

# FARM Africa and SOS Sahel International/ UK Participatory Forest Management Programme (PFMP)



## FOREST FARMING IN BONGA (PROJECT PROFILE)

The Goal of PFMP is to ensure environmental sustainability through Community based natural resource management systems



A PRIVATE RURAL DEVELOPMENT & AGRICULTURAL EXTENSION AGENCY  
A Public-Private-Rural Community partnership  
March 2004, Addis Ababa

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# 1. INTRODUCTION

## 1.1 Natural Resources Under Threat in Bonga

The Gimbo woreda was the subject of a farming systems study by an international team under ICRA (ICRA and SUPAK-S, 2000) published under the title, "**Natural Resources under Threat**". The study has clearly established that the forests are under threat from the advances of cereal-based agriculture and increase of settlement areas – caused by government resettlement programs, natural influx, and population growth from within the area. The high rate of population increase is illustrated in the fact that 45% of the population of Gimbo woreda is under 15 years of age and that of the zone is 49%.

As stated above, the expansion of agriculture and settlement is at the expense of the forest where all new cultivated land is taking away a large area from the natural forest. The study, in terms of scale of agriculture expansion, gave the following land use categories:

- Forest Coffee-based land use (Forest zone)
- Forest/coffee/cereal-based land use (Transition zone), and;
- Enset/cereal-based land use (Transition zone in the Dega AEZ), and;
- Cereal/pulse-based land use (deforested zone)

Category 3 and 4 are similar but are listed separately because one is predominant in the **Dega AEZ** and the other in the **Woina Dega AEZ**. Thus, there are three scales of agricultural expansion (leading to deforestation), namely **(a) Forest zone with wild coffee and other NTFP**, **(b) Transition Zone**, and **(c) Deforested zone**. From the above 4 land use systems, one can see that cereal agriculture appears in all except one, i.e. the Forest zone.

The study revealed that the extent of cultivation of annual crops in terms of land allocation is getting higher and higher as new settlements clear forests for cultivation. Annual food crops (composed of cereals, pulses and chilies) accounted for an average of 3.44 ha/household compared to only 0.65 ha for perennial crops (enset and coffee). Cereal crops alone accounted for 2.74 ha of the cultivated land where maize alone accounted for 1.6 ha. The other feature of the dominance of cereal farming is that maize, teff, sorghum, and barley were cultivated by 100%, 70%, 47% and 38% of farmers respectively. According to the study, 72% and 36% of the farmers grew Enset and coffee respectively. This surge of

food crop farming, especially cereal agriculture is encouraged by the government's food security and food self-sufficiency policy. The agricultural package program of improved seed (mostly cereals) and chemical fertilizer are reflective of this Federal and Regional government policy. But such ecologically unsound farming practices are leading to the degradation of land resources, which will have grave consequences for food security. In Ethiopia, it is reported that nearly 17% of the potential GDP is being lost due to soil degradation resulting from unsound farming practices (ICRAF, Annual Report 2001-2002).



**Picture 1: Expansion of agriculture leading to deforestation**

Much of the farming in the Bonga area and the general southwestern highlands is done without soil conservation measures - both physical and biological. The predominant slope of these agricultural lands ranges between 10%-30%, with some going up to 60% slope. Most soils of the area are characterized as **Nitosols** that easily satirizes (baked by the sun and become hard like brick) when vegetative cover and soil organic matter is lost as happens when cereal farming is continued without mulch, or any of the possible soil amendments are not employed. By definition, Nitosols are deep, well drained, slightly acidic, well structured reddish clay and with moderate inherent fertility. But field observation however suggests that shallow and more intensively leached, poorly structured, acid clay soils are dominant in Bonga area (A&NR Desk/SUPAK, 2003). Without proper terracing and contour farming, soil erosion followed by land degradation will occur affecting productivity of land leading to more extensive cultivation and deforestation.

## 1.2. The Food Self-sufficiency Policy and the new Settlement Program

The 161-page document (in Amharic), “**Food Production Package Field Manual**”, introduces the manual by stating that farming needs to be agro-ecological-based and lists the suitable crops to be: coffee, spices (i.e. black pepper, hale, and ginger), root crops, and fruits. The manual further lists coffee, tea, fruits and livestock. In the second priority list are maize, sorghum, teff, wheat, rice and field peas.

The justification given for making maize a first priority crop is that it is the staple food and also serves as cash crop (when prices are good). On the other hand, the manual states that maize yields in the Zone are low – less than 1.6 tons/ha. Oxen plowing is used for maize

cultivation. Row planting is not practiced in the area. Weeding is mainly through "**shilshela**" (using oxen – instead of the customary hand weeding) after maize has germinated and the field is weed-infested. It is not uncommon to see "shilshela" done twice, the first, within a month from planting - largely to reduce maize population and weeds, and the second, "**shilshela**" is done after 60 days from planting when the maize has formed field canopy. The manual does not cover the pros and cons of this prevalent practice by maize farmers. But the manual recommends the use of the following land husbandry and yield enhancing practices, namely:

- Intercropping,
- Relay cropping (with a legume crop after 60 days from germination of the maize crop),
- Use of green manure and compost,
- Crop rotation (cereal followed by pulse crop)

None of the above recommendations are in use nor does the package program provide any practical training. Instead, the government is busy distributing chemical fertilizers and herbicides/pesticides. Improved maize seed is generally not available and is costly for farmers. Indeed, these latest efforts are in response to the government policy of food self-sufficiency. This policy is made even clearer in the new settlement program that is currently the top priority for the local government agencies in the *woreda* and the Zonal administration. Many government staff members are redeployed to this activity. Settlers are being given 2 ha each of forestland to clear and put in food crops such as maize. Certainly an opportunity is being lost to start right and stay on course in harmonizing agriculture and forest environment. Obviously, this cannot happen when food sufficiency is taken to mean to produce your food even during the first year of settlement. Professionals are not happy with this rush to clear the forestland for growing maize and other annual food crops in the new settlements, not thinking of other social and ethnic problems that may arise. But this is not to mean that the government's concern to prevent people from reoccurring famines is wrong. In fact, the government must be advised properly

and supported in this end. Integrated forest farming without endangering the forest is possible as discussed below. Other countries have succeeded in doing so and they are food and cash secure as well. A recent study from central Kenya highlands showed that 51% of the household income came from trees integrated in the farming system.

## **2. RATIONALE**

### **2.1 Forest Farming: A Sustainable Land use System for the Humid Tropics**

Historically, the south and southwestern region was a hoe-culture and a horticultural form of land use was dominant outside the forest area. Essentially, under the Hoe-system, all land being used to produce food was through the intensive home gardens that effectively integrated food production with livestock. A small area outside their homestead was used to graze the animals. The food crops were perennial crops dominated by root and tuber crops including enset (the others are yam, taro, banana, cassava, etc.). Cereal crops were introduced towards the early part of this century, led by maize. Maize cultivation was first in the home gardens mixed with coffee. But as the cultivated lands expanded outside the compound area (homesteads) it was soon being grown in pure stand but with use of manure and compost from the compound system. But as animal numbers declined, so did the supply of manure and priority for its use was given to the crops in the homesteads. Besides, the maize fields were getting further and further and carrying manure was not a task appreciated by members of the family.

Ideally, what is best is, to expand the area under homestead multi-story tree based farming to apply to all lands that have come under agriculture (food and livestock production) and for new forestlands to come into cultivation to retain the forest environment as much as possible or re-establish an equivalent forest farming system. Presently, farmers bringing forestland are being allowed to clear the forest, use fire to burn the newly cleared land in readiness to put in a maize crop. This system is essentially used in forestlands with long fallow periods where the fallow period is sufficiently long for secondary forest to re-establish itself after 20 or more years. But this long fallow system is not possible here as population and land ratio is narrow, or, more people, less land with each passing generation. There is hardly any fallow being used and if there is a short period, it is used for grazing and biomass is not allowed to accumulate to regenerate land fertility again.

The Gimbo woreda shows the impact of clearing the forest completely and attempts made to continually cultivate/farm and graze animals to be food self-sufficient. The area before Gojeb river and near the Gimbo woreda town (Yabekecha) which were areas of earlier settlement areas, now show land degradation reflected in declining maize and other crops yields. Fuel-wood and timber shortages are occurring and households are seen planting eucalyptus trees. Was this planned, one may want to ask?

Is it not possible to replace cereals by other crops that are more shade loving or at least shade-tolerant and are semi-annual or perennial food crops. The answer is yes, as can be seen in the more developed and well-managed homesteads.

There are few agroforestry practices that can accommodate maize or maize will accommodate. One such system, as suggested by the Food Crops Production Package Manual is **relay cropping** with such woody perennials as **Sesbania spp.** and **Pigeon pea**. In addition, maize will be intercropped with legume crop which is either simultaneously planted or is also relay cropped. The Oromo (Kotu) farmers of **Harar highlands** practice mixed cropping of cereals (maize and sorghum planted in equal proportion simultaneously and mixed cropped with bean in a permanent Chat farm. Farmers, using this system and tethering one bull to fatten from weeds and sorghum leaf stripping (after grain filling stage of the sorghum) are both food and cash secure. Such farmers are said to have a net income of ETB 70,000/ha/yr compared to farmers growing only maize or sorghum who get between 1,000 and 2,000 (see Global 2000 Report).

### 3. PROJECT OBJECTIVES

- Introduce a productive and balanced tree-crop farming system to targeted communities.
- Build capacity of farmers, farmer associations, and community groups in carrying out and managing profitable and sustainable forest farming
- Improve marketing of forest products

### 4. SPECIFIC ACTIVITIES

- Selection of appropriate tree species and germplasm development for distribution to farmers and community groups to start an income generating tree-crop enterprise.
- Training of farmers, private entrepreneurs, and local government staff (mainly research technicians and extension agents) in improved forest farming practices, technologies, and management.
- Establish Farmers Field School (FFS)
- Encourage and support the private sector in processing and marketing of forest farming products
- Work with regional R&D institutions and EARO to provide appropriate species and technologies to support a productive and sustainable tree-crop farming system

- Networking with and leveraging resources from collaborative partners

## **5. EXPECTED OUTPUTS**

- Capacity of targeted beneficiaries in management of forest farming increased.
- Household food security and income increased
- Environmental degradation through deforestation reduced.
- Overall Bonga economy improved from increased trade of forest products

## **6. IMPLEMENTATION STRATEGY**

- Improve Tree Fallows to Enhance Forest Farming in the existing agricultural lands through Sesbania based fallows
- Enable communities and local authorities participate in all process
- Build on better traditional forest farming practices
- Relay Cropping using Sesbania
- Establish Farmers Field School (FFS) OR upgrade PFM sites as FFS
- Establish demonstration plots on different forest farming methods
- Establish On-farm trials and collaborate with research institutions
- R & D networking with relevant institutions and individuals

## **7. PROJECT SITE**

All Kafa zone woredas but emphasis should be given to PFM sites of the five woredas adjoining the Bonga Forests. Priority should be given to Gimbo woreda where cereal (maize) farming is on the increase mainly due to new settlers.

## **8. BENEFICIARIES**

- PFM groups

- Local communities
- Local government staff
- Private sector
- Local government

## **9. IMPLEMENTING PARTNERS**

- FARM Africa
- SuPAK
- Kaffa Zone and respective woreda Administrations.
- Jimma Agricultural Research Centre
- EARO
- MoA
- Agriculture & Natural Resources Office (Region, Zone, Woreda)
- Jimma University
- PFM Coops.
- ICRAF
- Private sector
- Other Relevant NGOs and GOs

## **10. DURATION (3-10 Years)**

- Seed/Germplasm supply and nursery Development
- Capacity building of farmers, private entrepreneurs, and local government staff in improved forest farming practices, technologies, and management.
- Establish Farmers Field School (FFS)
- Work with relevant R&D institutions
- Networking with and leveraging resources from collaborative partners

## 11. INDICATIVE BUDGET (700, 000 ETB)

- Capacity Building of communities and local government staff (100, 000)
- Seed/Germplasm supply and nursery Development (90,000)
- Networking with relevant institutions and individuals (50, 000)
- Establish Farmers Field Schools (60, 000)
- Establish demonstration plots on forest farming methods (50, 000)
- Establish On-farm trials and collaborate with research institutions (100,000)
- Monitoring and evaluation (50, 000)
- Project Document Development (200, 000)
- Source of funding (EU, SuPAK Netherlands Govt.) World Bank, UNDP, & other NGOs/donors).

## 12. THE NEXT STEP AND WAY FORWARD

### 12.1 Reconciling Policy of Food Self-sufficiency with Sustainable Resource Management

Some space has been given to highlight the scale of the problem of land and resource degradation through the traditional system of cereal farming here in the region as elsewhere in Ethiopia. The system has left other highlands degraded and many out of use after long years under this **exploitative system or natural resource mining**. This period of land degradation is likely to happen soon, within the next 15 to 20 year because of the soil type and local topographies. The rains are also erosive on land with no adequate vegetative and tree cover.

An all out tree farming is actually needed but this may be contrary to the government's maximizing food production to feed its people at all cost. ICRAF and other similar organizations attempting to "**transform lives and landscapes**" see such policies as costing countries more in the near future and examples to this effect abound around the tropical world, but more so in Ethiopia.

The **Improved Sesbania-based Fallow** is certainly a displacement of the short natural fallowing system in use today in the area. The addition of grass strip along with the line of sesbania, i.e. Elephant grass, not only is to re-enforce soil conservation measure, but it is also to enhance and increase feed

resources for livestock. We see the need to go more into **zero grazing schemes** in the future which will also decrease animal diseases and exo-parasites for sheep and cattle. Even poultry feed formulation will benefit more from this MPTs production system.

We also see the additional contributions that **trees around the perimeter of the farm** can contribute but this system is described elsewhere but it is part of the Forest Farming System. Similarly, the **Multi-story home garden system** is planned to be intensified as proposed in another program document where MPTs including sesbania will have their right full place in bringing about increased productivity and sustainability to the landscape. Not presented as a separate program, is the role **Buffer zone management** systems play in the overall increase of trees in the landscape, falling as it does between two opposing forces, forests on one hand and agriculture on the other. Finally, tree farming is increasing the overall output on the land and achieving sustainable and integrated natural resource management. The **Improved Fallows** with the **temporal** (time sequence) sub-management tools (i.e. relay cropping, strip and contour terraces of MPTs/grass, windrows, etc.) described here, not only do these make cereal farming more productive but also will make it unnecessary to expand the area under cereal farming as the government is doing inadvertently.

### **3.2 The Next Step(s)**

We see that agroforestry is not a taught subject in institutions. Only at degree levels is agroforestry taught, often as Farm forestry/Social Forestry by AUA, WGCF/Debu University and Makelle University (Dry-land Farming/Agroforestry). Research in agroforestry has been limited to only MPT trial and selection for site condition not to farming systems/cropping systems. There is nothing to suggest an agroforestry system of production and management as described above for the extension system to use. As a result all "packages" are deficient on agroforestry interventions for adoption.

We therefore suggest a strong on-farm agroforestry pilot models be established and adequately monitored and results compiled and written up into field guides for others to use and further refine them to suit local and specific felt-needs. FARM Africa has successfully assisted the establishment and operation of PFMs and the regional government is likely to expand on this experience to which it is already a party. We therefore strongly suggest not only support services of seed and planting material (suggested in the other program) be established, but also that each PFM be developed as **Farmers Field School**. TAM Agribusiness operates such schools for farmers as effective tool of development, especially for the expansion of Contract farming and out-growers schemes.

But the first step toward the establishment and use of **Farmers Field Schools** at the PFMs is to train the trainers and the **DAs**. We suggest and recommend therefore that an institution, private firm or a consultant be engaged to help design and help establish one such center for the others to copy and

emulate immediately. TAM Agribusiness in collaboration with the ICRAF/Ethiopia Coordination Office could be contracted to do this. **This Farmers Field Schools** will also be developed as sources of germplasm.

In order to facilitate the implementation of the above recommendation, an appendix on Sesbania has been prepared and is appended to this technical (strategic plan) document.

## **REFERENCE**

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# **APPENDIX 1. PERENNIAL SESBANIAS IN MAIZE FARMING - BONGA**

## **1. BACKGROUND & JUSTIFICATION**

Cereal farming and maize in particular is increasing rapidly in the Bonga sub-region. Soil conservation measures and soil fertility enhancement and maintenance practices are not in place. Cereal yield especially that of maize is low and declining. Improved Fallow based on Perennial Sesbania using *Sesbania sesban* as an example and probable species of choice has been suggested. Looking at the knowledge base of farmers, development agents and researchers, one realizes that it is very low to expect the suggested practices to take off. A strong and participatory on-farm research is necessary. An information input on Perennial Sesbania is thus essential and is here provided. The technical note and the identified species, sub-species and varieties need to be used to start with.

## **2. Sesbania in agriculture and land management**

### **2.1 Introduction: Perennial Sesbania**

Perennial Sesbania species are found in diverse environments and agroforestry system in the tropics and sub-tropics. They are used for ruminant fodder, firewood, wood products (construction poles), and soil improvement and for human food (especially *S. grandiflora*, a common swamp tolerant planted on rice bunds in southeast Asia flower eaten as salad). *Sesbania sesban* is the most widely cultivated species in Asia and Africa for fodder and for soil improvement. Research and development has therefore concentrated on *Sesbania sesban*. ICRAF, through its regional programs in Eastern and southern Africa has focused its R&D efforts on this species. Much information is therefore available from this International Center and its sister organization, ILRI, the later maintains Sesbania germplasm collected from Eastern Africa (Ethiopia, Kenya, Tanzania, etc) and from international collection, i.e. Hawaii, FAO, and ODI (UK).

The most important species and sub-species of perennial Sesbania of interest for the Bonga Region are the following and effort must be made to procure seed to start the program, namely:

- *Sesbania sesban* (*S. aegyptica*)
  - *subsp. sesban var. sesban*
  - *subsp. sesban var. nubica*

- *Sesbania macrantha*
  - *var. macrantha*
  - *var. levis*
- *Sesbania keniensis*
- *Sesbania goezei* (native in the Ethiopian highlands)
  - *subsp. goetzi*
  - *subsp. multiflora*
- *Sesbania formosa* (for wet places)
- *Sesbania dummeri* (also for sampy ites)
- *Sesbania rostrata* (? annual sesbania)

The above 7 species (and subsp. and vars.) need to be tested in the area with a view of selecting the most suitable species or var. of the species. The local *Sesbania sesban*, now seen growing in the area should be used as a standard all local check in all the test trials and demonstration at the Farmers Field Schools/centers. In the event that the other species of sesbania are not available, the program need to proceed with *Sesbania sesban*, which is already in the area. The following highlights on **Sesbania sesban** should be helpful to know and understand and thus know how best to deal with sesbania fallow technology.

## 2.2 **Sesbania sesban: widely distributed MPT NFT (Nitrogen fixing tree)**

### 2.2.1 **Description**

*Sesbania sesban* is a many-branched, soft-wooded small tree that grows up to 8 m in height. Its many branches often give the tree a shrub appearance. It has a spreading habit due to its wide branching angle (as wide as 45-60 degrees). This canopy structure of sesbania is a porous canopy where reduced light can reach the ground floor or the crop under,

### 2.2.2 **Ecology**

*Sesbania sesban* has a wide ecological range and occurs naturally in semi-arid to sub-humid areas with rainfall 500 to 2000 mm. It seems to do well in areas with bimodal rainfall or areas with long growing season as in the southwest Ethiopia. It grows from sea level to 2000 m elevation but the upper limit is

uncertain. It does not tolerate frost; hence it is unlikely to do well in the **dega** zone. Soil alkalinity and acidity is tolerated to a considerable degree.

*Sesbania sesban* is relatively short-lived, and under intensive browsing or cutting management will not last more than 3-5 years. Its rapid seedling growth is conducive to short-term fallows and to replanting if management should reduce growth vigor, which is often the case. In the Improved Fallow technology, this has been factored in as well.

### 2.2.3 Uses

**Fodder:** Traditional use of *S. sesban* is for fodder and soil improvement. The leaves and tender branches are high in protein (20-23% crude protein) and have high digestibility when consumed by ruminants. Anti-nutritional factors are suspected to be present in sesbania fodder. Feeding sesbania fodder to chickens, rabbits and pigs is not recommended, as they are mono-gastric animals. Feed livestock sesbania fodder only 10-29% of their diet for best results.

**Soil improvement:** *Sesbania sesban* establishes quickly and grows rapidly and is thus little affected by weeds, which it quickly can suppress through shading effects. In Kenya and other parts of Africa, it is scattered in the farm for its nitrogen fixing ability, mulch and green leaf manure it provides. It can be shallow rooted, and may compete with adjacent crop for moisture in low rainfall conditions, which is not the case in Bonga.

**Wood:** Its wood is light-weighted compared to other NFTs such as Calliandra and Leucaena but it is still harvested for fuel wood in Africa and India where flood is scarce or unavailable. The wood is not durable and should not be considered as construction wood but it is still used in Western Kenya to make roofs of traditional houses. Because of its fast growth, sesbania has the potential for pulpwood production. Plantings of 10,000 trees/ha have produced 10-20 tons woody biomass (dry weight) in one year.

### 2.2.4 Management

Sesbania is generally propagated from seed but propagation by cutting and tissue culture is also possible. Seed pre-treatment needed has been described in the text document. Seed weight ranges from 55 to 80/gm for **S. sesban var. sesban** and to 80-130/gm for **S. sesban var. nubica**.

Plants grown for fodder can be planted as close as 30-50 cm apart in rows of 1 m apart. But plant population/ha should be a factor of moisture and soil conditions as a general rule. The suggested trials should determine optimal planting density for the proposed Improved Fallow technology for a maize-based farming in Bonga area.

## APPENDIX 2. Improved Tree Fallows to Enhance Forest Farming in the existing agricultural lands through Sesbania based fallows

ICRAF (The World Agroforestry Center) in collaboration with NARS (National Agricultural Systems) has been experimenting and developing the **Sesbania-based Improved fallows** for the maize-based farming system in the Western Kenyan highland (Kakamega highlands) These western highlands are similar to the agro-ecology of the southwestern highlands of Ethiopia, especially the Kaffa zone. The results and the package developed are directly applicable for this region. But maize farmers of Kakamega (Western Kenya highlands) have been using **Relay Cropping** using Sesbania. Maize is normally row-planted but the system can also work for broadcast maize, as is the case in Bonga. The practice is to plant maize first. It is advisable and is recommend that at least half of the recommended chemical fertilizer rate be used. This is to ensure that the initial growth of maize and Sesbania is good. (Note that we have large total plant population in the farmland now with the addition of Sesbania and the young Sesbania will be feeding from the same soil depth as the maize crop).

Once maize has germinated, Sesbania seeds (scarified or hot water treatment by dipping seeds in a cloth or screen bag in water just below boiling point for 30 seconds or 5 to 10 minutes in water heated to 80 degrees centigrade or pour a volume of boiling water five times the volume of the seeds to be treated is poured over them and allowed to cool) are broadcast in the maize field during the first weeding or in Bonga case, during the first or second "**shilshela**". Sesbania seeds should be planted 1 to 2 cm depth and covered with soil. Sesbania is fast growing, reaching height of 10 cm in 20 days, 1 m in 6 weeks and 2 m in just under 4 months. Because of its fast growing, it is essential to control their shading effect on the maize by both determining the optimal sesbania population in the maize field, or choose the second **shilshela** period to establish them or/and remove the excess sesbania population. Any of these could be determined on site observation by farmers and extension agents.

In the system of relay cropping described above, both the sesbania and maize crops grow together. But sesbania will soon overtake the growth of maize and it is therefore essential that sesbania shading on the maize crop be managed (until after maize tattling for effective pollination to take place) by reducing side branches of sesbania or altogether cutting back the excess sesbania population. Such management will yield green manure if applied to the maize, fodder if fed to animals and fuel wood.

When, and after the maize crop is harvested, the sesbania, which now has established itself as the **planted fallow** and is allowed to continue to grow, at least until the farmer is ready to put in a new crop, i.e. bean crop (or faba beans in Bonga). In the case of farmers of Kakamega, Kenya, the sesbania is allowed to become a **forest/woodlot** by closing its canopy for 18 months. During this planted fallow period, soil moisture and organic matter is greatly improved. Weed flora is decimated and soil bulk density is greatly reduced allowing zero or minimum tillage possible when cropping commences. The cut sesbania yields construction pole and fuel wood, the later a badly needed commodity as the area is dominated by commercial sugar cane farming for sugar industry in the sub-region.

Applying the improved tree fallow agroforestry practice, using sesbania in Bonga, we take a farmer who has put in his/her maize crop in December and expects to harvest early June. The broadcasting of sesbania (after seed treatment as described above) can take place during the first **shilshela** early January. With proper monitoring of sesbania shade on the maize crop, Sesbania will have grown tall by harvest time in early June. With the maize harvest done, the farmer should find his/her maize field having become a sesbania **forest or high density woodlot**.

We assume the farmer has decided to put in a bean crop (faba bean). He will open his sesbania woodlot to accommodate the bean crop by harvesting sesbania to make a wide alley for beans. The alternative is to completely harvest his sesbania, take out the wood harvest and leave the BLT (branch, leaf, twigs) by lying it as **trash line** to form a contour terrace at slope intervals as described above. The farmer can repeat sowing sesbania in his bean crop, perhaps selecting an annual sesbania species and one that yields fodder and fix atmospheric nitrogen (for the subsequent crops, not the bean which does fix its own nitrogen as well).

It is best not to completely harvest the sesbania woodlot following the maize crop. It is best to leave row of sesbania that corresponds to the terrace frequency as this line will eventually develop into a biological terraces where the BLT harvest is aligned to form the trash line or terrace line. These terrace line sesbania rows will act as windbreak and sesbania seed source for the farmer. It is also advisable to add a grass line on the sesbania rows such as lemon grass or elephant grass; the latter is difficult to establish if animals are on free-range system of grazing, as it is the case now. Lemon grass is not grazed or browsed by domestic animals and is a potentially new cash crop for Bonga, perhaps on **contract farming** or **out growers schemes** for the **Tea Commercial farms and Factories** in the area (See other document on the subject).

In summary, the cropping package suggested by the field manual for trainers for the woredas in the Kaffa Zone is sound and we assume that this will be implemented at least, on a pilot basis. The **Maize-bean intercropping and cereal-bean rotation** is a proven farming system in the East African highlands (i.e. The Embu maize/bean farming system of Eastern highlands, Kenya). Both are improvement from the present system of maize alone followed by other cereal crops such as barley or

wheat, etc. The Improved Fallow system using woody perennials such as *Sesbania sesban*, used here to illustrate the technology for Bonga will be built on this maize/bean intercropping and using cereal-legume rotation system.

Sesbania is established as a relay crop within the maize/bean growing period and the system at this stage can be referred to as **Relay Cropping/Farming**. The practice or system of allowing the sesbania to remain in the crop field after the maize has been harvested and before it is cut to give way to the next agricultural food crop is the **Planted Fallow Phase/Period**. Under the prevailing slope aspect of the landscape including croplands and the high level of weed infestation, it is recommended that on a pilot basis a longer sesbania fallow be tested, i.e. 18 months from establishment. This will more than pay than the opportunity cost of cropland left un-cropped for food crops. The economic and service benefits of this sesbania fallow period will reduce weed flora, improve soil tillage condition and soil fertility as well as yield important product, **wood** for the home and for the market to generate cash.

It is also suggested that the sesbania fallow be harvested in such a way to establish biological terraces using the percent slope and terrace frequency as illustrated here. At this stage the technology often referred as **Alley Farming or Hedgerow Intercropping** is indirectly being introduced in the farm management. The use of *Sesbania sesban* has been selected as the tree has already made its presence in the area, although farmers do not know its potential role in providing both **production** and **services**. But commercial coffee farmers who quickly cleared the forest canopy are now resorting to planting sesbania to provide both shade and reduce weed, both needed aspects in producing forest coffee." The choice of Sesbania is because it can be directly broadcast or sown in rows without going through tree nursery to produce seedlings. Its short-lived characteristics (dies within 5 to 7 years or longer under Bonga conditions) from planting is both a drawback and an advantage. We feel it is an advantage as there is no direct cost (no seed or cultivation cost) of sesbania establishment.