities for development, such as those of IFAD, AGRA, EMBRAPA, etc, is considered as highest priority.

Contact:

Eric Kueneman, AGP, FAO (eric.kueneman@fao.org)

William Settle, AGP, FAO (william.settle@fao.org)

Brahim Kebe, RAF, FAO (brahim.kebe@fao.org)

Theodor Friedrich, AGP, FAO (theodor.friedrich@fao.org)

Caterina Batello, AGP, FAO (caterina.batello@fao.org)

This is a story about how FAO assisted groups of farmers in five farming communities in the moist savanna zone of South Western Burkina Faso to enhance their crop-livestock systems through Conservation Agriculture (CA) practices, including crop diversification, using an innovative farmer discovery process, to bring about agricultural intensification and improvement in livelihoods. FAO's assistance was delivered largely by working with national institutions, adding value to ongoing stakeholder resources and activities.

It is a story of positive intensification outcomes brought about by adapting 'proven principles and practices' of CA and crop diversification into existing crop-livestock systems. FAO worked with a range of stakeholders including the farmers and their communities, and the research and extension stakeholders, to create convergence and enable a farmer-based discovery process to experiment with a set of fundamentally new principles and elements in their farming practices for integrated crop-livestock production intensification.

The positive outcomes offer a real promise and an opportunity for bringing about a large scale impact on agricultural productivity and livelihoods in the moist savanna zone of West Africa, often referred to as the potential 'bread basket' because of the zone's high productivity potential for integrated crop-livestock production. The conceptual elements draw substantially from new innovations in sustainable intensification in similar agroecologies in the savannas of Brazil. This publication describes the multi-stakeholder process which led the successful outcomes, and the opportunity for a greater change that now exists and should be harnessed for sustainable agricultural development, nationally and regionally.

ISBN 978-92-5-106508-2 ISSN 1020-4555



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