Soy Production and Agricultural Systems for Small Producers in the Province of Huambo, Angola.

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Introduction

The soybean has a set of features that allow it to be highly valued in terms of nutrition and agricultural development. Agriculturally, soy beans have the ability to fix atmospheric nitrogen for use by the growing plant and crops to be grown after the soybean rotation (Chianu, et al, 2009;. Misiko, et al, 2008). Moreover, soybeans are relatively easy to grow and have a low incidence of pests and diseases. Other advantages include the structure of own harvest. As a plant relatively low, most soybean varieties are about 14 inches tall and fan out once established in a wide canopy that blocks light to weed competition.

Nutritionally, soy is the only plant source of "complete" protein based which means that it provides sufficient amounts of all eight amino acids that the body cannot make on its own. Soy protein quality also outranks all other protein sources, except egg whites. Thus in areas where sources of high quality protein such as eggs, meat and milk products are not available or affordable, nutritious soybean provides a replacement which is lower in both fat and cholesterol. Soybeans also provide a number of additional vitamins and minerals and are a source of Omega 3 and fatty Omega acids, all of which combine so that it can be regarded as a highly nutritious food (American Soybean Association, 2004).

This combination of agronomic and nutritional properties of soybean make it key in systems for improved soil fertility for agricultural development, while the affordability and nutritional value of soybeans make it popular for food aid. The flexibility of soybeans make them one of the most widely adopted cultures and has been adapted around the world (Chainu, et al., 2009).

Angola has good potential for agricultural production, given the amount of land available (58 million hectares), its suitability for agriculture production (for instance, more than 90% of the country is suitable for soybean production), and its fertility (some areas can achieve 2 seasons of soybeans without irrigation) (TechnoServe, 2011).

The soybean industry is characterized by imported inputs (mainly from Brazil, South Africa, and Zambia), low and centralized production, dominated by commercial players (around 15,000 ton, 70% from commercial players), small domestic market (small poultry industry, and significant pork industry, but very informal and fragmented), very low trade, except for soybean oil (95,000 tons imported), and poor infrastructure (transport, ports and storage) (TechnoServe, 2011).

The cost of producing soybeans varies between $300 and $600 per ton. The main problems are low yields and a lack of access to markets, lack of knowledge on production, and lack of cohesive industry bodies (TechnoServe, 2011).

Often times farmers use local seeds that come from previously harvested seeds. And while seed traders sell enhanced, imported seeds, they sell them at a rate that makes it impossible for small farmers to purchase them without subsidies. Therefore local farmers are left without alternative seed options and are essentially forced to use local varieties that are poorly selected and of low quality.

On the other hand, imported seeds are not adapted to the local conditions as they demand for higher rates of fertilization application and intense labor. As a result, post-harvest losses are very high, ranging between 30% and 40%. These losses are due to lack of pre-storage and selection, in addition to poor drying practices. The technical assistance to small producers is at the heart of harmful traditional agricultural practices.

Recently the demand for soybean production has escalated in the province of Huambo and Bie. Paradoxically, the annual production of soybeans in Angola is low, despite a high demand within the food processing industry and animal feed. Field research data asserts that the region can obtain yields ranging from 1.2 to 2.5 tons/hectare when using improved germplasm. Soy is an important crop with clear properties that can positively contribute to soil health, nutrition and human health, nutrition of livestock, family income, poverty reduction and overall improvement of livelihoods and ecosystem service.

Therefore, the local cooperatives need assistance identifying varieties that can be adapted to the local conditions, multiplying these varieties at a cooperative level as well as, selecting the fields and storage using the prototype stores and distribution to their members.

The CODESPA Foundation has been working in Angola since 2010 on a rural development four-year program , with a focus on value chains. The program consists of a comprehensive (legalization, technical training, management training, market access and access to credit) and plural (in coordination with local authorities, NGOs and international bodies: TERRA FAO, FAO SPFS, IDA, IIA, FCA, Municipalities and communications, etc..) strengthening of 40 agricultural organizations (cooperatives / associations) for a total of 700 families (40% women) in the Provinces of Huambo (Caala and Bailundo) and Bie' (Cuemba, Nharea, Kuito, Kamacupa, Kunhing), with the aim of systematizing a replicable model of local agricultural development, integrated into the PMIDRC (Municipal Integrated Rural Development Plans to Combat Poverty).

CODESPA in coordination with UNDP is strengthening small farmers associations and cooperatives through the promotion of soy production and commercialization, in the provinces of Huambo and Bie, for the period of ten months. This document is the first step in a much larger project that includes testing improved varieties as well as strengthening the complete value chain for soy.

Theoretical Framework: Local Knowledge

One of the points of departure of this paper is the importance local knowledge. Local knowledge may be defined as dynamic and complex bodies of know-how, practices and skills that are developed and sustained by peoples/communities with shared histories and experiences. This knowledge provides a framework for decision-making in a plethora of social, economic and environmental activities and livelihoods among rural peoples. Local knowledge, therefore, facilitates dynamic information systems critical in decision-making (Scoones and Thompson 1994). It is knowledge which is developed and used over time by local people and is influenced by environmental and socio-economic realities. It is based on experience which has been empirically tested and proven often over many generations and is adapted to local culture (NUFFIC 2003).

In Angola, as elsewhere, such knowledge has been shaped and modified by continuous farm level experimentation over many generations. Local knowledge, and its associated skills, has been developed outside the formal educational system and is embedded in culture and steeped in tradition. It is the basis for decision-making in rural communities with respect to food security, human and animal health, education and natural resource management. Several interrelated issues characterize the nature of local knowledge.

Firstly, it is localized in nature and, more often than not, traditional in context. Secondly, it is unique to specific environmental and cultural conditions. Thirdly, it is knowledge constructed in informal settings, it is orally transmitted and rarely documented. It is dynamic, adaptive and holistic in nature

and is a significant part of the way of life and subsistence of rural peoples everywhere.

An important issue is the importance of geographical scale in the definition of 'local'. The term can be applied at different spatial scales ranging from the village to the national level. In this paper, we use the term 'local knowledge' to describe knowledge and practices within a particular study area in Huambo, Angola.

The term 'local' does not mean that knowledge and practices originated in the study area, although this probably is true in at least some example cited. Neither does it mean that such knowledge and practices are unique to the study area, although this may be the case. Local knowledge may be focused on specific cash or staple crops and is likely to be fairly sophisticated where such crops are important to household food security or income. At the same time, different soil, environmental and cultural conditions may create differences in farming knowledge and practices about the same crop in geographically separated farming communities. Thus, although 'local' knowledge may have commonalities between geographical locales, the specifics often vary spatially. For example, all farming communities have informal knowledge about soils and there are common themes (like color and texture) that are used for classification. However, the basis of the classification and the local taxonomy often vary from area to area and from farming system to farming system.

Farmers experiment constantly and are capable of formulating their own innovations to solve problems (Scoones and Thompson 1994; Chambers 1989 1990; Chambers et al. 1989). Many traditional food production systems are complex, reflecting generations of careful observations of the agro-ecological and socio-cultural environment (Eyzaguirre 2001; Shepherd 2001), and producing food from diversified agro-ecological environments to meet the nutritional needs of local peoples. There is a growing recognition that such food production systems are far more sophisticated than they are given credit for, and that they can contribute significantly to food security at the household level.

Goal and Objectives

The specific objectives were: 1) rank the crops in terms of importance for the different cooperatives, 2) to evaluate current practices and production systems (with an emphasis on Soy) in use at the cooperatives, 3) diagnose problems in the soy production and interventions to improve them, 4) to train the cooperatives to improve farm management practices for soy, and 5) to examine gender activities.

Project Site

The province of Huambo is located in the central highlands of Angola, characterized by a mild tropical climate, with altitudes between 1,000 and 2,500 m. This plateau recorded rainfall between 1,250 and 1,500 mm / year and an average temperature between 18 º -20 º. Corn is the main crop, traditionally produced together with other crops such as beans, potatoes, soybeans, peanuts and sweet potato.

Methodology and Activities

We conducted an assessment on the problems affecting vegetable production, including management practices and pests affecting the cooperative's crops. This was done by conducting participatory rural appraisal (PRA) which is a set of participatory and largely visual techniques for assessing group and community resources, identifying and prioritizing problems and appraising strategies for solving them. The majority of the information came from seasonal calendars. These charts show monthly changes in climate (rainfall or temperature) or agricultural activities (agricultural hours worked, different activities

undertaken, crop cycles). The calendars are useful in identifying planting and harvesting times, labor constraints and marketing opportunities.

The seasonal activity calendar puts into visual form the seasonal patterns labor grouped by gender. The members explained each of their main lines of farming separately, in chronological order which activities they implement throughout the seasons and the character of involvement of men, women and children in each of these period/activities and the amount of time involved. The data was filled in the rows of the square using simple easy to understand codes and symbols.

Preference ranking was also used with the importance of crops. Preference ranking method helps to quickly get a good idea of what people think are the priority preferences. Individuals or groups vote on the items from most important to least important item. In this case the choices were between crops. The criteria attached were their importance in the household primarily in food security and later potential for sale.

The PRA was conducted with three cooperatives of which all have very different production systems. The first cooperative "Ekolelo" is composed of 75 producers that manually prepare the land which has gentle rolling slopes. The cooperative was formed in 2006 and legalized in 2011. The main objective of the Cooperative are support their members with improved agricultural techniques. The members live and produce in relative close proximity to the cooperative working both communal and individual plots. To date the Cooperative has not executed any projects but has successfully passed all the steps as it became legally incorporated.

The association of Chipipa has a much broader range of activities and land preparation techniques. It was founded in 2006 has 1,200 members in 32 associations. The cooperative has a board of directors that meets with delegates from each of the associations. The cooperative owns four tractors, raises cattle, farms communal land, owns small mill to process grains into flour, has a small store with agricultural inputs, and also engaged in forestry. The majority of the producers are manually preparing their land but also have the option of using a tractor from the cooperative. Other producers are using animal production for land preparation.

The cooperative "Agropecuario de Camponeses e Agricultores de Ussunda" has 110 members and was established in 2009. The goal of the cooperative are to improve their production, create professionals, serve as representatives with the government and NGO's, as well as to defend the interests e of smallholders (example is bargaining for lower fertilizer prices with the government and private vendors). To date the cooperative has coordinated their planting schedule (in this manner they can transport their crops to market together), worked together in raising animals (soliciting vaccinations, etc.), and diversifying their production system. The production system is much more driven by animal traction and manual labor.

The information from Participatory Rural Appraisal was combined with soil and germination tests. Soybeans need the 13 mineral nutrients, nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), magnesium (Mg), zinc (Zn), manganese (Mn), copper (Cu), iron (Fe), boron (B), chloride (Cl) and molybdenum (Mo). Of these, soils provide adequate amounts except for nitrogen, phosphorus, potassium, sulfur and iron. Rare instances of manganese and zinc deficiency have also been seen, but their occurrence is of only minor importance. In soybean crops, a proper balance of nutrients like nitrogen, phosphorus, and potassium can help achieve high crop yields. Soil testing provides the best opportunity to accurately measure soil nutrient status in order to see if the nutrients currently are sufficient for the production.

Ekolole

Chipipa

Agropecuario de Camponeses e Agricultores de Ussunda

A germination test was conducted to evaluate the quality of the seed. High quality seed is an essential factor to ensure good crop establishment. The seed must be viable and possess physiological traits that allow rapid germination and seedling establishment. Seed germination and vigor are the main physiological quality attributes. The highest vigor status occurs at physiological maturity, after which deterioration processes begin. Deterioration involves loss of membrane integrity, slower respiration, more leakage of electrolytes and decreased enzyme activity, all of which may be reflected in lower germination percentage (Delouche and Baskin, 1973). Roberts and Osei-Bonsu (1988) identified the symptoms of reduced vigor as slower and more variable germination, a greater proportion of morphologically abnormal seedlings and a reduced emergence from the seedbed under stressed conditions. Slow or erratic emergence and poor stand establishment are symptoms of low seed vigor (Tekrony and Egli, 1991).

There are several factors which affect seed vigor such as genetic make-up, mother plant nutrition, field weathering, time and method of harvesting, drying, processing, treating and storage (Harman and Stasz, 1986). Unfavorable pre-harvest and storage conditions accelerate the deterioration, during which seed germination and vigor are mainly affected.

For many crops, one of the main problems observed in the field is poor stand establishment, which can be influenced by seed quality, adverse climatic conditions, and poor field management (Maiti and Carrillo Gutierrez, 1989). The standard germination test is universally accepted as an index of quality for marketing seed (Barla-Szab6 and Dolinka, 1988).

Seed was bought in the local market from which producers buy their seed. We obtained a representative sample of the seed. We then spread a towel on a flat surface and moisten with water

until it is thoroughly damp. We placed the seed in an area with sunlight and applied water daily to remain damp. After the required germination period, we removed the towels from the container and unwrapped the seeds carefully so that the fragile shoots were not destroyed. We counted the seedlings that with shoots. We then determined the actual percent of germination (Maynard,and Hochmuth, 1997.

Results

Objective number one was to rank the crops in terms of importance for the different cooperatives. Extensive subsistence hoe farming without fertilizer provides by far the main economic occupation in all households in the cooperative. Some of the agricultural produces may be marketed at the main road or in town. The crops were ranked and the basic criteria were their importance as staple foods. Food security is basically guaranteed through the production of corn and beans. Corn was the most important crop in all three cases followed by beans in two of the three cases. Maize is grown by smallholder (mainly subsistence) in diverse production environments. Corn is the base of the diet in Angola. Most farmers practice traditional agriculture using hand tools for land preparation and weeding, planting local seeds held over from the previous harvest. Intercropping is the usual agricultural practice, with maize, beans, and cassava the most extensive.

Potato has also become an important crop as a "hungry season" crop as it was ranked third in two of the cases and second in another (see Table 1). In almost all of the cases if there was excess produce it could be sold.

Soy was ranked above beans by the Cooperative Agropecuario de Camponeses e Agricultores de Ussunda because disease problems and the relative stability of soy. In the other case soy ranked fourth and fifth . In this last case there was a perceived importance but the lack of seed limited the extensions it may be planted (see Table 1).

Cassava was ranked above horticultural produce in two of the three cases. Overall cassava is not ranked as high but provides some food security. It is also perceived as important because of its ability to remain in the ground and at any moment it is available providing added food security (see Table 1). Horticultural products were ranked last in two of the three cases mainly due to cost and water. In general these crops are perceived as as an important source of money for those families with sufficient capital to produce including seed, fertilizer, insecticides, and fungicides. These expenses put them out of many people's range. The other major limiting factor is the need for water and pumps in order to provide irrigation (see Table 1).

The importance of the exercise was to understand farmer priorities. The majority of the products were first for consumption and second for selling. As one participant stated, “we produce first to eat., then if there is extra we can sell it.” This is significant as we reach the section on local knowledge as we examined the section with local practices.

Last year there was severe drought, food insecurity, malnourishment, and infant mortality. The 2011-2012 agricultural season was marked by a shortfall of rain of more than 60 per cent compared to normal years, resulting in the current drought conditions. According to an assessment by the Gabinete de Segurança Alimentar (United Nations Office for the Coordination of Humanitarian Affairs -OCHA, 2012) of ten provinces, agricultural production in general and cereal production in particular has been affected, with an average production decrease of 30 per cent, depending on province and crop. It is estimated that agricultural production decreased by more than 400,000 tons nationally and an estimated 366,780 households (1,833,900 people) were affected across the ten provinces assessed.

While the drought impacted the entire country, the provinces of Bengo, Kwanza Sul, Benguela, Huila, Namibe, Cunene, Moxico, Bie, Huambo and Zaire were the most affected. Given that farmers were not be able to put aside seed stocks and not be able to repay credits already received, the drought also impact food production in the current agricultural season, especially among vulnerable populations.

Food insecurity, high food prices and other factors linked to the drought negatively impacted the nutrition status of children under age five. An increase in admissions of severely malnourished children to provincial therapeutic centers, as well as an increase in mortality rates, initially alerted. Most of the population, especially those in rural areas, was affected by the drought. Based on extrapolations of the assessment results, the total number of acutely malnourished children in the ten affected provinces is currently estimated at 533,000. It is estimated that 20 % of these children could be suffering from severe malnutrition, corresponding to 105,000 to 110,000 children, with a possible 20 % mortality rate, corresponding to 20,000 to 25,000 children (United Nations Office for the Coordination of Humanitarian Affairs -OCHA, 2012).

It is important that recommendations and research remember this reality when developing new techniques. Farmers do not forget episodes of food insecurity and their agricultural practices are adapted to years in which there is minimal production as they prioritize crops that provide food security.

Table 1. Preference Ranking of the Crops in the Three Cooperatives

Chipita	Agropecuario de Camponeses e Agricultores de Ussunda	Ekolelo
1. Corn	1. Corn	1. Corn
2. Beans	2. Potato	2. Beans
3. Potatoes	3. Soy	3. Potato
4. Soy	4. Beans	4. Horticultural produce
5. Sweet Potato	5. Cassava	5. Soy
6. Cassava	6. Horticultural produce	6. Cassava
7. Horticultural produce		

Objective number two was to evaluate current practices and production systems (with an emphasis on Soy) in use at the cooperatives. It is important to contextualize these systems into a larger outlook of weather insecurity. These factors influence planting models that are used in the current system.

In 2010, the ‘Climate Change Vulnerability and Adaptation Assessment' (Food Agriculture and Natural Resources Policy Network, 2010) was published. the Vulnerability and Adaptation Assessment provides empirically downscaled projections of future climate change for the country, Although historical climate trends in Angola, as elsewhere in Southern Africa, remain comparatively under-studied (Midgley et al. 2005), the Assessment tentatively identifies trends in air temperature and air circulation over the course of the twentieth century, as well as significant changes to precipitation. We note an overall increase in mean air temperature over the second half of the twentieth century, in the order of 1-1.2ºC, as compared with the beginning of the century, and observe this rise to be greater than those in global air temperature trends over the same period.

Manuel gathering information during the PRA

Citing Hewitson and Crane's (2006) study, which observes higher pressure on a daily frequency during the December-February period between 1979 and 2001 across the African continent; Dirkx et al correlate higher pressure with a reduction in the frequency of rainy days over this period. Following Tadross et al (2007), they note that these changes have occurred in Zambia, Zimbabwe and Malawi. They further note that whilst evidence for similar changes across broad spatial scales in Angola was inconsistent.

The Vulnerability and Adaptation Assessment found it more difficult still to establish trends in rainfall when measured in four-year intervals over the course of the twentieth century, largely due to Namibia's considerable climate variability. However, from the 1960s onwards, the authors suggest, a decrease in the length of the rainy season was apparent, with rains falling later – and in some areas with greater intensity – and finishing earlier in the year than had previously been the case.

Notwithstanding the lack of certainty inherent in current assessments of climate change impacts, four important points can be drawn from what is known, which give us useful indications of current and potential yield vulnerabilities in Angolan crop production. Stige et al (2006) look at the impacts of El Niño Southern Oscillation (ENSO) and the North Atlantic Oscillation on agricultural production inAfrica, noting that climate models predict global climate change conditions which are more Niño-like in character. Observing the strong association between ENSO trends and Southern Africa, they contend that productivity could be expected to drop by 20-50%. In their analysis, maize, another staple crop in North-Central Africa.

Second, observed trends in Angolan climate suggest, over the course of the second half of the twentieth century, a shorter growing season characterized by a later arrival of rainfall, an earlier cessation of rainfall, greater intervals between rainy days and an increase in the intensity of rainfall when it does occur (Dirkx et al 2008:10). Were these trends to continue, the combination of a shorter rainy season with higher temperatures might impact adversely on crop harvests. Later onset of the rains, the interruption of rains within the growing season and the adverse effects of drought upon soil conditions are all factors which could render crop failure a likelier occurrence especially given that the majority of smallholder farmers rely largely on rainfall for their staple crops.

Third, the devastating effects of sudden increases in rainfall intensity were demonstrated two years running, in 2008 and 2009. In early 2008, abnormally high Southern Angola throughout January to March led to flooding across much of Angola on a level unseen for four decades (Weidlich 2008; Ellis and Matjila, 2008). The floods in 2009, which badly affected Angola, Botswana, Mozambique and Zambia, were reported as "the worst floods in years".

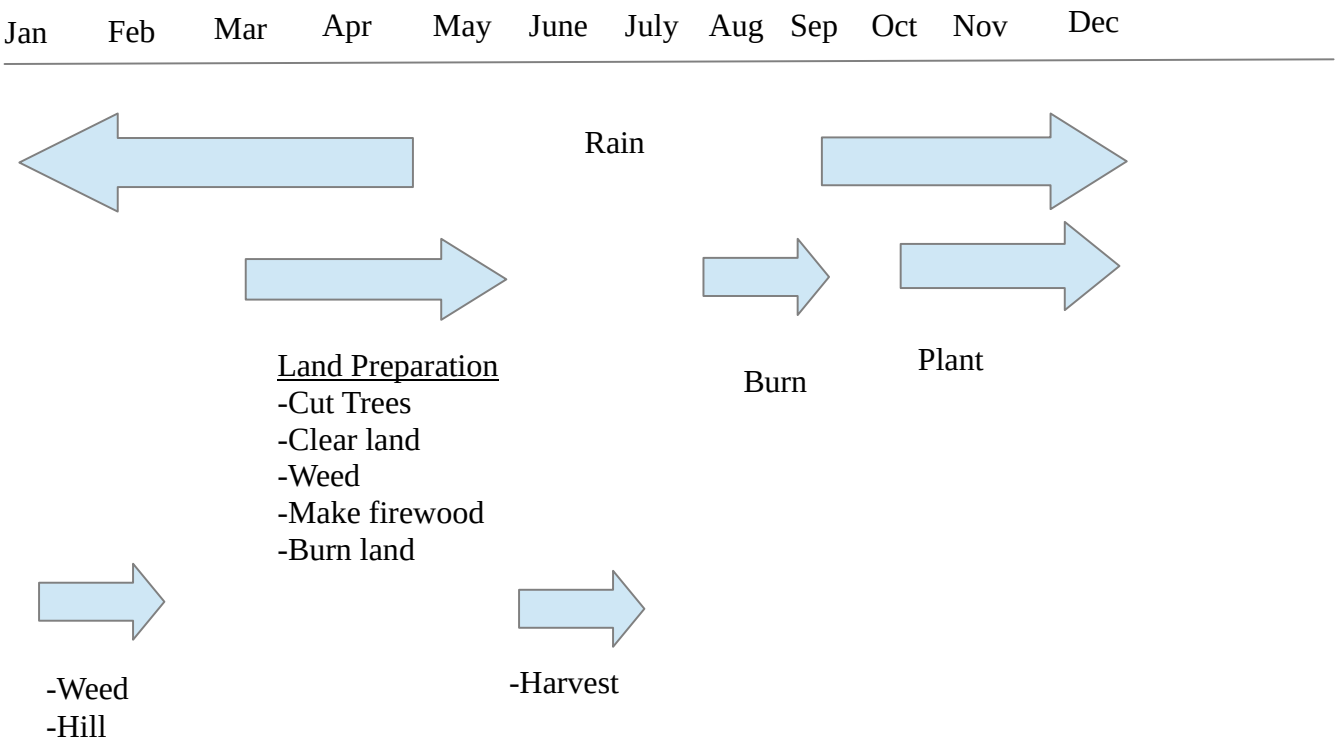
Primarily a small holder crop, maize is perhaps the single most important determinant of welfare in the central regions of the country where it is the staple grain. Maize is a family crop and is cultivated on the largest area in all zones. It is the first crop to be sown after the rain starts. Soil preparation for corn begins in September. It is normally planted on virgin land which includes slash and burn of the area. It is also the first to be weeded and the first to be harvested. Thus the main concern of every cultivator is to fill up the granary bin with enough of the whitish corn to feed his family until the next harvest. The surplus is sold in the market (see Figure 1). Cassava is inter-planted with the corn and harvested up to three years later.

Common beans and are important crops for smallholder farmers in Angola, with approximately 36% of households in a recent survey indicating that common beans were the most important source of cash income from crops. About two thirds of household production was sold, for those households growing

beans. (MSU, 2012). In the interviews, however, the producers emphasized that the beans were first used for consumption and sold if there was extra.

Beans are planted in two different time of the year including from November to March and March to June. After planting, the beans are then weeded, hilled, and harvesting. There are various pest problems including aphids, as well as diseases and virus of which the majority occur when there is rain (see Figure 2).

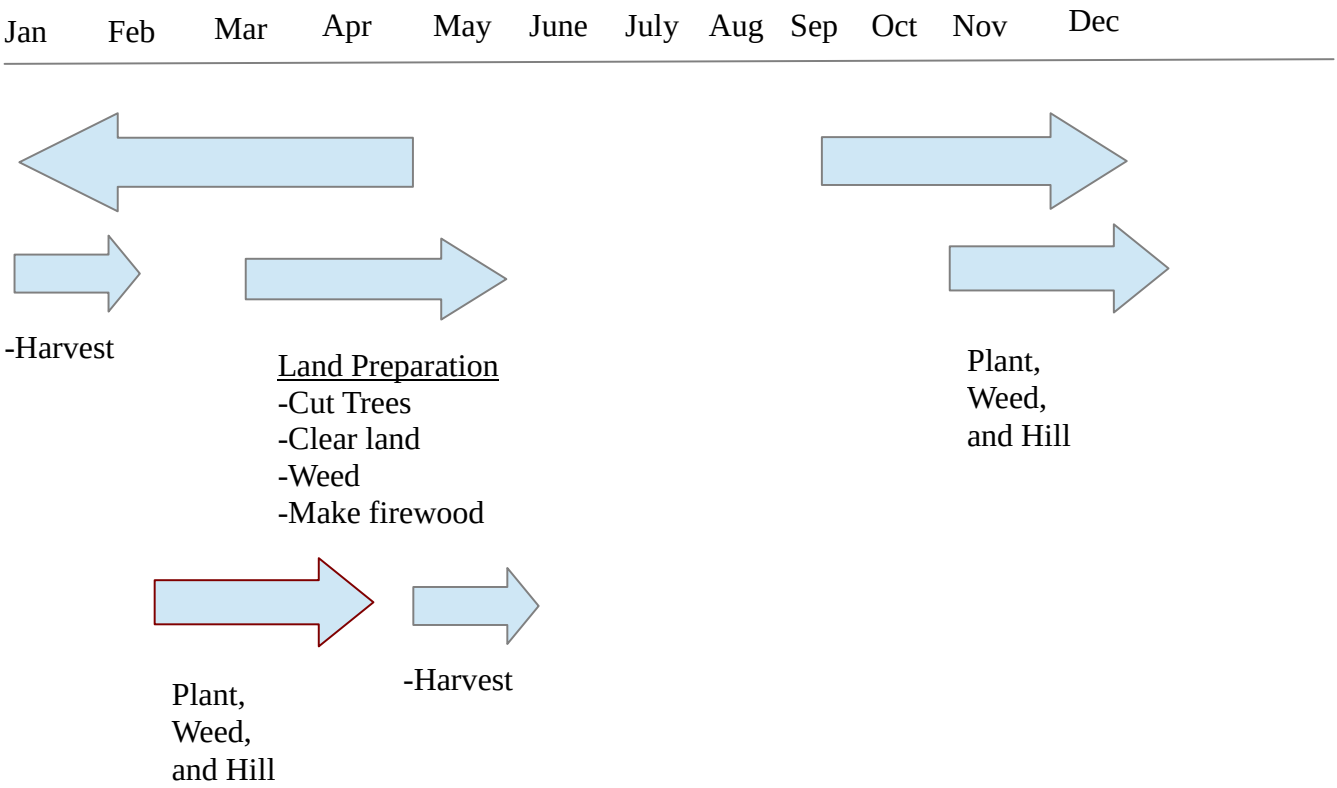
Figure 1. Maize production



Potato is used primarily as a source of income, consumption, and part used for the seed. There were two varieties of potato that were identified. The preparation for the land begins in April for the Irish potato; it is planted in May with between 15 to 20 cm between the plants, and 30 to 40 cm between rows. It is planted in flat rows and fertilizer (12-24-12) is broadcast, later, after germination the soil is mounded around the base of the potato. Unlike the sweet potato, the potato is very vulnerable to disease, pests, and virus. Finally it is harvested in July (see Figure 3). For the dry-land variety the land preparation begins in March with clearing the trees. The land is then plowed in May using animal traction and then planted in June. Fertilizer is applied after the potato is planted and the second application comes in October when the soil is mounded. Finally the potato is harvested in June (see Figure 3).

Vegetable production varies between households and depends on access to water and sufficient capital. Almost all of the vegetable production is done with a gas pump and flood irrigation. Horticulture crops include onions, lettuce, tomatoes, peppers, cabbage, and Garlic. Cabbage and tomatoes are planted in January and transplanted in February. Onions are transplanted in April. There are usually one or two application of fertilizer (12-24-12), and is weeded once or twice. They are then harvested in May or June while the onions are harvested in August. Garlic is planted in April. When it has three leaves it is weeded and fertilizer (12-24-12) is applied and it is harvested in August. Peppers are planted in November, transplanted in December, and harvested in March.

Figure 2. Beans production



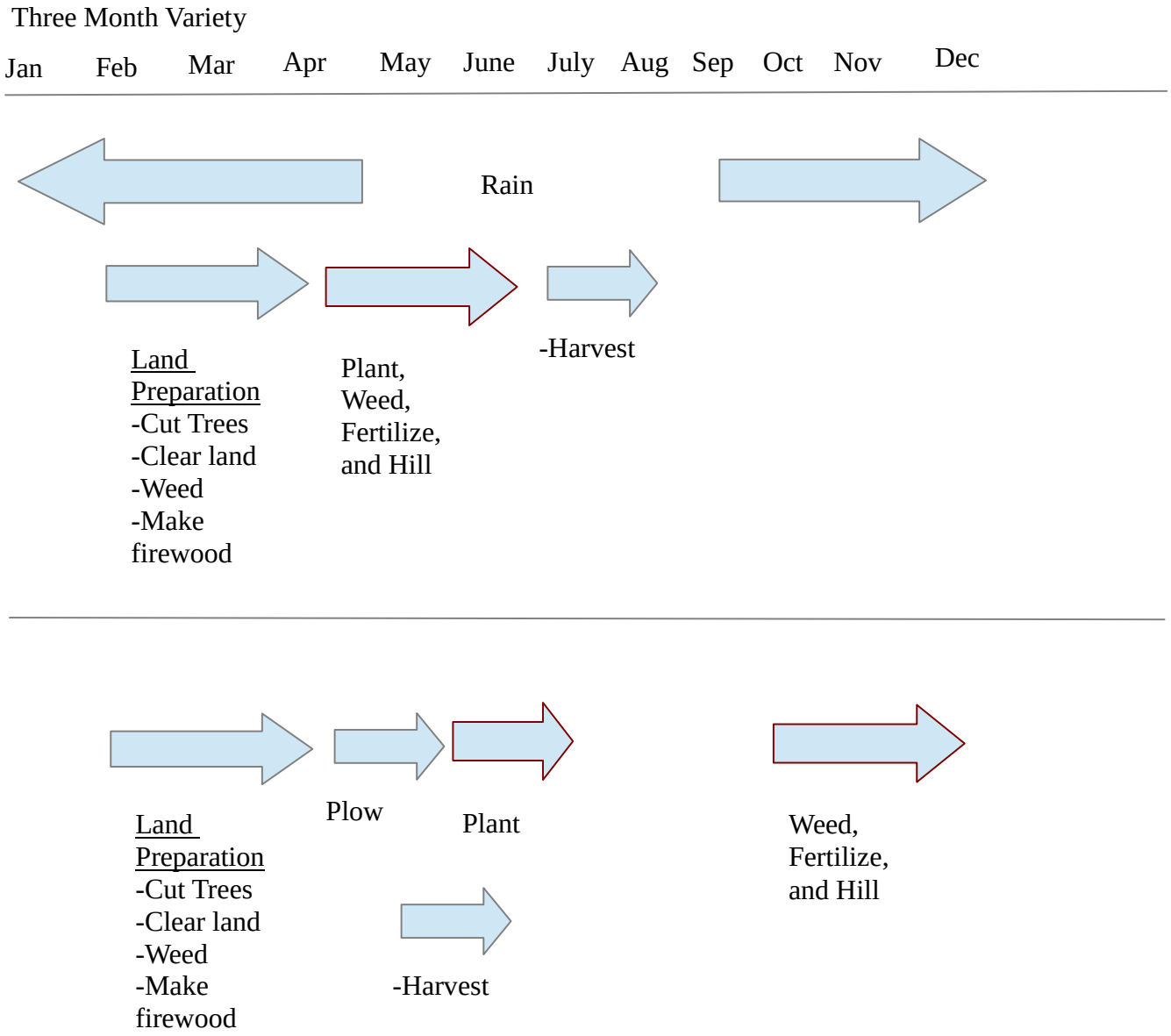
In Soy preparation begins in February included cutting down trees and clearing weed. A second clearing takes place in November either by hand or plowing with animal traction or tractor. The soy is planted with the rain between October and December. The planting distance varies a distance of 25 to 40 cm between plants and between 40 and 1 meter between rows. Several producers are using 12-24-12 fertilizer around the base of the plant. There were reports of disease problems with the rain.

Sweet potato much like cassava is not considered one of the most important crops but plays an important role in food security. In case of any other crisis it provides a safety net. In February the land prepared, planted in March, and in May it is harvested. It is used for both consumption and sold.

The timing of farming activity shows a nearly permanent throughout the year, with cycles of cereals, tubers and legumes between November and May and vegetables (tomatoes, onions and cabbages) between August and October. Men and women participated in agricultural calendar, either at the stage of sowing, either at the stage of harvesting.

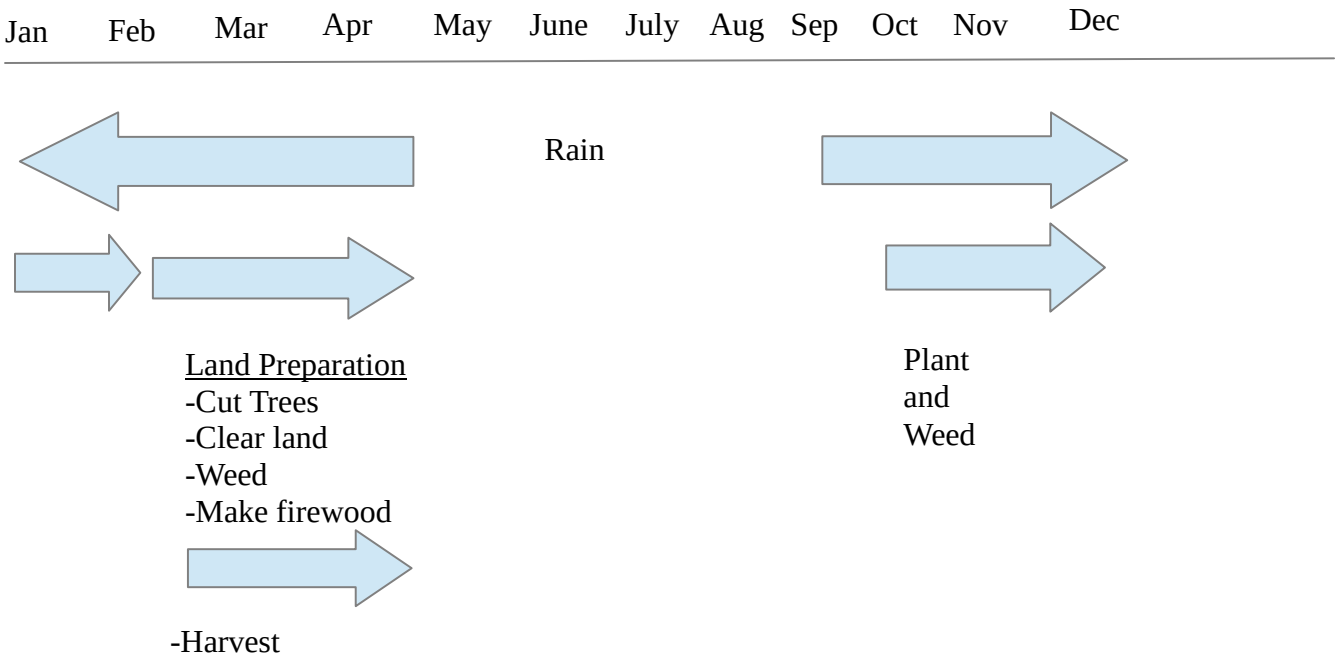
The farmers use a system that adapt to variable weather conditions. The primary crops of corn, beans and potatoes are generally the most important crops. The farmers plant around the rain and also use varieties that are drought tolerant and early maturing. Other crops such as cassava and sweet potato add further insurance into the system.

Figure 3. Potato Production



As noted, local agro-ecological knowledge allows farmers to respond to a range of conditions in the growing season. Yet an absence or abundance of water, especially combined with soaring temperatures, can exceed the physiological limits of any of the crops, land or animals available to the farmer. Another means of gaining some perspective on the potential impacts of climate change, in the face of uncertainty in droughts and floods.

Figure 4. Soy Production



When droughts or floods cause harvest failure and/or drastically reduce available grazing resources, the responses farmers have in their attempts to cope are subsequently more limited, not least because the supplementary resources people. Yet a number of options were listed by focus group participants when asked how they, their parents or grandparents had responded to the droughts and floods that they had identified. Most of these responses were common to droughts and floods because both phenomena were viewed by participants as having essentially the same consequences for crop and livestock farming alike. The most common responses for both villages are listed below:

- sharing food with family and neighbors
- Selling cattle
- Hunting wild animals
- Increasing consumption of hardier wild resources such as leaves
- Digging wells for water
- Government assistance
- Purchasing food to compensate for a shortfall

It should be noted that whilst many of these responses are of use for floods as well as droughts, there is less adaptive capacity in relation to the former than to the latter. Many farmers use increased seed densities and furrows in fields are mounded to capture water in the case of drought.

Objective three was diagnose problems in the soy production and interventions to improve them. These steps are basically following the production activity. Land preparation is done between April and May. The team proposes using land preparation before planting to reduce reduce competition and reduce weeding.

The soil tests from the three cooperatives showed a neutral Ph., adequate Nitrogen and Potassium, and a slight deficiency in Phosphorous. The germination test came up with a 67%. When coupled with

seed selection this should boost the germination up to 80%.

In terms of fertilization there is little criteria utilized. When there is fertilization it is done with 12-24-12. Our recommendation is to use the history of the land as a guide. For example if the area has been consecutively planted with corn it is more than likely that it is depleted of nitrogen. When coupled with a quick field test it is easy to determine whether fertilizer is needed (see Table 2).

Currently there is little seed selection which is one of the crucial steps in this process. The team suggests cleaning seed removing seed and seed obviously deficient by using immersion in water-dense as well as visual selection. When coupled with germination tests this should ensure good crop establishment (see Table 2).

Plant density remains one of the largest problems in the system. The distance between rows varies in the preparation manner from between 40 cm up to one meter. There were almost no criteria between seeds and the team witnessed as much as 12 seeds in one hole.

The team recommends the use of a spacing of 40 x 40 cm between rows with animal traction and 60x60 with a tractor and manual preparation. The distance between plants should be 25x25 cm between plants. A standard distance between plants simplifies recommendation and minimizes competition.

In terms of number of seeds the team recommends the use of one or two seeds at a depth of 5 cm. If one seed is used it requires reseeding around eight days. If two seeds are used then it will require the removal of plants. The goal of the recommendations is to increase the area of development of each plant and to increase productivity (see Table 2).

After planting there needs to be monitoring for insects, weeds, and fertilizer. Once there is a substantial weed population weeding needs to occur in order to allow the plants to become well established and eliminate competition for moisture and nutrients. If at all possible the team wants to eliminate the use of pesticides and fertilizer depending on the condition of the plants and the presence of pests (see Table 2).

Harvesting, grain processing and storage are a key phase in order to ensure the quality of future harvest and sales. The harvest-time is currently done when the pod changes color. However, even though the seed is ready to harvest it is often left because of rain. The longer the grain stays in the field it loses quality and viability. The team recommends monitoring and harvesting as soon as possible to loss of grain quality and losses in field (see Table 2).

The grain processing is currently done with beating and cleaning in the wind. The major limiting factor is the rain. The team recommends the use of a canvas canvas for drying, ensure drying the grain as soon as possible, and drying the beans to 13% humidity. In this manner there is little loss of quality and potential problems with fungus (see Table 2).

Codespa is currently working on creating a storage system. Currently there is miscellaneous storage with little criteria. The team recommends storage with 13% humidity, temperature monitoring, and monitoring of pests and diseases in order to maintain the quality of stored grain (see Table 2).

Future climate scenarios suggest that mean temperatures. Precipitation projections show a trend to increase during the warm semester, which encompasses the growing seasons of both maize and

soybeans and to decrease during the coldest months.

Soybean will be certainly the most benefited crop under future conditions. Assuming that the effect of CO2 will effectively occur, yield increases could attain more than 60% only by modifying planting dates. Sustainability is an inaudible objective for the agricultural ecosystems of the 21st century. Adaptation measures should thus promote adequate nutrient supply, crop rotations, soil organic matter balances, crop and soil management practices, as well as weeds, pests, and disease control to sustain the environment and the welfare of farmers in the region.

Objective four was to train the cooperatives to improve farm management practices for soy. We used farmer field schools to help promote improved soy production. Farmer field school is a school without walls. A group of farmers gets together in one of their own fields to learn about their crops and things that affect them. They learn how to farm better by observing, analyzing and trying out new ideas on their own fields. The farmers first selected seed using local standards. The seed selection was essentially the elimination of the worst seed and trash.

After selecting the seeds a 20 meter by 20 meter plot was laid out with four five by five sub parcels. These sub plots were divided using two local varieties planting two parcels using traditional methods of planting and two parcels with those proposed by CODESPA.

The traditional method had rows that were approximately 1.1 meters and the farmers placed between two and 14 plants per hole. Once again it is important to take into consideration the priorities of the small producers. These farmers are often hedging their bet against extreme issues of drought and rain. The farmers explained that many of them thinned the plants out after they germinated. Some farmers varied their spacing so that the plants would be able to develop. Others planted more seeds so if there was an impact on the germination that they would still have some plants.

The farmers did further selection of the seeds. This time there was more criteria in choosing larger grains without any defects. These seeds were planted using a spacing of 40 x 40 cm between rows. The distance between plants was25x25 cm. and the seeds were planted at a depth of 5 cm.

With peers, the major subjects of exchange were the farm practices, individual experiences and farmer- to- farmer counseling, with the contacts increasingly tending to assume a group format. The focus and nature of these contacts stressed that the emphasis now is on sharing experiences and discovering and analyzing new farm practices, through more horizontal forms of communication. Our communication emphasized the facilitation of discovery, not with the diffusion of “technological packages” in a top down manner

Objective five was to examine gender activities. About a third of households are headed by women, but in some rural areas the figure may be higher. Households headed by women are among the poorest and most vulnerable. Women sustain a heavy burden of labor. In addition to housework, caring for their families and fetching water and wood, they are also engaged in farming activities and in processing crops such as cassava and maize. Without male labor to clear and plough land, households headed by women face severe obstacles to food production (African Development Bank, 2008).

In the agriculture sector, it is estimated that adult men work 5 hours a day on the farm, while women work 6 hours; men work 3 hours a day off-farm and women 2.5 hours. Besides those figures, household work, which is woman’s responsibility in rural areas, must be taken into account. Some estimates conclude that farming women work 14 hours a day on household and economic activities if they have a

husband and 15 hours a day if they are single11. Those figures and estimates indicate that women's total contribution to the agricultural production implies a huge amount of daily working hours to meet the needs of the household. During the war, women upheld traditional agricultural expertise, in times when extension activities as well as access to agricultural inputs ceased to exist. They are still today responsible for household food security and thus comprise the majority involved in food crop production. Due to the impact of the war, food crop production has been negatively affected, resulting in serious household food insecurity (African Development Bank, 2008).

Rural households depend greatly on women's food production and, whenever possible, the marketing of surplus produce. Rural trade has practically ceased, as well as the marketing of agricultural surplus due to lack of security and expensive transport costs. Farming is limited to a few resistant and secure crops such as cassava, which worsens the nutritional situation in rural families. There are few economic alternatives for rural women apart from agriculture. Collecting firewood is mainly the task of women and children. Scarcity results in having to walk long distances, or in purchasing fuel wood or charcoal which increases household expenses and further reduces disposable income (African Development Bank, 2008).

Women play an important role in small scale agriculture, family members provide most of the labor required and it is well known that in particular women play a major role in agricultural production; carrying out most of the work, and in ensuring food security. However, they rarely have the formal rights to the land they work, the decision making power over resources or production decisions, nor access to information. Women, therefore, need to be an important target.

Conclusion

We view local traditional farming knowledge in Angola as a valuable cultural capital and a tangible resource. Traditional knowledge is driven by, and is a response to, the everyday demands of farming in a challenging economic, political, environmental and enigmatic socio-cultural context. Knowledge is constructed in real contexts, typically characterized by economic and environmental risks and uncertainties. Knowledge then becomes a type of survival algorithm.

Part of the epistemic foundation of traditional knowledge is related to the asymmetrical power structures within which they evolve and exist, and to issues of independence, self-reliance and problem-solving which are fundamental to successful farming and rural development. It is important to re-iterate that local knowledge does not possess the ability to solve all rural problems on its own and should not be implemented as an alternative to conventional scientific knowledge.

We conclude that the individual and collective ingenuity of small-scale farmers is fundamental to the survival of the domestic food production sector, rural development and food security in Angola. In the context of the socio-cultural, economic, political, environmental and global realities of small-scale agriculture in Angola, local traditional knowledge is indispensable. Small-scale farmers have traditionally operated in an environment where they have had to fend for themselves. Local solutions based on traditional knowledge and wisdom, and farm level experimentations, are a sine qua non in the ability of these farmers to continue to survive.

Table 2. Participatory Diagnostic of Soybean Production

STAGES	CURRENT ACTIVITY	PROPOSED ACTIVITY	OBJECTIVE OF THE PROPOSED ACTIVITY
Initial diagnostic	No activity	Crop-ground History	-To determine incidence of pests and diseases -Level soil fertility
Land preparation	Land preparation in April-May	Before planting, you need to prepare the land	Elimination and / or reduction of competition Reducing work-weeding
Fertilization	-Fertilize with 12-24-12, not quantity test	History of the land- Quick-determination tests fertility level	--Determine whether it is necessary or not fertilize -Determine based on the level of fertility.
Seed selection	Cleaning seed removing seed and seed obviously deficient.	-Selection of seeds: Immersion in water-dense -Visual selection -Germination tests	-Ensure good crop establishment -Learn from the seed quality
Plant Density	Between Rows: Varies from 40 x 40 cm. To 1 meter x 1 meter	Between Rows: 40 x 40 cm Assessing the degree of germination after 8 days: less than 80% need reseeding	-Animal traction: 40x40 -Tractor and manual: 60x60
	Between plants	25x25 cm	-Standard density to simplify reccomendation and minimize competition.
	Depth:	Depth: 5 cm	Allow good germination
	Number of seeds / seed point: 3-11	- Number of seeds 1 (Requires reseeding) - Number of seeds: 2 (Requires removal of plants)	-To increase the area of development of each plant and to increase productivity
	Reseeding: no Reseeding:	Assessing the degree of germination after 8 days: less than 80% need reseeding	
	Elimination of plants: no	- Elimination of double plants and replanting of empty at 8 days	-Ensure adequate plant population / ha
Monitoring	No information	-If possible 1/week: Pests and diseases	
		-Weeds: Control at 15 days after sowing	-Avoid competition for nutrients, light, water, and other factors
Fertilization 12-24-12	12/24/12	-Determine whether it is necessary or not: -Diagnosis -History -Development of Cultivation (force) -If necessary, use only UREA, not 12-24-12	-Avoid unnecessary expenses
Harvest	Harvest-Time: color change of the pod	- Time of Harvest: color change pod of 50% from the field. -Based on type of variety -Criteria: the longer the grain field it loses quality	Avoiding losses in field- -Reduce the loss of grain quality
Grain processing	Shattering: beating -Cleaning: wind -Drying: Not specified	Shattering: hitting, but considering the moisture to prevent mechanical damage Cleaning: wind -Drying: drying construction site. Use of canvas for drying.	-Ensure drying grain as soon as possible -Drying the beans to 13% humidity
Storage	Miscellaneous storage with little criteria	Requirements for storage: 13% humidity, clean. -Monitoring of temperature, pests, and diseases.	-Maintain the quality of stored grain

Seed selection

Planting local varieties

In this context, traditional knowledge is a critical safety valve that has evolved and developed out of necessity. Given the vital role that domestic agriculture plays in employment, food security and foreign exchange earnings and savings, and in the context of the biases against this sector, the continued negative attitudes towards traditional knowledge is an injustice to farmers and is inimical to rural development.

It is widely accepted that agricultural development will be severely curtailed without addressing the risks and capitalizing on the opportunities posed by climate change (FAO, 2010). The agriculture sector must adapt to the impacts of climate change in order to provide food security to the world's growing population. At the same time agriculture must mitigate its contributions to climate change (13.5 percent of global greenhouse gas emissions) in order to slow the progression of this global challenge (FAO, 2009).

Concurrently, it is internationally recognized that addressing gender issues in agriculture reduces hunger and poverty. People could be lifted out of poverty if women had the same access to and control of resources as men (FAO, 2011). Although they are important food producers and providers, women presently have limited access to and control of resources. However, to date, these ideas – that climate change and gender issues are integral parts of agricultural development – have not been implemented in an effective way.

The driving forces for growth of such smallholder based soybean production include potential increases in farm family income to help lift them out of poverty, and also - in relation to sustainability - the need for an easy-to-grow, leguminous, rotation crop for the millions of hectares in cereal and root crop production. Farmers need to rotate crops to break disease and pest cycles and to maintain soil fertility, and the rotation crops need to be profitable.

There are, in some cases, other options for rotation crops, but soybean can be a good choice especially when other legumes are subject to heavy insect and disease pressures and where there is a clear market link from the grower to the industry. Soybean is one of the few choices where major expansion in production area might be possible because of the crop's demand in the vegetable oil and feed sub-sectors.

Soybean can be grown with very few inputs – some smallholder farmers grow it using only the seed. However, to grow it well, soybean requires appropriate use of seeds, lime, fertilizer, inoculant and herbicide.

Small holders face a number of challenges. Smallholder farmers typically have poor practices due to lack of knowledge and experience. Soybeans are also a lower priority crop than the staple food crops and, as a result, whenever there is a pest outbreak a timing overlap in the planting or care of soybean and the staple crop, smallholder farmers focus on the staple crop.

Smallholders have very little access to mechanization as the amount of land available to them does not justify the expense of investing in equipment, and they typically lack the financing required. They rarely use fertilizer and lime; this is due to a lack of knowledge about what fertilizers to use, a lack of sufficient cash to purchase, a lack of testing equipment and poor availability of the right types of fertilizer and lime. Most production from smallholders is stored on-farm, under poor conditions, with significant economic losses from spoilage and quality deterioration.

Smallholder farmers are consistently able to make a profit on a cash basis as they use very few inputs with a cash cost. However, they do not make a profit when all costs (including their labor costs) are taken into account – labor costs typically make up 70% of the total costs as all of the cultivation is carried out manually (including land preparation, planting, weeding and harvesting). In addition, smallholders do not always take into account the rotational benefits of growing soybean as they are not always aware of the benefits of increased nitrogen in the soil.

The project needs to
• Enhance productivity and increase area planted
• Improve storage infrastructure and management
• Incorporate local knowledge into on farm trials
• Target women as key Focus groups
• Ensure that new soy varieties adapt to on-farm realities including drought and rain

The project needs to get access to and improved seed in the region. Furthermore improved techniques including distance between plants, appropriate fertilizer, insecticide and fungicide use. When combined this should allow producers to significantly increase their production. Focus on agricultural development focused on supporting broad-based agricultural development, not just seed production, with extensive farmer involvement and demonstration of new techniques and approaches

The projects efforts must be two-pronged: 1. Create awareness of improved agricultural practices, including the benefits of using quality seed and improved cultivars; 2. Produce and supply quality seed of the best local and or improved varieties that are available elsewhere and are suited to local ago-climatic conditions.

The second of these should be allied with efforts to strengthen traditional seed systems, particularly through promoting awareness of new varieties, linking farmer seed producers with sources of seed of improved varieties, making seed available through extension agents and key farmers, and supporting appropriate systems for marketing farmer-produced seed.

This will contribute to increasing productivity and food security in the subsistence sector, generating surpluses for sale and encouraging a move towards more market-oriented production. Farmer should be engaged in participatory evaluation of cultivars. This will require investment in collecting and characterizing traditional varieties and potentially suitable modern cultivars, and in training for all aspects of seed production, health and storage. Improved storage also enables more cost-effective aggregation of smallholder production.

Our final recommendation is a serious look at gender. In Angola, women represent 51% of the total population, of which 68% leave in rural areas (Population Census, 1996). It is estimated that about 75% of them are engaged in agricultural activities. In terms of household economic activities, subsistence agriculture, especially the production of staple food crops tend to be an activity women are responsible for, while men tend to be responsible for cash crop production, industry and services. Women also represent a major group in the informal market chain.

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