

**Dissemination of *Calliandra calothyrsus* in Marangu, Mshiri, Masia villages in
Moshi Rural District, Tanzania**

**Selian Agricultural Research Institute (SARI)
in collaboration with**

ICRAF Nairobi

Principal investigators

Ms M. Kingamkono and Mr C. Lyamchai

Collaborators

Ms Rose Marandu (Extensionist in Mshiri village)

INTRODUCTION

Dissemination of fodder materials by the Selian Agricultural Research Institute (SARI) in collaboration with AFRENA-ECA on the slopes of Mount Kilimanjaro (Marangu, Mamba and Kilema wards) and AHI in Lushoto respectively started in 1999. The high population density and continuing land fragmentation in these highland areas, has reduced the land holdings to about 0.5 and 1 acre. Free grazing is no longer possible and even pasture establishment is quite limited, (Lyamchai et al 1998, Lyimo et al 1999). The main resources available are the banana-based diets, such as the pseudo stems, leaves and weeds collected in the banana fields. In the dry season animals could be fed on crop residues, low in quality and digestibility, such as maize stovers and bean haulms. In general, the livestock diets lack protein and mineral sources which can be obtained by supplementing the diets with concentrates. Most farmers cannot afford buying the concentrates due to low availability and high prices. As a result livestock productivity is very low and farmers realize few benefits from livestock keeping, as the animals' production potentials are not fully exploited contributing to poverty among the majority of farmers.

It is against this background that different fodder materials were introduced in the area and distributed to selected farmers in selected villages. The species included fodder trees such as *Calliandra callothyrsus*, *Sesbania sesban*, *Leucaena spp*, *Flamingia macrophylla* and Napier grass. The species were introduced primarily to alleviate fodder shortages and increase milk production. Stabilization of soil conservation structures and improve soil fertility were added advantages.

Activities under AFRENA-ECA stopped three years ago due to lack of funding. However, a recent visit in Marangu and Mshiri sites in September 2002, showed that farmers had continued growing, utilization and sharing *Calliandra c.* with other farmers. For those who were feeding *Calliandra c.* to milking cows, noted an increase in quality and quantity of milk and therefore went on looking after the few trees they had. There were also attempts to share some seeds with neighboring farmers. Others experimented on nursery establishment to add more trees. Based on what transpired from the visit, it was proposed and agreed to conduct an informal survey on *Calliandra c.* dissemination to capture the processes, experiences and opinions, biomass yield, their feeding pattern and planting pattern. Other factors to be captured included, whether the *Calliandra c.* is competing with other crops, demand by their neighbors or friends, advantages and problems associated with *Calliandra c.* and its utilization in conjunction with other forage materials like Napier.

This report therefore, documents the results of the informal survey conducted at Mshiri village in Marangu ward on 10th to 12th February 2003.

METHODOLOGY

A checklist for conducting informal survey was requested and received from Dr. Steeve Franzel of ICRAF-Nairobi and was adopted and used in this survey (see Annex 2)

Selection of farmers to be interviewed was based on the following criteria;

- i) Farmers who had interacted with researchers in 1999, planted some *Calliandra* trees and visited Kenya on a study tour in July 1999,
- ii) Farmers who had interacted with researchers in 1999, planted *Calliandra* but did not visit Kenya

- iii) Farmers whom have not interacted with researchers but through their fellow farmers have either planted, heard or are interested in *Calliandra*.

With the assistance of the extension staff for Mshiri village, Ms Rose Marandu, a total of seven (7) farmers were interviewed, two in each of categories (i) and (iii) and three in category (ii). This small number of farmers is only about 15% of farmers who were given *Calliandra* seedlings. A small sample was taken in order to understand and get used to the methodology, see the kind of information obtained and make amendments where necessary. The survey will continue to cover all farmers who were involved in *Calliandra* upon finishing this report. Group interviews were held only with category (i) because they were visited and partly interviewed during the preliminary visit in September 2002. The rest of the farmers were individually visited and interviewed at their homesteads.

RESULTS

Category 1: Farmers who visited Kenya in 1999 and were given *Calliandra* seedlings by Selian researchers.

Basic information

Ms Kalebi Mosha and Frank Shayo were among the representative farmers who went to Kenya on a farmer-to-farmer training visit in July 1999. Ms Kalebi Mosha is a fulltime housewife and her husband is a teacher at a nearby school. Their household activities are planned together but implementation is mostly done by the wife and the husband assists when he has time. Mixed farming and employment of her husband are their main enterprises. Dairy animals, coffee and banana cultivation around their homesteads are the major agricultural enterprises.

Mr. Frank Shayo is a self-employed man dealing with farming and he has milling machine operating as a business. He is the main planner and implementer of household and in a few cases assisted by the wife like in feeding the dairy cows and milking. Coffee and banana cultivation and dairy animals are his main occupation.

Both households are skilled in crop and animal husbandry and are all considered 'rich' in their respective villages.

a) Basic enterprises

Enterprise	Mrs Kalebi Mosha	Mr Frank Shayo
Farm size	1.5 acres (home garden)	1.5 acres (home garden)
Animals	4 cows (cross breed)	5 cows (cross bred)
	1 goat (local breed)	-
	10 local chickens	20 local chickens
		2 pigs
Others	Husband is a teacher	Used to a milling machine (stopped 2 years ago)

b) Planting of Calliandra

Both Mrs Kalebi and Mr Frank reported to have received seedlings from researchers from Selian Agricultural Research Institute in 1999. Each received about 250 seedlings and planted them along the walkways, borders and contours as were advised by researchers. Two seasons after transplanting some trees started seeding and they tried to raise their own nurseries and increased the number of *Calliandra* trees. Currently Mrs Kalebi has about 400 and she says the trees are not quite enough for her milking cows. Frank Shayo has 300 *Calliandra* trees which he reported that the trees are not at all enough. They continued planting extra trees along the walkways and borders. When asked as to why not planting the extra *Calliandra* in other areas of their farm they responded by saying that due to land scarcity and heavy shade in the coffee/banana system, they do not have any other choice except along walkways and some points along the borders. Mrs Kalebi reported to have been allowed by her husband to continue planting *Calliandra* along the un-arable river valley within their 1.5-acre plot. She is determined to grow more *Calliandra* especially after a private milk-collecting center has been established at Marangu Mtoni. Farmers are getting 250 Tsh/L. The milk is taken to Dar es Salaam weekly for processing and distribution.

Establishing the tree nursery was difficult at the beginning, says Kalebi. I used to boil the seeds for a few minutes but found the germination was not good. Tried to soak for 48 hours and germination improved to over 80 % especially in the wet season. The survival rate of *Calliandra* seedlings after transplanting was reported to range from 60-80% by both farmers Kalebi with Frank rating 80% especially during the rain season. In dry months of the year, survival rate is low unless the trees are irrigated.

Farmer's perceptions of benefits and cost/problems

i) Advantages/benefits

Increase in milk production in both quantity and quality: The two farmers reported increase in milk quantity and quality because of feeding *Calliandra c.* Kalebi reported her milk production to increase from 4 to 5 litres per cow per day. Frank reported an increment of 1.5 L upon feeding *Calliandra c.* The same increment (1 L) was also recorded by farmers in Babati district whom are conducting a similar activity since 2000 (Lyamchai *et al* 2003). “ We have also noted an increase in milk quality because the rating we get at the collection center for our milk is better if we have fed the cows with *Calliandra c.* than when not” says Frank and supported by Kalebi. “Upon feeding *Calliandra c.* as a supplement to milking cows the water content goes down and the flavor becomes better. The changes are very clear when one stops feeding the cow with *Calliandra c.*” they added.

Cost reduction in maize bran: Before she came across the technology, Mrs Kalebi used to supplement her cows with 1 tin (a tin is a 20 L container), about 10 kg, of maize bran per week. It costs 1,000 Tsh (about 1 USD). These days she uses ½ the amount, adds a bunch of fresh *Calliandra* and she gets the same amount of milk but of higher quality. So there is a saving of 500 Tsh every week. Such a reduction of maize bran costs has impressed her husband and is encouraging and assisting her in raising a tree nursery and offered more land for planting the seedlings when the rain season starts.

Palatability: *Calliandra* is highly palatable to the animals. Signs and gestures that were attributed to it are: i) animals do rush for *Calliandra* tree immediately they are let loose; ii) animals do eat even the woody part except the very hardened parts iii) Once there is a bunch of *Calliandra* in the feeding trough the animals would rush to it and select it first than the other feeds like grasses. It is good to mention here that the two farmers have also some *Leuchena trichandra* which is growing very well. They claim, the plants are hard to distinguish physically, in palatability to the animals and milk quality and yields.

Time and labor saving: Both families appreciated that availability of full-grown *Calliandra* around their homesteads has reduced their time for looking for feed thus enabling them to do other things. “Of course it is advantageous and I badly need to add more” said Kalebi.

It makes a nice hedge along the walkways: “This is one of the first things our friends and relatives see and become curious. We explain to them what it is, its uses, benefits and then they request for it” the farmers said.

Problems

i) Aphid infestation

One of the problems they have so far noted is infestation by aphids. The attacks are more serious in the dry season. It kills a number of trees. In the wet season the problem is not as serious. They have tried a few control methods like spraying cow urine, soap foam and ash solution. The control measures have been helpful. Kalebi claims, dusting with ash is fast and effective.

ii) Moles feeding on the roots

Moles are a big problem as they feed on roots including *Calliandra* which kills the affected plant. However, during their visit to Maseno in Kenya, they learnt about intercropping the crop with *Tephrosia* as a strategy to reduce mole infestation. *Tephrosia* roots are too bitter to moles and once they encounter such bitter roots they abandon the farm. Kalebi brought some *Tephrosia* seeds from Maseno, intercropped them with other crops including *Calliandra* and it has reduced mole infestation in her farm.

Distribution of *Calliandra* to others

Both Kalebi and Frank reported to have given either seed or seedlings to their neighbors and friends. Kalebi gave seeds to a friend but did not take off and she is suspecting that the friends did not irrigate. Currently she has some few seedlings that she plans to use on her own and the rest give them to her neighbor. Frank Shayo has given seeds to a friend in Dar es Salaam, a relative in Arusha, Mamba and Kimangaro villages in Kilimanjaro and to about 5 neighbors. As to how his friends got to know *Calliandra* Frank says, once people see it along its walkway and around the house everybody becomes curious to know it since it is a new plant in the area. So he takes time explaining to them its uses, advantages and his own experience. As soon as they hear that this particular tree increases milk production and reduces the costs of using maize bran, they immediately request for it. Mr Frank gives them free of charge although some were ready to pay for it. He was certain that some are still ready to buy if given a reasonable price and currently he has about 0.5 kg of seed. It is mostly women who are seeking for *Calliandra*. This is because women are responsible for managing them, feeding, cleaning the barns and milking although

traditionally cows are owned by men. However, the milk belongs to the women. Mrs Kalebi's story was very similar to Frank's.

Having noted that there is a moderate demand for *Calliandra*, both farmers agreed that it is worth starting raising *Calliandra* seedlings for sale. They are ready to start this 2003 growing season.

Calliandra pruning and feeding management

Initially Kalebi and Frank were using machetes or knives to prune *Calliandra* but they noticed that they were dying instead of sprouting. Kalebi's husband advised her to use secateurs. The results are good in the sense that the plants are not drying any more. Frank has been using secateurs all along. Frank feeds his milking cows a bunch of *Calliandra* at 10 am together with some little maize bran. Kalebi feeds maize bran and other grasses in the morning then the *Calliandra*. She uses this regime to avoid disturbance during milking. "If you feed them *Calliandra* during milking they disturb the milking process as they are too much excited by the *Calliandra*" she says.

Other uses

Mr Frank also feeds it to his chicken. First of all he dries the leaves for about 2 to 3 hours and then mixes it with maize bran. He has noticed that it increases intake and the egg yolks turn very yellow. The woody parts left out by the animals are a good firewood – it lights very easily even when it is not completely dry.

Competition with other crops

When asked their experience as to whether *Calliandra* has any effects on crops/plants growing nearby, none of them has noticed any competition problems. "No problems, I have planted beans close to *Calliandra* and they are growing nicely even than the ones far from the *Calliandra*. I think this plant is very good for crops as well", said Mrs Kalebi.

Seeds

Each farmer has selected several trees for seed production. Kalebi has 5 trees for seed and currently she has ¼ kg whereas Frank has 8 trees and has so far collected ½ kg. Both have noticed that the seeds need to be harvested before the pods are too dry. Otherwise a lot of the seeds will be lost as the pods are very dehiscent.

Category 2: Farmers who did not visit Kenya but were given Calliandra seedling by Selian researchers

Three farmers, Mr Penda Lauo, Mr Julius Mtui, and Mr Ruaichi Mtui individually visited and interviewed at their homesteads.

Basic enterprises

Enterprise	Penda Lauo	Julius Mtui	Ruaichi Mtui
Farm size	½ acre (home garden)	1 acres (home garden)	¼ an acre (home garden)
Animals	1 cow (Friesian)	1 cow (cross breed) and a calf	1 Jersey (cross bred)
	4 goat (local breed)	-	2 goats (local)
	Several local chickens	Several local chicken	-
Others	Employed as Village Executive Secretary	A Pensioner (retired teacher)	-

Their major enterprises are mixed farming – coffee, banana and dairy animal keeping. Salary and pension earnings rank second for Mr Penda and Julius Mtui respectively. Only Mr Ruaichi Mtui is considered ‘low income farmer’ but the rest are considered ‘medium income farmers’. They all have good management level of their farms and animals.

Calliandra pruning and feeding management

Mr. Penda uses a sharp machete or a sharp knife in pruning the *Calliandra* and he has never seen any problem. Pruning is done once a month during the rain season. Mr Julius uses secateurs because he has noted that using a machete, the cut ends dry up and eventually the plant dies. Mr Ruaichi has observed that it is good to using a sharp machete to avoid splitting the plant – otherwise it dries up if it splits. Both Mrs Julius and Ruaichi commented and recommended that necessary steps should be taken to ensure that more people are sensitized on *Calliandra*. “People do not have information on this tree – they need to be educated and sensitized” Mr Ruaichi commented. “People need a seminar on *Calliandra* and this is the very right time after the establishment of milk buying and collecting center at Marangu Mtoni” said Mr Julius Mtui.

Planting of Calliandra

Mr Penda has about 50 *Calliandra* trees that survived from the ones he got from Selian Researchers. He got some few grams of seeds and out of which he has added 5 more trees along the borders of his garden. Irrigation water is a major problem facing his extra planting of *Calliandra* and he is waiting for the coming long rains to start growing more.

He is also constrained with land scarcity. He has not yet noticed any difference in milk production with or without *Calliandra* because he does not have enough plants thus the amount he feeds is too small and he is also feeding his animals with concentrates. He spends 6,000 to 7,000 Tsh per month on concentrates and gets 6-8 L of milk per day

Mr Julius Mtui has about 50 trees of *Calliandra* (about 10) which he got from Selian Researchers in 1999. He has tried to get his own seed, seeded and gave some seedlings to 2 neighbors. He told them what he heard from a seminar given by researchers that *Calliandra* increases milk yields and quality. When he fed his milking cow, the milk production increased from 2 to 3 L. Mr Julius has also noted that cows like it. When asked as to why he did not add some more plants while he had seen an increase in milk production whenever he fed the cow with *Calliandra* . Mr Julius responded by saying that currently he has no milking cow but he is planning to add more plants as soon as the cow conceives. Although he has no seeds now but he

admitted that, he has a long enough border to put them (he is sharing a border with the public road).

Ruaichi Mtui got 10 seedlings from researchers and 1 was destroyed by moles. He got seeds from the plants and last year he added 24 plants along the farm border (he is bordering with his own children). He had high (about 95%) survival rate. Ruaichi's wife was around during the discussions and she reported to have noted an increase of 1 'kopo' (a kopo is about 1 L) of milk whenever she feeds *Calliandra* for about 3 days continuously.

Farmer's perception of benefits and costs/problems

Advantages.

i) Competition with other crops: All three farmers (Penda, Julius and Ruaichi) have not yet seen any problems associated with competition.

Penda: Any tomato or cabbage growing near *Calliandra* grows well than the others

Ruaichi: “It has no effect on other crops- only that it does not like shade. It does not produce enough leaves when under shade. It may even die”.

ii) Palatability to animals: All three farmers (Penda, Julius and Ruaichi) admitted that animals do like the plant. Penda gave an example that goats rush to, and never leave a place with *Calliandra* if they are let loose

iii) Callindra sprouts very fast. During the wet season it sprouts within 2 to 3 weeks – Penda.

iv) Labour saving: It does not need any extra labour except at early stages during dry spells when they have to be irrigated (Ruaichi)

Disadvantages/Problems

i) Aphids and scale infestation: All three farmers reported that the plant is easily infested with scales and aphids especially during the dry season. They have not yet used any pesticide; instead, Mr Penda just shakes them off before feeding. Moles invasion is another problem noted by both Julius and Ruaichi. Penda has never seen this problem because moles are none-existence in the village.

ii) It is too much liked by goats. (Penda and Ruaichi) It is too hard to raise when you have baby goats roaming around. It is just too much liked by goats.

Views and experience with neighbors

Penda: Many people do not know what *Calliandra* is. A few ask whenever they see it. His brother in Dar es Salaam has quite a good number of *Calliandra* trees.

Ruaichi: “No neighbor who has asked. They have no information. Last year I had only three friends from a nearby village that asked and I gave them some seedlings. Unfortunately, all seedlings got stolen from one of the recipients”.

Willingness to buy seedlings

Ruaichi: I am ready to buy but I have seeds about 100gm of my own. I may try to raise and sell seedlings to others but not as a serious occupation because I am not sure whether there will be enough number of farmers to buy.

Other uses of *Calliandra*

Ruaichi: I have discovered it is a very good firewood although the animals eat almost every thing. It catches fire even when it is not dry enough.

Category iii: Neighbors and friends who picked the technology from the initial farmers and elsewhere.

This is a group that has not interacted with researchers but through their fellow farmers have either planted, heard or are interested in *Calliandra*. Two of them were visited and were all women.

Their basic enterprises are as shown bellow:

Enterprise	Mama Babilon	Mrs Zablun Mosha
Farm size	½ acre (home garden)	½ acre (home garden)
Animals	4 cross breed cows	1 cow - Jersey
	2 Goats	2 goats
	Several local chicken	Has several local chicken
Others	Owner of Babilon Hotel at Marangu	Her husband is a shoe maker at Bomang'ombe Hai District

Source of information

These farmers were first of all requested to give a short story of where they heard from, and what they heard about *Calliandra*.

Mama Babilon: I heard and saw it from my neighbor Frank Shayo that *Calliandra* can increase milk production without using maize bran. I then followed it up with Ms Rose Marandu the Extensionist. I have 4 dairy cattle whose milk is consumed in my hotel and is not enough. I want to increase my milk production and I heard *Calliandra* can help. When she was asked whether she is ready to buy the seedlings; she said, “yes I will buy”

Mrs Zablun Mosha: I heard and saw it from my friend Mrs Kalebi Mosha since last year. She told me how good is *Calliandra* in increasing milk production and saves from buying maize bran. I got interested and she showed me how to establish a nursery and how to feed. I also liked it because it is nice along the walkways. I have enough area for planting it and I have planted some along my walkway. Unfortunately, they are not establishing well. I am expecting to get more seedlings from my friend Kalebi and I am also ready to buy if I know where to buy them. **Action.** She was advised to plant the expected seedlings in the more fertile area of her farm.

SYNTHESIS

Those farmers who went to Kenya have proved that “Seeing is Believing” as they are more enthusiastic in adoption of new technologies than those who did not visit. When comparing farmers in category (i) and those who did not go to Kenya there is a sharp distinction between them in their perception of *Calliandra*.

Who did not visit Kenya	Who visited Kenya
Have not increased the number of trees	Have increased the number of trees
Have no enthusiasm	Are enthusiastic and ready to excel
Have not seen much advantage	Have seen several advantages
They are skeptical	They apply what they saw
Not ready to experiment	They experiment on their own

Other issues that arose and needing some attention are as follows

- i) Many people do not know what is, and the use of *Calliandra*
- ii) *Calliandra* is mostly asked for by women
- iii) There is demand for seeds and seedling for those who have already seen, heard and utilized *Calliandra*.
- iv) Possibilities of having an enterprise of seedlings
- v) Now that the milk market is available at Marangu Mtoni what does the future hold?
- vi) Labor requirements?
- vii) What other institutes in the same or nearby area that are working with farmers on *Calliandra*?
- viii) A need to establish a *Calliandra* database on who has how many where (village)

FUTURE PLANS

By farmers

i) *Growing more Calliandra*; Frank showed some interest to grow more *Calliandra* but he is constrained by land scarcity. “As you all know a border belongs to two neighbors, so it is not possible to replace the indigenous border with *Calliandra*. But I will try my level best to plant wherever possible” he said. Mrs Kalebi is planning, and has been allowed by her husband, to expand their *Calliandra* plot to the river valley where she will remove the Guatemala grass and add more *Calliandra* trees (to about 800- 1000 trees) and Napier. They have found Guatemala to be not as good as Napier) “Also, given the growing demand and curiosity of friends and neighbors, we need to make sure we have some enough seedlings to offer” Mrs Kalebi emphasized.

ii) Those who have not tried *Calliandra* would like to try it. They want seeds or tree seedlings for planting as the rain season begins. They also need details on it’s management and utilization. In general, they would like to grow it whatever it takes and they requested support.

Researchers

- i) Tracer study for farmers who visited Kenya is important.
- ii) The project needs to come up with strategies to supply seeds and promote nurseries in order to avail the seedlings and meet the demand for *Calliandra*. Collaboration with other partners like HEM and KEDA will be very helpful.
- iii) Framers have indicated that they have tried direct seeding without much success. They have also tried several other methods like a) Establishment by cutting which has failed; b) Boil the seeds which decreased germination; c) Soak the seeds for two days which increased germination to about 90%. Therefore, the project needs to embark on capacity building on informal seed acquisition, handling and nursery management.
- iv) Verification and documentation of IPM strategies used by farmers. Farmers reported several IPM methods to control different disease and pests in *Calliandra*, animals and human beings as follows
 - *Tephrosia* and *Calliandra* intercrop for control of moles
 - Use of ash or cow-urine and dung mixture to control aphids in *Calliandra*.
 - Use of *Tithonia* to control internal parasites in animals.
 - Use of *Tithonia* to control Newcastle in local chicken (see Annex 1)
 - Use of *Tithonia* to control typhoid fever in human beings (see Annex 1)There is a pressing need to verify these IPM technologies over a wider range of farmers and document it.
- v) It is suggested that a seminar be held where those excelling farmers will be among the resource persons. This will be followed by a field day to be held at Mrs Kalebi's farm to sensitize other farmers on *Calliandra*

Reference

Lyamchai, C. J, S. D Lyimo, R.V. Ndoni, M. Z. Owenya, P. A. Ndakidemi and N. F. Massawe. 1998. Participatory Rural Appraisal for Kwalei Catchment, Lushoto District. The African Highlands Ecoregional Programme (AHI), Selian A.R.I Arusha, Tanzania

Lyamchai, C.J and E. S. Kweka. 2002. Introduction and evaluation of exotic MPTs for adaptation and adoption in Babati district. Annual Progress report for 2002

Lyimo, S.D; C. J. Lyamchai, M. Z. Owenya, M N. Kingamkono, F.S. Ngulu, H. Mansoor, and S. Bitende. 1999. A Participatory Rural Appraisal (PRA) of the Chagga homegardens in Moshi District, Kilimanjaro Region, Tanzania (A draft)

Annex 1

IPM methods for treating Newcastle and Typhoid fever for chicken and human beings respectively.

Newcastle is a problem in poultry production in rural areas in Tanzania. Frank explained one of his innovations where he tried to use wild sunflower (*Tithonia*) against Newcastle for his local chickens and as a pesticide.

About 6 green leaves of *Tithonia* are pounded together with 3 pieces of garlic. The mixture is then boiled with 5 L of water, cooled and given to chickens as drinking water for 3 consecutive days and then routinely every other day. His entire chickens survived Newcastle outbreak for the past two years while his neighbors lost their flocks. Such experiments by farmers might bring about real solutions.

Another use of *Tithonia* was reported by Ms Rose Marandu, the extensionist, for treating Typhoid fever in humans. She gave an example of its use by Nuns at Kilema Convent to have tested and found it to be very effective for Typhoid fever that did not respond to common drugs. Three large leaves of *Tithonia* are pounded and boiled. A patient takes $\frac{1}{2}$ a glass every day for 3 days a week until complete recovery.

Annex 2

1. Information checklist for informal survey, including objectives, hypotheses, and interview plan, *Calliandra* adoption survey

Objective

Document farmers experiences in testing and using *Calliandra*, primarily as livestock feed, but also its other advantages and disadvantages

Hypotheses

Farmers do like *Calliandra* and want to plant more of it but are constrained by seed supply.

Yes but they are not doing much to get seed from their own farms

They are waiting for seedlings from dev. agencies (T received seedlings three different times).

Some farmers lost seeds to birds (T) or to black ants. Scales also a main problem.

Some farmers lack enthusiasm because, with such small numbers of trees, they are unable to assess *Calliandra*'s benefits as a livestock feed.

Female headed households may use pruning methods that require less labor.

And this will be more likely the less important dairy is relative to other households.

If labor is a big constraint, farmers may be more interested in dairy meal rather than *Calliandra*.

The less important dairy is, the less important *Calliandra*.

Information bits

1. Basic information

Farm size

Household type (male, female managed.)

Livestock type and numbers

Main enterprises, ranked according to contribution to income

Management level

Wealth level

2. Farmers' planting of *Calliandra*

Original plantings,

 niches,

 reasons for planting in a particular niche,

 reasons for planting,

 source of planting material

 survival rate, cause of mortality

 information sources

For each later expansion, same information as above.

No. of trees at present

3. Calliandra Pruning and Feed management methods.

How pruned (Frequency/plant, Tool used) how fed
Which animal type fed (cow, goats, etc.)
Wet, dry animals
Wet, dry seasons
How fed.

4. Farmers' perceptions of benefits and costs/problems

(Open question)

We may want to ask about some specific benefits and disadvantages:

4.1 Advantages/benefits

Use as a substitute or a supplement for dairy meal
Effect on milk production
Effect as a dry season supplement
Risk minimizing role (uncertainty about availability of dairy meal, cash for dairy meal, quality of dairy meal.
Use of wood
Soil fertility
Soil erosion control
Other benefits

4.2 Disadvantages/costs

Competition with crops
Palatability
Effect on milk quality
Labor in planting, pruning, feeding
Other problems

Views and experiences of neighbors

Willingness to buy seedlings. What price?

5. Seed Production

Ever produced seed?
If not, why not?
If producing seed
season started, for each harvest:
quantity of seed harvested
Use of seed (own plantings, given away, sold)
No. of persons affected
No. of trees used for seed

6. Future plans

Have enough trees?
Interest in planting more?
If so, why? which niche

Constraints limiting expansion of *Calliandra*

Constraints limiting expansion of dairy enterprise

Idea on optimal number of trees, given size of your farm and number of livestock you have?