inter aide

Farm-based micro nurseries

an effective way to provide fast access to large quantities of fodder grasses (and other vegetative material)

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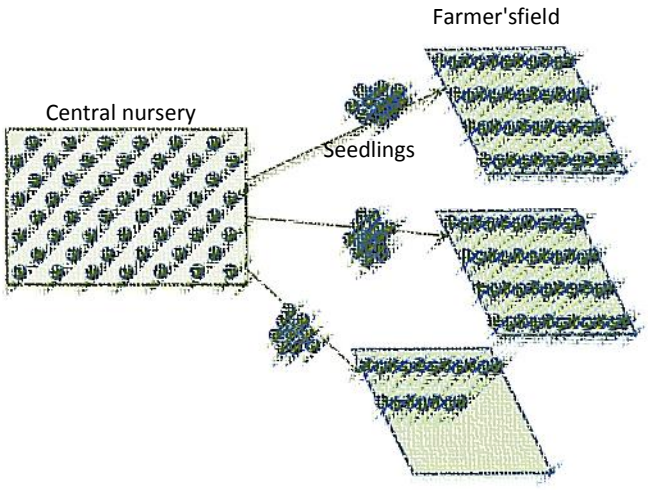
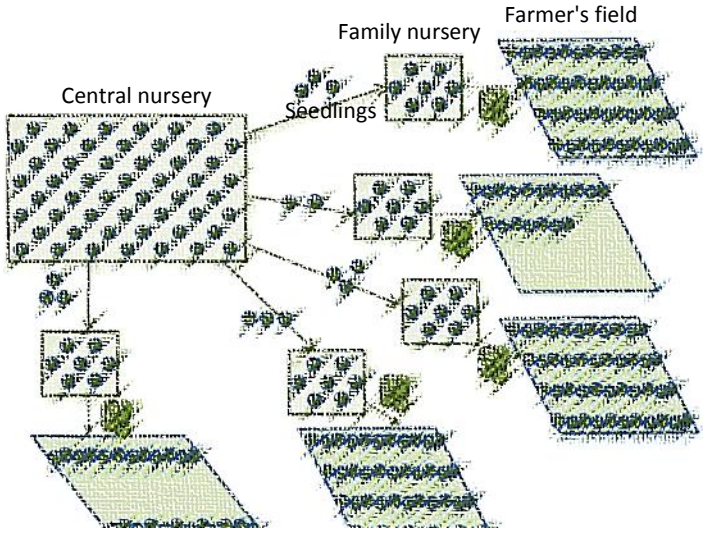
Introduction

The issue of distributing (new) vegetative material for a large number of families often represents a major bottleneck for organizations and institutions (Ministry of Agriculture, Research Centers, NGOs…). When Inter Aide started to work in south-Ethiopia, we were relying on large central nurseries to multiply and provide planting material to farmers, especially Vetiver (*Vetiveria zizanioides*) in order to consolidate anti-erosive structures made with soil bunds. But the cost to maintain those project nurseries, to produce and to transport the vegetative materials to farmers' field was substantial. Paradoxically, this onerous logistic and the related expenses only allowed to reach a restricted number of farmers, residing at accessible place close to roadsides. Furthermore, the survival rates of the vegetative materials after transplantation on the farms were sometimes below 50%.

Involving farmers in the production and propagation of vegetative planting materials has considerably and rapidly increased the number of targeted farming family, for a similar cost. The introduction of farm based micro nurseries has also largely improved the average survival rates of the plants after transplantation, reaching more than 90%. However, this new practice has faced difficulties to be accepted, as farmers never considered before producing fodder within their very small arable land. They were mainly relying on natural grasses and crop residues to feed their cattle. But with the shrinking of the farms and the subsequent increasing pressure on the land, farmers start to feel a growing imbalance between animal needs and available resources to feed them.



DIRCECT SUPPLY OF VEGETATIVE MATERIAL FROM **CENTRAL PROJECT NURSERY**



REACHING MORE FAMILIES WITH FARMERS MULTIPLYING THEIR OWS SEEDLINGS IN **FARM-BASED NURSERIES**

The combination of farm based micro-nurseries and palatable fodder integration on anti-erosive structures appeared therefore as a key innovative solution for the families. They first start to practice the cropping and multiplication of fodder grasses on very small plots, mainly for multiplication purpose in order to then transplant the seedlings on anti-erosive structures. But rapidly, notifying the benefits of fodder integration within the farm, and the possibility to autonomously control the multiplication of the grass, most farmers have extended fodder production in new areas: along hedges, around crop fields, on farms' contours, and even on dedicated small areas within their farm to develop permanent fodder plots.

After 10 years of experience in southern Ethiopia, 16.000 families have integrated fodder production on their farms. This model of farm based micro-nurseries, mainly used for the multiplication of Pennisetum varieties (riparium, purpureum…) was a real innovation for a lot of farmers. It also paves the way for the diffusion of other new fodder varieties, and notably leguminous species.

Integrating fodder in the farms: the constraint of access, multiplication and conservation

The demographical pressure on resources is correlated with a gradual imbalance between available natural grass and farmers' needs to feed their cattle, which is essential in the agrarian systems of South Ethiopia. An article written in 1988 by, AdugnaTolera (Awassa College of Agriculture) and AN Said (ILCA) already highlighted the relevance of integrating fodder production within farming systems in very densely populated rural areas: "*Because of the high population density, land holdings per household are small. Inadequate feed supply is the main constraint to livestock production. In order to optimise overall productivity there is a need to integrate food and feed production. Introducing forage legumes seems an acceptable approach: forage legumes will improve soil fertility, crop yields and herbage quality, and make the system more sustainable. Hedgerows of multipurpose fodder trees, productive backyard forages and under-sowing or inter-planting improved forages with food or plantation crops will probably be the most successful forage development strategies in this area. Research should look at temporal interactions between forage supply and form of feeding and nutrient demand by animals to exploit opportunities for marketing animals and their products.*

However, growing fodder is not a widespread practice in Southern Ethiopia. Many reasons can explain the limited development of fodder production, among which Duncan A. et al (2011) emphasize the very low availability of forage seeds, as the Ethiopian seed system is mainly dedicated to cereal production. In addition, according to researchers from the International Livestock Research Institute (ILRI) and the International Food Policy Research Institute (IFPRI), organised markets for quality forage practically don't exist, both at a local level and on a larger scale.

To integrate fodder cropping in their farms, the farmers have to overcome three major issues:

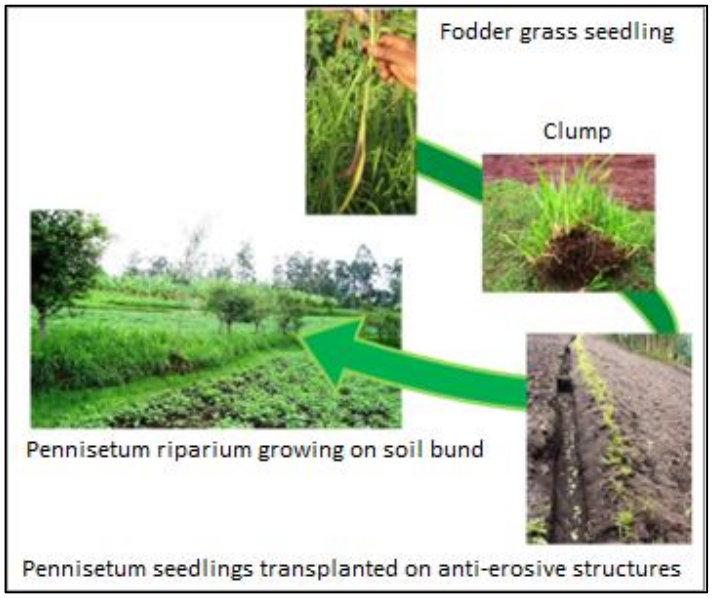
- Accessing to an initial quantity of planting material or seeds,
- Propagating the species,
- Securing and conserving seeds and/or planting material over the seasons

Farm-based micro nurseries establishment to address several constraints

Several species of fodder grass and leguminous can be multiplied in family backyard nurseries before being transplanted in the farm: on anti-erosive structures, in fields' contours, on degraded and abandoned lands, to create live fences or hedges... The multiplication of vegetative material on a small plot near the home garden (from 6 to 20 m²) is **an efficient way to facilitate access to new varieties for a large number of farmers**, who **directly control the multiplication and transplantation process**. For some fodder grasses, as certain *Pennisetum*, the multiplication can easily be done by cuttings. Backyard nurseries give therefore **autonomy to farmers** who can **rapidly increase available biomass**. Finally, the introduction of farm-based micro nurseries has also largely **improved the average survival rates**, reaching more than 90%, as farmers can decide the most appropriated time to move the seedlings.

Involving farmers in the production and propagation of seedlings has considerably and rapidly increased the number of targeted families, for a similar cost. It also highly contributes to reduce the initial inputs. And once some farmers have propagated the species, they can exchange their vegetative material and know-how with other farmers, who in turn, easily multiply the clumps. Individual small nurseries can address several difficulties faced by farmers:

- Limited access to fodder seeds and planting material
- Onerous logistic constraints for the transportation of planting material from "central" nurseries to farmers' site and related risk of low survival rate of the plantlets
- The conservation and the renewal of the seeds: especially for certain grass species or for annual crops, compelling farmers to search for and buy their seeds every year
- The difficulty for farmers to recover their planting material when affected by drought



From seedling taken from backyard nursery to fodder production on anti-erosive structure

Main steps to implement a family backyard nursery

This section presents an overview of the main steps and technical specifications for the establishment of the farm-based micro nurseries in the context of south Ethiopia. This information is indicative and illustrate one experience in a specific context. Moreover, the illustrations below mainly concern a certain species of Pennisetum called "Penissetum riparium",which has proven to be well adapted, with appreciable fodder values in South of Ethiopia. But family backyard nurseries can be used for many other species and adapted to different agro-ecological contexts.

Site:

The nursery should be established:

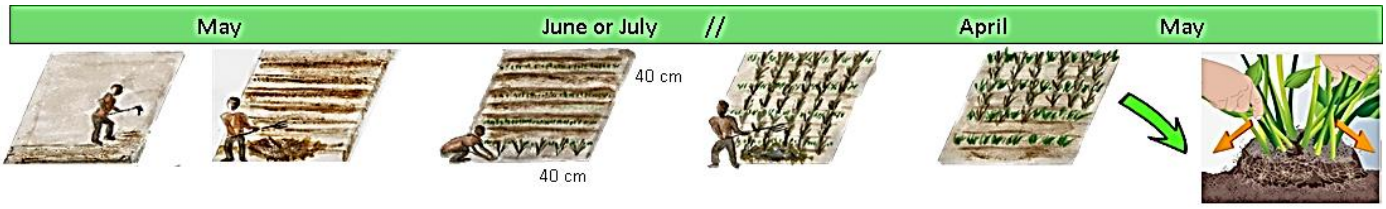
- Close to the house, to facilitate care to young plants and ease the maintenance during plants' growth
- In a clear area, but protected against mid-day sunlight, strong winds, and animals.

Open-grazing should be carefully controlled to prevent animals for eating and stampings the young plantlets. If any risk, the backyard nursery has to be fenced or kept in an area enclosed by a hedge

Size:

An individual backyard nursery of 10m² to 20m² produces enough seedlings to vegetalise 200 to 300 m of anti-erosive structures.

Timeline:



Bed preparation	Bed fertilization	Clump plantation	Bed fertilization	Clump division and transplantation
Layout and superficial tillage of the bed	- 3 baskets of manure - 1 basket of wood ash	- 40 cm between 2 clumps - 40 cm between 2 rows	3 baskets of manure	- 20 to 30 seedlings from 1 clump - 20 cm between 2 seedlings

Preparation and fertilization of nursery beds

A key factor for the success of seedlings' production in backyard nursery is the optimal preparation and fertilization of beds. After demarcation, **superficial tillage of 15 to 20 cm** should be done to take out stones or roots **and get a loose, levelled fine soil**. For optimal growth, nursery beds should be fertilized with orga nic manure one month before the plantation of the seedlings (preferably at the onset of the rainy season) and three weeks to one month before the transplantation of the grass.

As most of the grasses, *Pennisetum Riparium* needs nutrients to thrive. Nitrogen (N) is the most important one, and is mainly responsible for growth and photosynthesis, which is crucial for fodder grasses. For a nursery of 9m², at least 3 baskets (total equivalent to 8kg) of decomposed manure should be mixed with the soil. One basket of wood ash can also be added during the first input. Wood ash helps increasing soil pH to correct acidity, and is also a source of nutrients such as phosphorus, potassium, magnesium and calcium.

Adapted period for clumps plantation

Ideally, clumps should be planted at the beginning of the main rainy season (Meher in Ethiopia). Indeed, to produce healthy seedlings, it is recommended to manipulate and multiply clumps under a warm atmosphere with enough rains as grasses like Pennisetum (riparium, purpureum…) better grow in moist soil.

Source of planting material: where to get the first seedlings for multiplication

The first step is to get at least some varieties introduced in the area, which is not simple. To accelerate the introduction and diffusion process, buffer "communal nurseries" may present an interesting intermediary option, especially in case of vegetative material scarcity in the area. A first pre-multiplication process can be done at central level (communal nursery, Farmer Training Center) to get a first round of planting material to then supply farm-based nurseries.

A communal nursery developed by the communities, as "buffer production site", to then supply community members (Damot Sore District)

A Farmer Training Center managed by the MoA with demonstration plots, that are also used as multiplication source to supply farmers (Hadero District).

Spacing and density in the backyard nursery

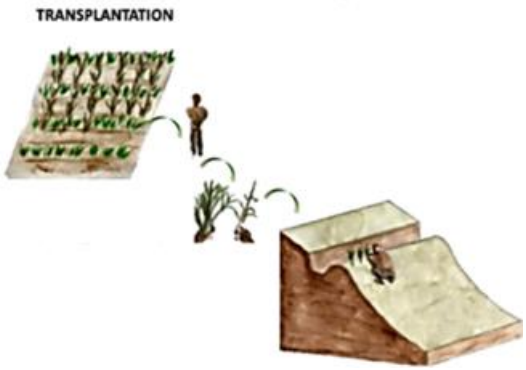
For grasses (especially Pennisetum): the average distance between two clumps of Pennisetums should be 40cm x 40cm. A small hole of 10 cm deep is enough to plant the slip. After the insertion of the base of the clump within the hole, the soil should be piled up and compacted enough to insure good rooting.

For the production of legumes seedlings (such as for Desmodium) **or seeds** (Pigeon pea, Alfalfa, Vetch…): from IA team observations, it seems recommendable not to associate legumes and grasses in the same nursery for multiplication purpose, as there might be competition at very young stage.

However, it is highly recommended to associate foddre grasses and legumes anywhere else out of the nursery, especially on permanent forage production areas where some associations of grass and legume fodder are really relevant: to diversify fodder sources, to maintain nitrogen that can be used by the grass, to increase biomass production per surface unit… Better to allocate separated plot for propagation of newly introduced legumes, then most of the seeds or cuttings (i.e. gliricidia, desmodium, tree lucerne…) can be collected directly on site (from forage trees, shrubs, on the field…).

When to transplant the seedlings from the nursery to the field?

Transplantation has to be done at the onset of a rainy period, to ease seedling rooting. Usually, farmers wait at least 6 months to transplant their seedlings. At this stage, clumps have usually already produced more than 20 slips.



Division of clumps for transplantation

A clump can either be totally uprooted from the nursery, or partially. If a farmer wishes to keep multiplying seedlings or to produce fodder on the same site, only part of the clump should be taken out. One clump can spawn 20 to 30 seedlings, which can be easily divided by hand. If seedlings are harder to separate, a knife should be used to get a clean cut.

a) Clump removed from the nursery with several seedlings;
b - c) Division of a seedling from the clump

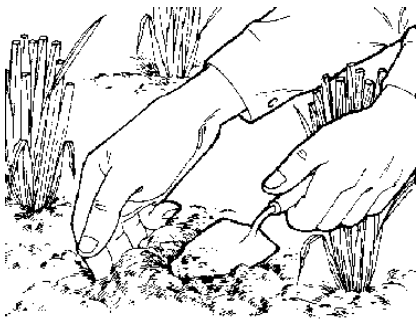
With **5 clumps of *Pennisetum riparium*** as starting material for one family:

- ⇨ **100 seedlings** (each clump containing about 20 seedlings) can be **planted** at a distance of 40 cm x 40 cm from each other **in a nursery of about 15m²**
- ⇨ 1 year later, **each seedling planted can produce in turn 20 new slips minimum**, corresponding to a total of **2000 new seedlings** (if the moisture is good, the seedlings can already be harvested after 6 months)
- ⇨ Transplanted every 20 cm on anti-erosive soil bunds, these 2000 seedlings can vegetalize **150 to 200 m of anti-erosive soil bunds**.

Maintenance of nursery beds

Weeds compete with seedlings for water and nutrients → weed frequently nursery beds, taking care not to damage seedling roots.

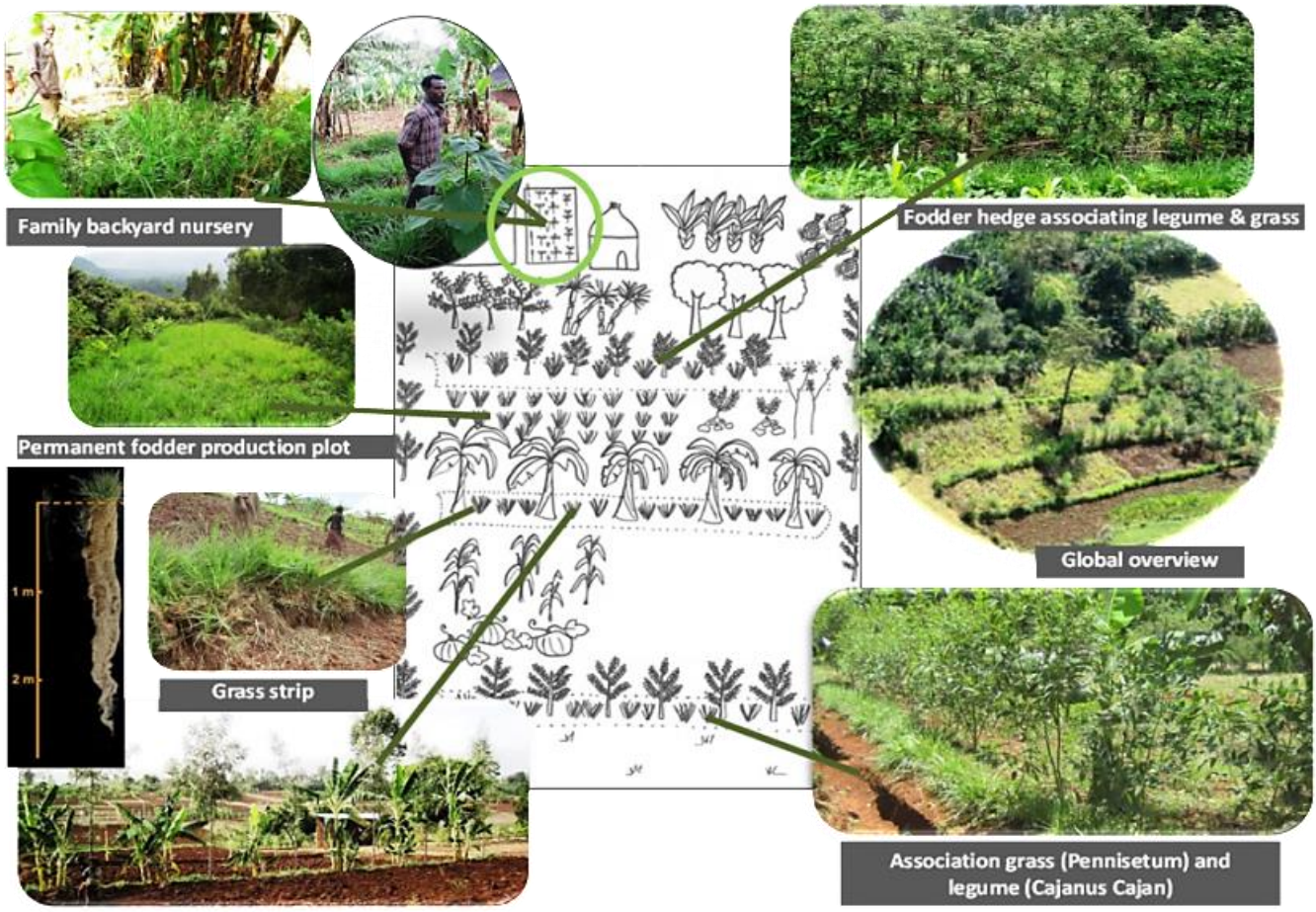
Soil should be kept friable → lightly till the top of the soil to allow water and air to enter it easily.



From the backyard nursery to the field: illustrations

The combination of farm based micro-nurseries and fodder integration on anti-erosive structures appeared as a key innovative solution for the families. Farmers generally start to practice the multiplication and the cultivation of fodder grasses on very small plots, essentially to transplant the seedlings on anti-erosive structures. But rapidly, notifying the benefits of integrating fodder within the farm, and the given possibility to autonomously control the multiplication of the grass, most farmers are extended fodder production in new areas: along hedges, on farms' contours, and even on dedicated small areas within their farm to develop permanent fodder plots.

The following figure illustrate the diffusion of fodder species in different areas of the farm, starting from the micro nursery (inside the green circle)



Examples of transplatation on antierosive structures and as grass strips on the field:

Deep ditch with newly planted bunds

Double row of fodder on both sides of the ditch

Grass strip in fields on gentle slope

Propagation of planting material in the backyard nursery and seed collection

Grass species: propagation in backyard nursery by cuttings

From left to right: 1 :Elephant grass multiplication, 2 :Pennisetum riparium, 3 : clump divided in to slips



Legume forage species seed production by individual farmers to be self seed sufficient

From left to right: 1:Production of Vetch seeds; 2: Desmodium for a propagation by seedlings


Trees and shrubs forage species: seeds' collection from established hedges

From left to right: 1:Sesbania sesbane; 2: Cajanus cajan


Seedlings grown in backyard nursery for tree and shrub forage species

Here with Sesbania sesbane


Different forage cultivation practices in the farm and uses

Desmodium associated with bana grass at permanent forage production plot

Alfalfa with Pennisetum riparium making a good vegetative strip to control erosion

Desmodium cropped under the coffee plantation

Grass (different types of Pennisetum) have been transplanted to create a permanent fodder production plot.

Natural pasture improved by oversowing vetch

Alfalfa on anti-erosive structure

P.riparium and vetch

Advantages, limitations and adoption

Thanks to individual backyard nurseries, farmers can **multiply themselves vegetable material** (i) to consolidate anti-erosive structures, (ii) to produce fodder to feed their animals or to sell at the market, (iii) to establish hedges...

The backyard nursery requires only **a small plot** next to the house and little maintenance **to produce an important quantity of seedlings.** In addition, **farmers control themselves the appropriate timing to transplant** the seedlings from their backyard nursery. According to a study conducted in 2005[1], , the survival rate of slips after transplantation reaches 90% when the vegetable material is produced on farmers' plot, against 40% when the seedlings are supplied by central nurseries.

Advantages	Limitations
• Farmers are autonomous to produce their own vegetative material • Somegrass species (like Pennisetum) are easy to propagate by cuttings • Enable a rapid multiplication of a large number of plantlets (or seeds for somelegumes) on a very reduced area • High survival rate of the plantlets • Direct control of the transplanting time, at the most suitable moment for the farmer	• The technique requires some practice to get confidence, especially during the 1st year • Areas formerly used for home gardens product may become dedicated to fodder production, leading to a slight reduction of vegetables for self-consumption • Absolute necessity for the nursery to be protected from open-grazing, to avoid the risk of losing all plantlets at once • slips require wet soil for seedling establishment or germination, at least during the first 2 months

Adoption by the farmers

Regarding the **adoption**, it requires some timefor farmers to be convinced. Indeed, when the practice is suggested in new areas, farmers need first to perceive and observe the benefits of the nursery. Typically, they first see the constraints in terms of loss of space in the family home garden. But usually, after 1 or 2 years, when farmers have observed the interest in neighbouring farms or tried it on very small plots, the majority of villagers establish theirbackyard nursery in order to multiply fodder.

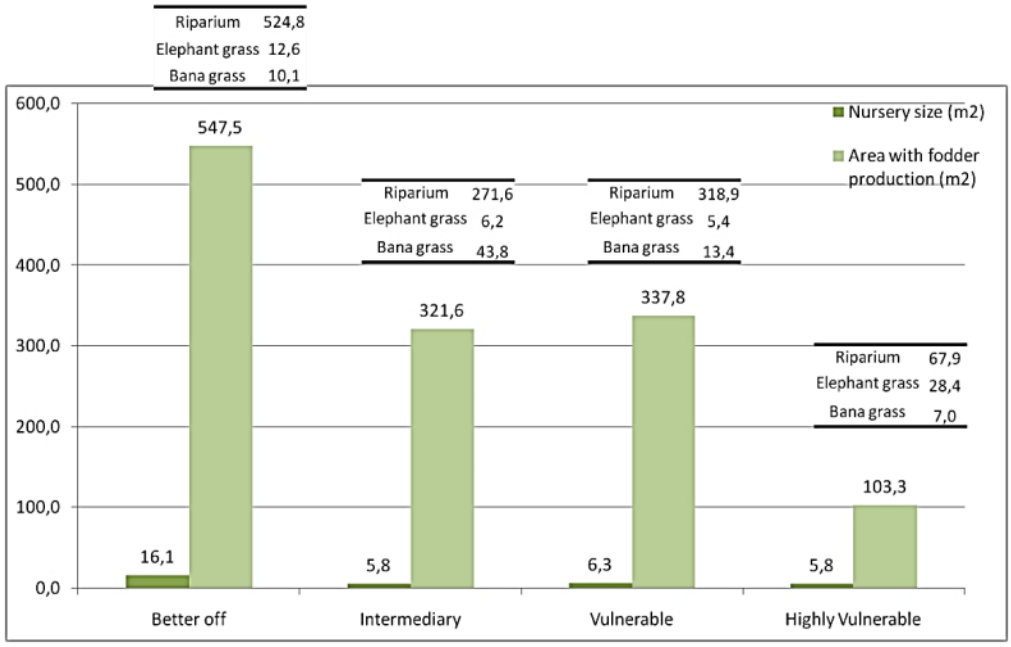
As an illustration, a survey conducted in 2012 in Inter Aide's project area among 744 farmers showed that **in 2 years time, 87% of the families had implemented a backyard nursery for the multiplication of fodder plants**.

[1]First year of individual backyard nursery implementation

Another assessment was conducted in 2015[2] in order to address 2 questions:

What is the evolution of the surfaces dedicated to fodder 2 to 3 years after the implementation of nursery?

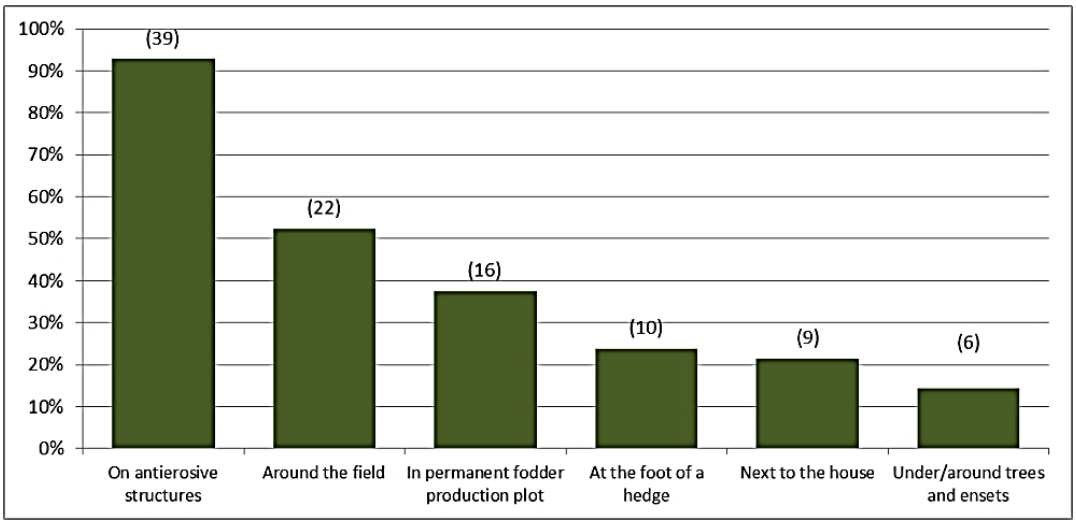
The average surfaces dedicated to fodder production has evolved from 8.5m² (the initial surface of the backyard nursery) to 327.5m². Before the introduction of farm-based nurseries, none of the families was growing forage species on their farmland. Natural grasses, weeds or crop residues (straw, maize stover, sweet potato vines…) were the main sources for animal feeding. The following chart provides the evolution of fodder production areas for 4 main social classes[3]: : for instance, the average surface for the 5 highly vulnerable families surveyed, has evolved from 5.8m² to 126 m².



Most of the farmers use the backyard nursery plantlets to integrate fodder production and optimise unused spaces of the farm. This new practice does not compete with the traditional cropping systems.

What is the destination of the seedlings produced in the backyard nursery?

Most of thefarmersare using the seedlings to vegetalise their antierosive structures[4], which was also higlhy promoted by the project. Half of them also counter-planted grass around their field. Except when permanent fodder production plot are created, all other uses consist in integrating fodder on unused spaces of the farm. **This new practice optimizes farmlands' uses, without competing with the traditional cropping systems**.



[2] Measurements done among 42 farms randomly selected in the project areas in Wolayta and Kembatta zone - southern Ethiopia
[3] Social classes are determined according to a set of 3 main criteria: the surfaces, animals, enset plot size.
[4] Data analysis collected from the same sample of 42 farmers