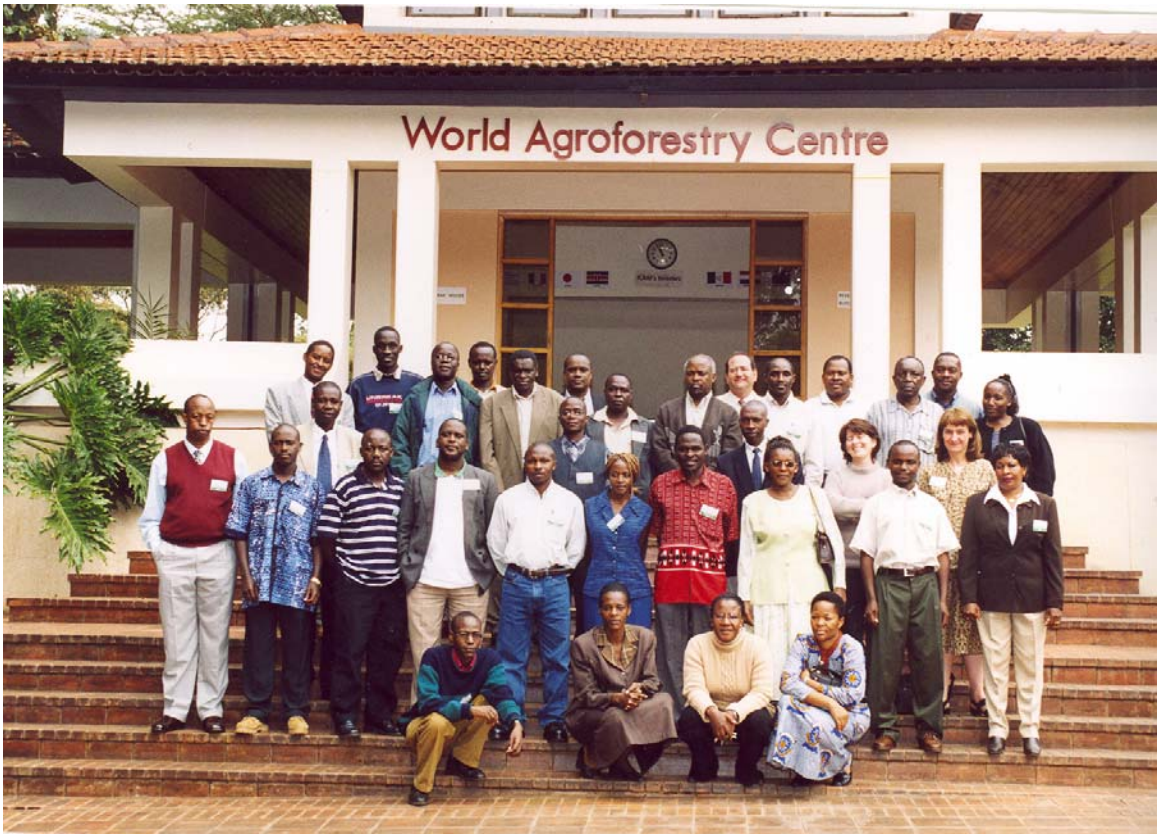
Workshop Record:
Scaling up the Promotion of Fodder Trees



Venue: World Agroforestry Centre (ICRAF)
United Nations Avenue, P.O. Box 30677-00100, Nairobi.
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Proceedings compiled by: Josina Kimotho, ICRAF

OXFORD FORESTRY INSTITUTE

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

FRP
FORESTRY RESEARCH PROGRAMME

DFID Department For International Development

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Acknowledgement

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Acronyms and Abbreviations

ICRAF	International Centre for Research in Agroforestry
ILRI	International Livestock Research Institute
FIPs	Farm Input Promotion Services - Africa
MOA	Ministry of Agriculture
KARI	Kenya Agriculture Research Institute
CIAT	Centro International de Agricultura Tropical (CIAT)
FRP	Forestry Research Programme
DFID	Department for International Development
FORRI	Forest Research Institute
KEFRI	Kenya Forest Research Institute

1.1 Background and objectives of the workshop

The project Scaling up the Promotion of Calliandra and other Fodder Trees has been running for two years and has made considerable achievements. The objectives of this workshop at ICRAF Headquarters, Nairobi, are to

1. Share and exchange experiences in scaling up the impact of fodder trees in East Africa
2. Review field work on disseminating fodder shrubs in Central Kenya
3. Assess main lessons and develop future plans for scaling up fodder shrubs

The workshop begins on the morning of Monday June 7 and ends at noon on Thursday June 10. The project will sponsor your participation in the training workshop by providing the following:

1. For those of you traveling from outside Kenya or Kisumu, a travel authorization will be issued by the World Agroforestry Centre (ICRAF) and you will be provided with a return ticket between your place of work and the venue of the workshop via the most direct and economic route.
2. Local transport from the airport in Nairobi to the hotel will be organized.
3. Hotel accommodation has been arranged on a bed and breakfast basis at the Lenana Mount Hotel near downtown. You will be expected to arrive on Sunday June 6. Departure will be on June 10 or 11, depending on the availability of flights.
4. Lunch and coffee breaks at the venue of the workshop will be arranged and paid for.
5. You will receive a daily allowance of $US 15 to pay for dinner and any out-of-pocket expenses you may have while attending the course.
6. Justified expenses (e.g. visa, vaccinations, public transport to the airport, etc.) directly related to your attendance of the course will be reimbursed against original receipt(s).

During the training, your active participation in workshop activities and discussions will be required. You will be given an opportunity to present your work related to scaling up and dissemination of fodder shrubs. Each of the six sites (Rwanda, Northern Tanzania, Central Kenya, Western Kenya, Lakeshore, Uganda and Southwest Uganda) will have one hour. The site team should prepare presentation(s) to cover 30 minutes, leaving 30 minutes for discussion. The team may decide to have a single presentation or to divide up the 30 minutes of presentations among the persons or organizations represented. Possible topics to cover in your presentations include:

- Experiences with different extension strategies
- Numbers of farmers trained and adopting, number of trees per farmers, number of farmers having different species
- Organizing seed production and distribution
- Gender and wealth analysis: are women participating at the same rate as men?
- Problems confronted and how you solved them
- Experiences of partners in promoting fodder shrubs

1.2 **Workshop Program**

Scaling up the Promotion of Fodder Shrubs
Workshop Program

Day 1: Monday, June 7

9:00-9:15	Opening	Dr. Dennis Garrity, Director General, World Agroforestry Centre
9:15-10:00	Introduction exercise	S. Franzel
10:00-10:30	Workshop objectives and expectations	S. Franzel
10:30-11:00	Tea break	
11-11:30	Project Overview	J. Stewart, Oxford Forestry Institute
11:30-12:30	Site 1: Western Kenya	H. Arimi and team
12:30-1:00	Herbaceous legumes for increasing fodder production	D. Miano, KARI
1:00-2:00	Lunch	
2:00-2:30	Adoption of legume forages and factors influencing their spread, central Kenya	J. Sinja and J. Nyangaga, ILRI
2:30-3:30	Site 2: Central Kenya	C. Wambugu and team
3:30-4:30	Checklist for field visit +tea	Group work
4:30-5:00	Presentation of check lists to plenary	
5:00-5:30	Interview drama exercise	
5:30--	Reception	

Day 2, Tuesday June 8

AM	Field visit (Participants break into 3 groups; each group visits two farms)	
2-4:30 PM	Group work and preparation of reports on field visit +tea	
4:30-5:30 PM	Site 3: Northern Tanzania	C. Lyamchai and team

Day 3, Wednesday, June 9

9:00-10:00	Groups report to plenary on field visit results	
10-11:00	Site 4: Lakeshore, Uganda	J. Kugonza and team
11:00-11:30	Tea break	
11:30-12:00	Farmers experiences managing calliandra, Uganda	P. Nyeko
12:00-12:30	Impact assessment of fodder shrubs, Uganda,	F. Mawanda
12:30-1:00	Socioeconomic analysis of fodder legumes in Embu District	S. Koech
1:00-2:00	Lunch	
2:00-3:00	Site 5: Southern Drylands, Uganda	S. Dickens and team
3:00-3:30	Farmers and private extension providers' experiences in central Kenya	J. Maina and J. Gichohi
3:30-5:30	Group work on selected thematic issues +tea	

Day 4, Thursday June 10

9:00-9:30	Improving communication and information flow among smallholder farmers and livestock keepers	Martha Musyoka
9:30-10:00	Adoption of fodder trees in Rwanda	L. Dusengemungu
10:00-11:00	Site 6. Rwanda	Rwanda team
11:00-11:30	Tea break	
11:30-12:00	Fodder shrubs in Zimbabwe	Lewis Hove
12:00-12:30	Estimating numbers of farmers growing fodder trees and mapping adoption	S. Franzel
12:30-1:00	Groups present to plenary	
1:00-2:00	Lunch	
2:00-2:30	Groups present to plenary	
3:00-3:30	Closing and evaluation	

1.3 Exercise: Fears and expectations

Fears

- Sustainability of the linkages when project winds up.
- Finishing late in the evenings.
- Limited time discussions.
- Long and tiring sessions
- Workshop too good but limited time.
- We might not be able to present fully our studies because of time allocation.
- Sustained seed availability, even at a cost is ensured.
- Supply of seed
- Content of presentation may not be understood by all
  - Languages
  - Complexity of terms
- Skewed representation of experience in the region.
- Over repeating ourselves
- No extra day and night in Nairobi paid for by the workshop
- Room temperature low
- Hotel far from the workshop venue.
- Something will get stolen from my hotel room.
- Security of valuables in rooms.
- Some people may not provide in puts to proceedings (presentation summaries).
- Limited eating joints around Lenana Mount hotel
- May not get copies of all presentations during the workshop.
- Traffic jams and tiresome.
- Effective scaling up community mobilization will be developed by workshop.
- Sustainability
- Improved mobilization on systems.
- Too much Calliandra.
- The working just ends just like another “ordinary workshop”
  - no out puts
  - no way forward

- Missing flights or losing passport or ticket.
- Getting lost or being robbed in Nairobi.
- Fear getting lost in town.

Expectations

- Learning from different teams.
- Chart out the future.
- Calliandra seed marketing improvements.
- A step forward in mainstreaming fodder trees research.
- Develop ideas and concepts for future work.
- Get to know experience from other places, how farmers are adopting fodder trees in their farming systems.
- Broad understanding of the adoption of fodder trees/shrubs from farmers experience.
- To introduce Calliandra to groups, also collection of seeds and planting them.
- To express knowledge to others.
- Enabling system that will encourage improved collaboration.
- Better ways of small packages of the seed.

- Improved mobility to be able to reach many farmers.
- Linkages are usually at a cost.
- We keep time.
- Achieve the objectives of the workshops.
- Participants interact as much as possible during presentations.
- Being able to put fodder in the business sense perspective to the household/farmer.
- Map out a strategy for improved fodder/trees establishment and use.
- Tangible future plan for the fodder promotion.
- Lessons and examples of success.
- Share experience.
- Shared experiences that can help us in our area.
- Way forward to scaling up fodder promotion.
- Changes in improved ideas in the fodder crops.
- Share experience for managing fodder trees.
- More insight to the project.
- New ideas and approaches will be generated especially on decision support tool.
- Draft road map on scaling up the promotion of fodder shrubs in East Africa.
- Get experience from other participants on the successes in fodder shrubs dissemination to farmers.
- To expand knowledge on role and potential of fodder legumes.
- Learn about successful scaling up approaches.
- Share experience on the project with colleagues from different countries.
- People learn from each other' experiences and apply to own situations.
- Learn about experiences in fodder trees in the ECA.
- Learn methods for tracking number of farmers.
- Expect to get a better mechanism for improving adoption in relation to farmers' priorities.
- Dry lands/areas may not effectively benefit due to recurrent droughts.
- To learn on methods/strategies of scaling up fodder trees.
- Interact with professionals dealing with dissemination strategies and exchange ideas.
- New sources of funding identified
- To learn a lot in dissemination of information and its impacts on adoption.
- Share success stories from different regions by different partners.
- Share experiences on challenges faced by partners while promoting fodder trees.
- We have tangible way forward beyond the workshop and project in forage use and expansions.
- We get to learn and share useful information in relation to legume forage use from all aspects: farmers, extensionists, researchers, NGO's etc.
- Share field experiences on Calliandra and other fodder trees.
- New opportunities to take advantage of in scaling up the technology.
- Practical and conclusive recommendation for extension staff and farmers.
- More work involving me.
- Meet new friends and create new linkages.
- More understanding scaling up strategies of Calliandra.
- More exposure on practical field capture of technologies

Paper Presentations.

2. Papers presented during the workshop
2.1 Overview

2.1.1 Scaling up the Promotion of Calliandra and Other Fodder Shrubs in East Africa: Project Overview

Janet Stewart, Oxford Forestry Institute, Department of Plant Sciences, University of Oxford, South Parks Road, Oxford OX1 3RB, U.K.

Introduction
Most of the presentations and discussions during the workshop describe different parts of a project funded by the Forestry Research Programme (FRP) of the U.K. Department for International Development (DFID): *Scaling up the promotion of calliandra and other fodder shrubs in East Africa*. The project is actually an extension, or second phase, of an earlier FRP-funded project (R6549) entitled *Investigation of factors affecting the nutritive value of Calliandra calothyrsus leaf as fodder for ruminants.* Rather than presenting any of the project findings here, this introductory paper sets the scene for rest of the presentations by explaining the context in which the project was developed, its rationale, main elements and underlying strategy.

The project has been operational since late 2001, though at some sites activities did not start until mid or late 2002. The project operates in four countries: Kenya, Uganda, Rwanda and Tanzania. It has six components (outputs), of which four (Outputs 1, 2, 3 and 5) are research studies and one (Output 4) is concerned with increasing uptake, adoption and impact of fodder shrubs in the region. Output 4 is by far the largest part of the project in terms of resources and the level of activities, and it is being implemented in all four countries. The newly added Output 6 will be a decision support tool and extension manual, drawing together the project's findings from both the research and the dissemination components.

The origins of the project: a look back to Phase 1
The original aim of the project was to optimise the feeding value of calliandra by identifying the most important sources of variation in nutritive value. In Phase 1, a combination of on-station feeding trials and laboratory analyses was used to estimate the effects on nutritive value of several important variables including provenance (seed source), post-harvest treatment (i.e. whether the leaves are fed fresh or dry to the animals), cutting frequency (6-weekly or 12-weekly), site quality, and season. The feeding trials were conducted at KARI Regional Research Centre, Embu, Kenya; and CIAT, Cali, Colombia. In Embu an agronomic trial was also established to investigate the effects of season and cutting frequency on digestibility, and on protein, fibre and tannin content. Most of the laboratory analysis was done in collaboration with the University of Reading (U.K.).

There were three key findings from this first phase of the research:

- ☆ Seed sources differ significantly in fodder quality. Two high-yielding accessions of calliandra from its native range in Central America, 'Patulul' and 'San Ramón', were compared with the local African land race found in Embu. Patulul was found to be very similar to Embu both genetically and in terms of nutritive value. San Ramón, which was genetically very distinct, also gave significantly lower quality fodder.
- ☆ No important differences in quality were found between freshly collected and wilted or dried leaves. In one trial in Colombia the quality was actually found to improve on drying. It had previously been thought that calliandra had to be fed immediately after it was collected, to maintain its quality, but this new finding (which corresponds to experiences from Zimbabwe and elsewhere) gives much greater flexibility in its management.

- ✯ Digestibility and intake of calliandra by animals are both reduced if the plant is grown on acid infertile soils.

The rationale for a second phase of the project was initially to promote calliandra more widely within the region, incorporating the new recommendations arising from these findings, so as to achieve a tangible impact for the research. However the scope of the promotion activities was extended to include several other important fodder shrubs (notably *Leucaena trichandra, L. pallida* and mulberry (*Morus alba*)), in recognition of the risks inherent on over-dependence on a single species.

Phase 2: research studies

Output 1. *Documentation of farmers' experiences with tree fodder*

This component of the project has been addressed in Uganda and Tanzania. In Uganda, surveys in three agro-ecological zones have focused on the knowledge, perceptions and practices, in the cultivation and utilisation of calliandra, of farmers who have adopted the technology; and in particular on their experiences with pests and diseases. In Tanzania an informal surveys has captured the experiences of farmers in the Mt Kilimanjaro area who first planted calliandra in 1999 (under a previous project) but then had no extension back-up or technical support for the next three years.

Output 2. *Adoption studies*

A adoption study in Rwanda has investigated the key factors affecting adoption in each of three agro-ecological zones. A study in Central Kenya has focused on the mechanisms of farmer-to-farmer dissemination, and how knowledge spreads through the farming community.

Output 3. *Economic impact studies*

In Uganda, a study of economic impact at two sites looked at the economic effects of using calliandra as a supplement, or of substituting it for purchased concentrate (dairy meal), as well as the costs of plant production and establishment. A similar study in Kenya (Embu) compares the economic impacts of calliandra and desmodium in an area where both forages are very well established and widely adopted.

Output 5. *Seed supply mechanisms*

A study was commissioned to investigate the current state of the market for calliandra seed in Kenya, and in particular the constraints to the operation of the market, which has generally failed to operate efficiently.

Promotion activities

Output 4 of the project aims to scale up the adoption and impact of fodder shrubs in smallholder dairy farms in East Africa. We have generally limited our activities to high potential areas, where crossbred exotic dairy cows (and, increasingly, goats) have an important role in the farm economy. Unlike local breeds, these animals have the genetic potential to show significant increases in milk production when fed high quality fodders.

Another important aspect of current farming practices in the high potential areas is that they tend to be undergoing intensification, as population pressure leads to a reduction in the size of land holdings. In many areas, systems involving tethering, or free grazing after crop harvesting, are now being replaced with zero grazing systems, which require a supply of fodder able to withstand repeated cutting.

Experience with calliandra and other shrubs over the last decade has shown that they are readily adopted in such areas. This is mainly because benefits quickly become apparent to farmers: in particular, increased milk production and money saved by substituting for expensive dairy concentrates. We estimate that over 40,000 smallholder farmers have already adopted tree fodder in Kenya and Uganda; but as there are 650,000 dairy farmers in Kenya alone, there is still plenty of scope for scaling up on an even larger scale.

Elements of the promotion strategy
There are many governmental and non-governmental organisations active in agricultural extension in the region. The project aims to facilitate and enhance their activities whilst avoiding duplication. We work with as wide a range of stakeholders as possible, but with the emphasis on training extension staff from partner organisations, rather than focusing on farmers directly. In this way we can ultimately reach much larger numbers of farmers.

There are currently several NGOs in the region using the 'passing the gift' approach[1] pioneered by Heifer International. Partnerships with organisations using this approach offer great scope for mutual benefit, because they typically require participating farmers to plant a specified number of fodder trees before they are eligible to receive a dairy heifer or goat. This generates a strong demand for fodder trees and for knowledge on their establishment and management, which our project can help to meet.

To avoid creating a culture of dependency among the farmers we are reaching, the project's policy is to minimise the provision of physical inputs such as poly tubes, seed or other equipment (such as watering cans, nursery tools etc). We provide free 'starter seed' to new groups (especially in areas where calliandra seed is not locally available) but thereafter we expect farmers to be able to start collecting seed from their own trees, or to buy it. At present, however, farmers do not always have their own mechanisms for accessing seed, as a functional retail market for small amounts of fodder tree seed has not developed in the region. We are experimenting with innovative approaches to seed supply in Kenya, packaging seed in small quantities and selling it, initially at a subsidised rate, through government agricultural offices and private stockists. The phytosanitary implications of this approach are currently being explored.

As well as disseminating seed, the project provides information about all aspects of fodder tree production and management, from seed collection through plant production to cutting management and feeding regimes. We deliver this knowledge not only through trainings but also in a range of written media, ranging from simple posters, brochures and booklets to book chapters and peer-reviewed papers in academic journals. In the coming year, as the project draws to a close, we will synthesise our research findings and field experiences into a decision support tool and extension manual for partners involved in promotion of fodder trees. This will offer recommendations on appropriate species and technologies, including seed supply and distribution, as well as the extension approaches most likely to succeed in particular situations, taking into account the farming system (e.g. whether there are free-ranging livestock), socio-economic and cultural factors, market access, and the legal policy framework (e.g. land/tree tenure, seed regulations).

Integrating research and development
A unique aspect of the project is that it comprises both research and dissemination components, and these are highly complementary, spanning the research-development continuum. The dissemination component (Output 4) includes sensitisation, partner support and training, and monitoring and evaluation. The other four outputs, briefly described in this paper, are concerned with research into a range of topics including the assessment of farmer experiences and innovations, understanding of adoption (including farmer-to-farmer dissemination) and impact, and exploration of options for seed supply systems. Moreover, the dissemination component has itself become an ideal 'laboratory' for further research on the scaling-up process.

Acknowledgement
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[1] This model works through farmer groups, whose members receive improved animals but have to pass on the first female calf to another member.

2.2 Farmers Experiences

2.2.1 Farmers' experiences in the management and utilisation of *Calliandra calothyrsus*, a fodder shrub, in Uganda

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1 Introduction

Despite considerable progress in agroforestry research and dissemination over the last decade, the adoption and impact of agroforestry on smallholders' livelihoods is generally still modest in the tropics. The challenge here is to understand the farmers' situation and start from there. Thus it is important to understand whether research findings concur with farmers' experiences and innovations, and ways in which research outputs have been adapted and tailored to farmers' own needs. This information is important in understanding how to expand agroforestry technologies that have gained footholds, ensure access to planting materials for important species, and provide useful information on their management and utilisation. Understanding farmers' experiences is therefore important in the scaling up of technologies that meet farmers' aspirations and are thus likely to be adopted by them.

In Uganda, one of the most promising agroforestry tree species is *Calliandra calothyrsus* Meissner (Mimosaceae), referred to as calliandra in this report. Calliandra is a fast-growing nitrogen-fixing multipurpose tree species native to Central America and Mexico. It has been introduced in many tropical countries where it is an important component of agroforestry systems. In Uganda, calliandra has been intensively evaluated under agroforestry programmes since 1989 for a variety of products and services, including fodder, fuelwood, stakes for climbing beans, soil erosion control and soil fertility improvement. Since the mid-1990s, the World Agroforestry Centre (ICRAF) and national partners have been actively involved in on-farm testing and promotion of calliandra in Uganda, where initial estimates of adoption have been very encouraging, and indicate considerable scope for further expansion.

This study documented farmers' experiences in the management and utilisation of calliandra in Uganda with the aim of scaling up the promotion of the species. Specifically, the study documented the following information about calliandra: (i) farmers' knowledge, perceptions, innovations and practices regarding its cultivation and utilisation (ii) their awareness and perceptions of research findings on the species and (iii) the problems they have experienced in managing and utilising it, with particular emphasis on pests and diseases.

2 Materials and methods

This study was conducted in three agroecological zones in Uganda, namely Lake Victoria Crescent (LVC), Southern Drylands (SDL) and Southern Highlands (SHL), where farmers had substantial experience with calliandra. A total of 30 farmers who had grown calliandra for at least two years were randomly selected from each of the three agroecological zones, using lists of agroforestry farmers obtained from ICRAF (for LVC and SHL) and Vi Agroforestry project (for SDL). The selected farmers were interviewed from November 2002 to February 2003 using a pre-tested questionnaire. The interviews were conducted in the farmers' local languages (Luganda and Rukiga), and their responses carefully translated and recorded in English. Interviews were conducted at the farmers' homes or in the calliandra fields, where such fields were within a kilometre of a farmer's homestead and the farmer was willing to be interviewed on site. After every on-farm interview session, at least 10 calliandra trees on the respondent's farm were examined for damaging insects and diseases. Insects on the species were sampled using a beating tray or by handpicking for later identification and reference.

The survey data were analysed using an SPSS statistical package. Percentages, totals and means on selected variables were determined using descriptive statistics and cross-tabulation of either single or multiple responses.

3 Results

Farmers established calliandra using nursery- raised seedlings, direct seed sowing in the field or through maintenance of wildlings. Whereas farmers' decision on the use of nursery seedlings and direct sowing seemed largely dependent on advice from organisations promoting calliandra, the use of wildlings was mainly attributed to farmers' own innovations. During the survey farmers had, on average, 924, 626 and 362 calliandra trees per household in SDL, SHL and LVC respectively. The most preferred planting niche was field boundaries mainly for soil conservation. A few farmers planted calliandra around apiaries and fishpond, which are relatively new niches for calliandra in Uganda. Farmers performed several tending operations including weeding, beating up, crown and root pruning, and manure application for their calliandra, using a wide range of hand tools. Most farmers claimed to have received relevant advice from organisations and/or individuals on how to conduct the different tending operations, except weeding that was largely based on their experience with crops.

Findings of this study indicate that farmers were aware and concerned about some pest problems on calliandra, but they lacked advice on pests and diseases that attacked the species. The most damaging health problem on calliandra was a dieback disease. Insect pests that may become important on calliandra, and thus require regular monitoring and control, include a scale insect, *Pulvinarisca jacksoni* (Newstead), and a termite species, *Marcrotermes subhyalinus* (Rambur). Other damaging agents reported by farmers included livestock, humans, birds and wild mammals. Farmers who attempted to control pest problems on calliandra relied on their own indigenous knowledge and experience.

Farmers cultivated calliandra for various products and services, the most important being fodder, which they fed to cattle, goats, sheep, rabbits, pigs, poultry and fish. Very few farmers fed cows on dairy meal concentrates mainly because of the high cost of the concentrates compared to low financial returns from milk. This indicates a high potential for using cheap protein-rich tree fodders such as calliandra in small-scale dairy enterprises.

The majority of farmers wanted to plant more calliandra. The most commonly cited reason was the need for all possible benefits from the species followed by expectation of more livestock, lack of fodder, income generation, need for continuous fodder supply, and availability of adequate land. However, some farmers were expecting organisations promoting calliandra to supply them with free calliandra seed for future planting.

Implications of results

- The diversity of extension providers gives farmers a wide choice of information sources to support the long-term sustainability of their agroforestry farming practices. For successful scaling up of such technologies, however, there is a need for strong partnerships among the stakeholders to support local farmers' organisations and promote farmer-to-farmer extension for sustainability of the interventions.

- Provision of planting material is key to the scaling up of important agroforestry species such as calliandra. Farmers need be trained and encouraged to produce and harvest seed to meet their own needs. In addition, mechanisms are required for decentralised seed supply with clear policies on seed quality and pricing.

- As agroforestry technologies are developed and promoted, there is a need to incorporate information on the diagnosis and management of pests and diseases of the agroforestry components in dissemination packages.

- The profitability of cheap protein-rich fodder trees such as calliandra in dairy farming could be maximised through deliberate government policies to improve the processing and marketing of milk.

2.2.2 Kagundu-ini Dairy Goat Self-Help Group
By Gilbert Kamau – group secretary

Kagundu-ini Dairy Goat Group was formed in April 1998 under the Ministry of Social Services. It's composed of 27 registered members. The wives/ husbands of these members are rightful members. It's neither a political nor a denomination affiliated group. It was formed with the aim of having better dairy goats from local breeds using an exotic German alpine buck.
To achieve our objective, in 1999 the group registered with the Dairy Goat Association of Kenya (DGAK) who have a good breeding program.
The idea of keeping goats was necessitated by the land limitation and thus low financial incomes from our coffee enterprise.
The group owns a German alpine buck that serves the members goats at a cost of Ksh 75/= per service, per goat and those from non-members goats at a cost of Ksh 150/=. As such it is an income generating project to the group.
The generated income is divided into three accounts i.e.

1. 50% to the groups account
2. 25% to the buck keeper
3. 25% to maintain the bucks feeding /health

The total numbers of goats with our members are as follows:

1. Original heard -17
2. Foundation-27
3. Intermediate-23
4. Apendix-11
5. Peddgree-2

The group has other Projects i.e.

1. Bee Keeping
2. Water harvesting (Construction of water tanks)
3. Fruit tree nurseries
4. Marketing/Processing of milk
5. Table banking (Revolving Funds)

1. Bee Keeping
The group has five KTBH and each member has at least one bee hive in his/her farm.

2. Water Harvesting (Construction of water tanks)
The group has constructed 10 water tanks to members and hence a balance of 17 more tanks. The estimation of one tank is 30,000/=. It is the groups wish and hope that we construct to each member a tank to complete this water harvesting project.

3. Fruit and tree nurseries
The group establishes four sites of tree nursery as a source of income. We have Mangoes, Passion fruits and Avocados.

4. Marketing/Processing of Milk.
The group has joined up with a neighborhood group known as Kihiga Dairy Goat and has as from last year but one started a milk shop. The idea was to buy the excessive cows' milk from our members and the surrounding community and sell the same to the increasing customers living in urban centres. Two of the members have been deployed in the shops, they know how to process the yoghurt and they do it and thus increasing the value of milk.
The shop has been operational for two years and its running has been quite smooth. There are two permanent staff members that run the shop which opens daily from 6:00 am to 8:00 pm.
We are planning to market our milk through the Kenya Creameries Cooperative, now that it has new management

5. Table Banking/Revolving Funds
The two groups after joining started a table banking project whereby each member contributed 200/= every month. Members can borrow the money and it is payable at an interest rate of 10% per month (the allowed amount should not exceed Ksh. 6000). Members have temporarily stopped this project so as to reorganize and streamline its procedures.

SEMINARS
The Group had interest of gaining knowledge and skills and thus approached extension staff from the Ministry of Agriculture, KARI, ICRAF and NGOs such as SACDEP and FIPs. To improve on the financial returns from ivestock, ICRAF and KARI staff introduced new fodder species such as calliandra, trichandra, mulberry and desmodium. The group has benefited greatly on introduced fodder species for increased milk production while feeding the animals with it and sparing the money which they would have used to buy concentrates such as the dairy meals. Calliandra seeds have also been fetching financial incomes to members (we sell seed to NGOs e.g. SACDEP and World Vision). The members have learnt organic farming and they practice this sort of farming.

BENEFICIARIES
These include all the registered members of the group and their families, surrounding communities. We train and render services related to our project to them when they need our services. We buy milk from non-members with excessive milk to sell.

2.3 Adoption

2.3.1 Adoption of legume forages and farm factors influencing their spread in Central Kenya

J Sinja, J Nyangaga, D Mwangi and D Romney

Introduction
Forage legumes have been introduced to farmers in Central Kenya between 1997 and 2002 through various efforts.

- Desmodium spp introduced in the early 80's by the National Dairy Development Project (NDDP) to be grown together with Napier for dairy cattle.
- In early 90's both herbaceous and shrub legumes introduced by Kenya Agricultural Research Institute (KARI) to be incorporated with food crops.
- In the mid 90's the Legume Research Network Project (LRNP) introduced herbaceous legumes introduced as green manure crops in Embu.
- 1996 – 98, KARI gave out Desmodium to 15 farmers in Kandara, Maragua district under NARP II. The forage was to be incorporated in Napier grass.
- Between 1997 and 2000, KARI and ICRAF through the System-wide Livestock Programme (SLP) activities distributed Calliandra to more than 100 farmer groups in Maragua, Murang'a, Nyeri, Embu and Kirinyaga districts. This was an ICRAF/KARI/ILRI collaborative project.
- As part of the intervention 'best bets' testing carried out by the Smallholder Dairy Project (SDP) Desmodium cuttings given out to 11 of the same Calliandra groups in 2001, building on findings of the previous exercises [See Miano Mwangi's presentation].

Adoption rates

- The observed adoption rates are still modestly low.
- In an NDDP report in 1994, only 1.9 % of farms surveyed in Eastern province had the forage, with the forages occupying only 0.1 % of cropped farmland.
- A report of the SLP (Franzel 1999) indicates legume forage technology is only reaching 1 % of smallholder dairy farms.

- In SDP farm characterization surveys conducted 1996-2000 reports show only 2.3 % and 0.9% of the 3,311 households visited (or 3.3% and 1.3% of farms with cattle) in 16 districts had Calliandra and Desmodium, respectively (Staal et al, 2001).
- Following SDP distribution of Desmodium it was decided that evaluation of this exercise would be combined with a more general evaluation of adoption and diffusion of both Calliandra and Desmodium. Specific objectives included:
    - To identify farmer and farm characteristics affecting the likelihood of sharing of *Desmodium* and *Calliandra* technologies i.e. farmer to farmer diffusion.
    - Characterise the spread of the technology from contact groups and the effect of distance from those groups.

Methodologies

- Three groups of farmers were approached:
- FIRST generation farmers: These are original group members who had received planting material from the projects' distributors. During the survey, Only 133 of these farmers from Embu, Maragua and Kirinyaga, and 43 from Nyeri could be contacted and interviews were conducted on a random sample 60% of those who still and 60% of those who no longer had the forage on their farms.
- SECOND generation farmers: These are non-members of the original groups who the First generation farmers had shared out shared planting materials to (Table 1).
- Randomly selected farmers: A diffusion survey was conducted on a randomly selected group of farmers from the following zones: 150 in the sub-locations where the original contact groups were located (0 km radius), 133 in sub-locations in a 5 km radius further, and 142 in sub-locations in a 15 km radius.

- Information collected:
    - Informal discussions were held with the farmer groups to identify and rank various forage and farm factors considered of value regarding use of the legume and sharing out. These discussions were also used to identify farmers with and without forages on their farm and used as the basis to select the sub-samples of first generation farmers.
    - Formal questionnaires were used on 1st and 2nd generation farmers to collect characteristics of the household and farm, the technology, as well as details of planting material shared. The 2nd generation farmers were asked about any technical knowledge they had about the forages.
    - A very short formal questionnaire was used with the randomly selected farmers focusing only on farm size, livestock kept, if they ever heard about the forages, sources of the information and planting materials and quantities of any forages they had growing on the farm.

Results and discussions

Adoption

- First generation farmers: Out of the 133 First generation farmers contacted in Embu, Maragua, Kirinyaga and Nyeri (who obtained forage from SDP, Miano), 86 (64.7%) still had Desmodium and 119 (89.5%) still had Calliandra. They had collectively shared planting material to 215?? other non-group (2nd generation) farmers (Table 1)
- There were 128 2nd generation farmers in Maragua and Kirinyaga. Out of these of only 98 could be traced and 93 were interviewed. These farmers gave material to 45 other 3rd generation farmers but these were not included in the interviews.
- Adoption: Table 2 shows levels of adoption among various types of farmers. Adoption in this study is defined as the presence of any amount of the forage on farm; no minimum amount was specified.
- Table 3 shows adoption rates (given as percentage of farms with) of Calliandra and Desmodium among the randomly selected farms in sublocations at specified distances from the original contact points (sublocations). The amounts per farm of those who had at least some is shown.

More farms in the contact sub-locations had the plants than the sub-locations further away, though significance of distance has not been worked out yet.

- The low percentage of farms with the forages among the random samples could be implying a slow adoption rate from the original contact farmers. This shows that adoption rates are still very low despite the large efforts of various projects to introduce the forages.
- However, there is no clear relationship between distance and amounts of forage on farm, an observation that was also made from other SDP findings: there is yet no pattern on who has the tree forages based on location, household characteristics, land size etc. (Steve et al 2001).

Attributes that influence farmer-to-farmer movement of planting material

- Tobit estimates of effects of farmer attributes influencing giving out Calliandra and Desmodium planting materials to other farmers are shown in Table 4. The larger the coefficient the more likely the effect is positive. A positive sign indicates a positive effect – i.e. for every unit increase in the variable you would expect the farmer to give materials to the number of extra farmers indicated in change in intensity.
- The status of the household head in the community seemed to affect the likelihood of giving out planting material. Group officials or those with community responsibilities were more likely to give out materials, most likely due to such people being elected representatives and thus by nature outspoken and active people. The community role could imply wealth status but it is not clear how public status is confounded with wealth. Data collected is being analysed to develop a wealth indicator that combines resource endowment and income generation. If significant, this could mean targeting technology at more influential members of the community. As a follow-up off farm income had a positive significant effect at 10% level for Calliandra. However, this variable should not imply that farmers with off farm income are wealthier. Off-farm income could be an indication of limited home farm resources necessitating outside ventures and thus more exposure to new ideas.
- The amount of *Desmodium* a farmer has on the farm had the greatest effect on both the extent and probability of giving out Desmodium but was negative for Calliandra because of the mode of propagation. The biggest limitation in sharing Calliandra was pointed out during group discussions as the availability of seeds. Use of cuttings as planting materials rendered Desmodium more available, especially if one had a relatively large area of the crop. **The longer the time a farmer has the fodder** on the farm allowed him/her to see its benefits hence can share this out. For Calliandra this allows for seed harvesting
- The negative significance in 'other farm visits' (taken to be contacts with other farmers) for both giving out Calliandra and Desmodium could suggest that these kinds of visits may not have involved discussion of the forages and sharing out of planting material.
- The n**umber of goats owned** by a farmer was positively significant for giving out Calliandra at 10% level. Thos can only be related to the fact that farmers who received the material originally belonged to goat rearing groups, and the more goats one had, the longer they had had the material and had the seeds to share out.
- Insignificant factors in sharing out planting material included the age, especially older farmers, and education of the household head. Old farmers got introduced to the technology far before the latest Projects that most farmers were involved in and they were not active in farmer group meetings and sharing of information. **Farmers with a higher level of education** may be more conversant with the technology and its benefits but they may be preferring concentrates, though the reasons for this were not collected. These types of farmers were also likely to be aware of alternatives, have higher wealth indicators that may allow them to use other alternatives.

Conclusions

- Proponents of the technology may have demonstrated its advantages and strived to have it spread as much as possible but its uptake from original contacts to the wider community is rather slow.
- According to these results, any efforts to promote or further increase adoption of legume forages should have the technology introduced to farmers who have substantial positions in farmer groups or have been bestowed community responsibility. Forage banks, for distribution, could be

established on farms where the technology has been for a longer time or there is a relatively large area of the crop.

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Tables

Table 1. Percentages of First generation farmers who have given out Calliandra and Desmodium in each of the districts.

	Embu		**Kirinyaga**		**Maragua**		**Nyeri**	
	Desm	Call	Desm	Call	Desm	Call	Desm	Call
n	18	18	39	39	56	56	8	8
% that gave out	8	71	21	52	34	40	25	83
Mean no. of farms given per farmer	0.25	1.6	0.5	1.1	0.8	1.3	0.6	0.4

Table 2. Levels of fodder tree adoption among the various types of farmers in Central Kenya

Farmers type	**n**	**% With forage**		**Mean quantities per farm**	
		Desmodium	**Calliandra**	**Desmodium** area (m^2)	**Calliandra** No of trees
1st generation farms	133	65	90	449 (SD 987)	300 (SD 569)
2nd generation farms	93	50	56	278 (SD 734)	40 (SD 68)
Random farms (total)	425	9	9	181 (SD 150)	38 (SD 77)

- **Table 3. Levels of fodder tree adoption among randomly selected farmers at different radius lengths from the original contact points (impact of distance).**

	Radius from subloc cluster dissemination point (Kms)			All Farms
	0	**5**	**15**	
No of farms visited	**150**	**133**	**142**	**425**
Calliandra (% of farms with forage)	13.3	6.8	6.3	8.9
No of trees per farm	*24 (SD 32)*	*50 (SD 117)*	*56 (SD 71)*	*38 (SD 69)*
Desmodium spp (% of farms with forage	10.7	7.5	7.7	8.7
Area m^2 per farm	*210 (SD 528)*	*142 (SD 324)*	*176 (SD 390)*	*181 (SD 430)*
No of farms with Call OR Desm	22.0	13.5	11.3	15.8

Source: Authors' survey 2003

Table 4. Tobit estimates of effects of farmer attributes influencing giving out Calliandra and Desmodium planting materials to other farmers (HH = household; Comm. Resp. = Community responsibility).

Variable	Coefficient	Std. Err.	Total change in giving out	Change in intensity of giving out	Change in probability of giving out
CALLIANDRA					
Age of HH head (yrs)	0.02	0.03	0.01	0.01	0.23
Education of HH head (yrs)	0.05	0.10	0.02	0.02	0.61
HH head is Group official (Yes/No)	**1.29[c]**	**0.72**	**0.56**	**0.43**	**16.98**
HH head has Comm. Resp. (Yes/No)	**1.50[b]**	**0.76**	**0.69**	**0.51**	**19.81**
HH has off farm income (Yes/No)	**1.38[c]**	**0.76**	**0.63**	**0.47**	**18.29**
HH enjoys other farm visits	-0.58	0.87	-0.26	-0.19	-7.67
Number of *Calliandra* trees on farm	0.00	0.00	0.00	0.00	0.01
Years of *Calliandra* on farm	**0.47[a]**	**0.15**	**0.20**	**0.15**	**6.24**
Number of cattle owned (TLU)	0.23	0.31	0.10	0.08	3.08
Number of goats owned (TLU)	**0.49[c]**	**0.28**	**0.21**	**0.16**	**6.47**
Distance from farm to road (Km)	**0.26[c]**	**0.14**	**0.11**	**0.08**	**3.39**
Constant	-5.68	2.78	-2.43	-1.85	-75.12
DESMODIUM					
Age of HH head (yrs)	0.03	0.04	0.01	0.01	0.36
Education of HH head (yrs)	0.06	0.14	0.02	0.02	0.73
HH head is Group official (Yes/No)	**1.96[b]**	**0.97**	**0.57**	**0.51**	**22.86**
HH head has Comm. Resp. (Yes/No)	-0.20	0.86	-0.05	-0.05	-2.25
HH has off farm income (Yes/No)	-0.14	1.00	-0.04	-0.03	-1.56
HH enjoys other farm visits	**-2.48[b]**	**1.10**	**-0.85**	**-0.71**	**-30.78**
Area (m^2) of *Desmodium* on farm	**3.12[b]**	**0.22**	**0.92**	**0.83**	**50.10**
Number of cattle on farm	**-0.72[c]**	**0.43**	**-0.20**	**-0.18**	**-8.33**
Number of goats (TLU)	-0.22	0.32	-0.06	-0.06	-2.55
Years of *Desmodium* on farm	-0.06	0.07	-0.02	-0.02	-0.71
Distance from farm to road (Km)	-0.29	0.23	-0.08	-0.07	-3.41
Constant	-0.82	3.36	-0.23	-0.21	-9.55

a=significant at 1%, b= significant at 5%, c= significant at 10%

Source: Authors' survey 2003

2.3.2 Improving Information and Communication among Small Stock Herders: A Case Study of Two Districts of Meru

by Martha W. Musyoka. (On behalf of the research team i.e. Martha Musyoka B.K. Kaberia, Isaac Mbeche and Dickson Muriithi)FARM Africa, Farmer-to-Farmer Research Project

Background to the Study

It is estimated that 70% of the world's poor rely on livestock as a significant contribution to their livelihoods. As the global human population increases, it is estimated that the demand for livestock products will double over the next 100 years (Taylor, 2001). Poor farmers are failing to benefit from new technologies due to a complex variety of reasons. However, it is widely assumed that a significant livelihood constraint is the inadequate access to and exchange of information among marginalized livestock keepers.

Effective communication mechanisms are necessary for researchers to link with farmers and extension agents to identify research problems, to adapt recommendations to local conditions and to provide feedback about the technologies adopted (Agbamu, 2000).

The needs of marginalized farmers are not being met by existing services due to the diversity of smallholder practices and fiscal constraints to service delivery, declining extension budgets and poor communication between research institutions, extension services and farmers. New models are required to meet the needs of the complex marginal environment of small stock keepers and which take into account farmers as innovators and researchers.

Farmer-led extension approach is thought to be more appropriate because it enables farmers to play a more active role in decision making and planning; builds local capacity to manage and control services; allows area-specific service delivery; and facilitates equity in delivery by targeting poor farmers. Most farmers get most of their information from other farmers; however, they do not necessarily have access to new, externally developed knowledge.

Farmer learning is facilitated by communication with other farmers, as well as by effective linkages with researchers and extension agents. By exploring different aspects of farmer-to-farmer dissemination, innovative routes can be developed, building on existing indigenous channels, for information to be relayed to other farmers. Communication does not take place randomly but within patterned networks (Garforth, 1993). Building effective links between farmers and research-extension, using these networks, will allow farmers to increase their output through farming innovations. In addition, by understanding how farmers communicate with other farmers, it is possible to use these channels and networks to spread technologies by horizontal scaling-up, especially through collaboration with government and the private sector.

The research set out to analyze the existing channels of communication and thus use the existing formation to develop a pro poor mechanism of communication. Data was collected using participatory tools (information maps, problem trees and timelines) and questionnaire interviews.

Methodology

The research was conducted in two districts of Meru i.e. Meru Central and Meru South. The research sites were selected during a stakeholders meeting which brought together farmers, extension staff, collaborators and FARM Africa staff. Eight groups were selected and were stratified within the old groups originally organized by FARM Africa and new groups brought together by extension staff, upper regions of the district vs the lower region. Tools were conducted for group and non-group members except for the timelines.

Results

Table 1: Frequency of adoption of different goat management practices by group membership

	Adoption levels (%)	
	Group Members	Non Group members
Building improved goat shed	65	28
Planting fodder species	73	51
Conserving fodder	48	34
Mineral supplement	86	65
Cross breeding	86	53
De-worming	89	65
Selling goats by weight	31	6
Record keeping	54	24
Ear tagging	51	18
Drinking goat milk	76	46
Selling goat milk	10	6

The results show that de-worming, cross breeding and mineral supplement were the best adopted practices for both group and non group member e.g. goat by weight and goat milk were the worst adopted practices.

From the eight timelines generated during the research process, five different sources of technologies were mentioned. These were farmers who were instrumental in distributing avocado seedlings, mango varieties and bananas; government extension who were responsible in the introduction of coffee, cattle dipping and dairy cattle improvement (AI); businessmen who introduced new bean varieties; commercial extension who also introduced new bean varieties and tobacco.

The timelines revealed different shocks to the system in the past. These were drought, livestock diseases and collapse of services. The results showed that there was institutional arrangement before any technology was introduced. The systems were flexible and dynamic and there were common experiences across the villages but each village and group has a different history and experience.

Out of the 54 causes fifteen were social cultural causes such as jealousy, laziness etc. while thirteen were related to lack or cost of inputs; six were related to extension services, two to lack of information among farmers and three to markets e.g. lack of market and exploitation. Eight of the causes were related to inefficiencies in information and communication (lack of awareness) and seven were other causes of poor information flow.

Thirty nine primary effects of lack of information flow were mentioned. The most commonly mentioned effects were hatred/jealousy, poor goat management, lack of upgraded livestock, poor livestock health, lack of development and poor livestock housing.

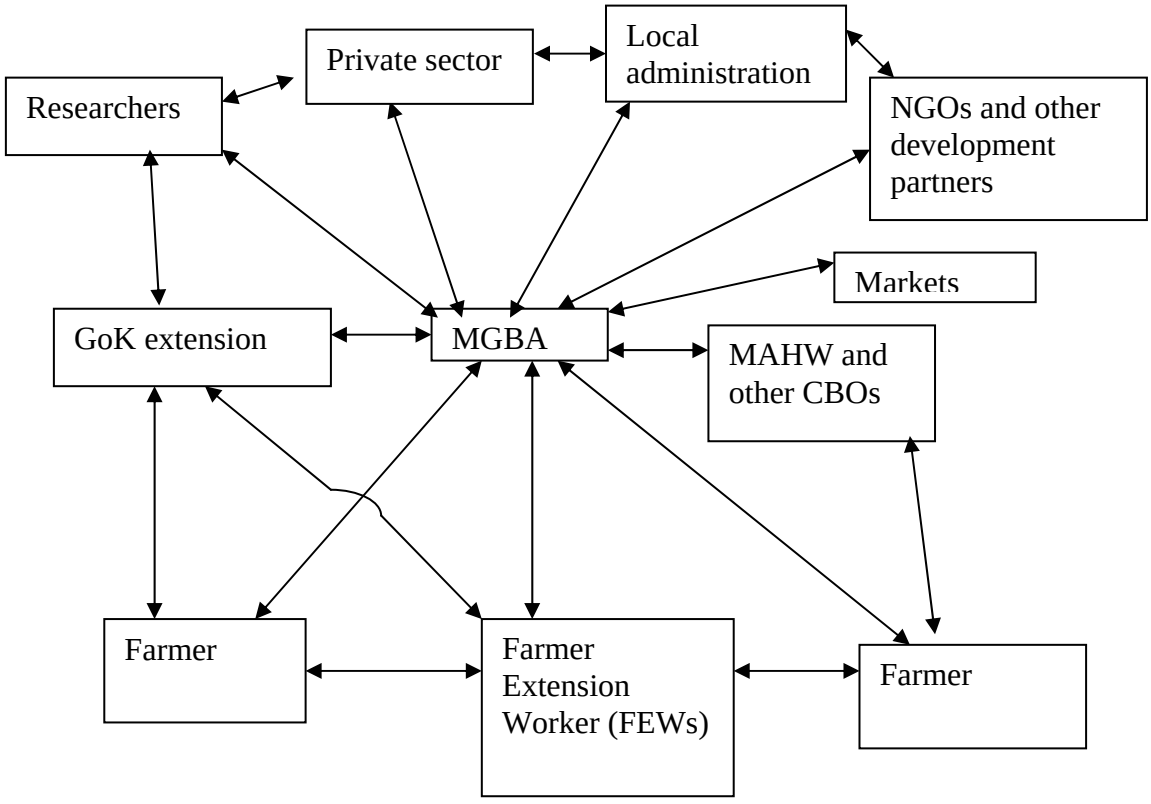
Sixteen information maps were generated during the research process. Within these maps there were thirty five sources mentioned within village/divisional level, twenty seven at district level and ten beyond district. The most frequently mentioned sources of information were radio, chief barazas, farmers and extension officers (mentioned in 14-16 maps) market places, groups, church and TV (mentioned in 10-12 maps) FARM Africa and shows (mentioned in 7-8 maps).

In summary, farmers are getting agricultural information from many sources. Farmers value interactive sources which allow for feedback, question and answers. Accessibility may conflict with reliability. Farmers value expertise, seeing as well as hearing.

These results gave us an indication of a communication model to be developed for improving information flow. The research team therefore drafted a communication model based on the results. The model was subjected to a consultative process involving about 31 people ranging from farmers (both group and non group), GoK extension staff from the ministry of livestock and fisheries who included, District Livestock marketing officer, Divisional livestock extension officers, District veterinary officers, veterinary officers, Meru Goat Breeder Association (MGBA) members, Meru animal Health Workers group (MAHWG) members, local administration (chiefs and assistant chiefs). This helped to fine tune the model to be relevant to the needs of the community. From the above process following are the key features of the model.

- It must be embedded in local institutions that are accountable to the people they serve and responsive to their concerns-use rural peoples organization/groups
- There should be deliberate efforts to integrate gender concerns in the model
- Should use key traditional channels of communication that have been identified in the earlier part of the research
- Engage farmers in planning and implementation of the model
- Establish linkages with extension and research systems
- Must be sustainable and replicable
- Must be subjected to criticism and different views on the model sought from the stakeholder
- Indicators of monitoring effectiveness, efficiency and economic viability – in some cases adoption, whether there are other groups which have taken up the practice

Farmer-to-farmer communication model



Roles of each institution

Meru Goat Breeders Association (MGBA) as a farmer institution plays a facilitative role where extension needs of the fellow farmers are identified and services of relevant information provided sort. Such service provider train farmer extension workers who use the identified channels to communicate the same to fellow farmers in their respective villages. Such service providers include Researchers, private sector, Government extension workers and MAHWG. Capacity building of MGBA on financial management, organizational competence and marketing techniques was singled out as key to the success of the model during consultations. MGBA can also play a role a facilitator in farmer field school where the Farmer extension workers farms are used as laboratories for experimentation i.e. where other farmers come to learn. The government policy on extension is to supply extension on demand driven basis. The government is encouraging farmer empowerment in extension. Farmers in both districts indicated willingness to provide motivation to the farmer extension workers as long as production is increased and they are helped to obtain markets for their produce. This Model emphasizes farmer-to-farmer interactions with researchers and extension through the mediation of their own institution. Arrows indicate the relationship between the different stakeholders i.e. the linkages. MGBA is in a position to seek collaborative partnerships with other institutions within the working area e.g. NGOs, networks such as Meru South Agricultural Stakeholders Forum and other development partners to be able to work efficiently and updating itself. They should also venture into other farming activities, which are related to goat enterprise.

Farmer Extension worker

- Provide information to fellow livestock keepers using identified channels of communication
- Hold discussions with fellow livestock keepers on their needs and communicate the same to the MGBA executive
- Provide linkage with extension and the researchers upon which new information is passed to the livestock keepers in the village
- Use their farms to demonstrate the livestock practices to fellow livestock keepers.
- Provide information and assistance on marketing

Sustainability

MGBA management is capable of interacting with the market forces to be able to generate it own income from the sale of goats and goat products and even offering training at a fee to other organization. Since the FEWs are already the active members of MGBA some of their activities are done on cost recovery basis e.g. ear tagging services. If this approach is well managed, it can ensure sustainability of FEWs effort of facilitating farmer-to-farmer interactions/communication.

Criteria of selection of FEWs

During the validation workshop and consultations with stakeholders, a criteria was developed on who should be selected as a farmer extension worker. This was mainly in response to the findings of the research that jealous is a major cause of poor information flow within the research area. Below is a criteria for selection of a FEW obtained from the consultative process:

- Should be a devoted person and self sacrificing
- Should be a practical example i.e. a model farmer who is practicing and has been recognized by the farmers and other stakeholders
- Should be socially acceptable by the majority
- One with leadership skills.
- Should be elected by the community people themselves i.e. selected by proposal and secondment method in the farmers forum
- Somebody with subject and communication skills
- Must be literate
- Must be a trusted and honest person

- Should be humble and convincing
- Should be a relevant stakeholder
- Should be an active member of MGBA
- Should be a community based person
- Should not be a jealous person

Training of FEWs

Farmer Extension workers (FEW) were identified and trained specific technology and made aware of the channels they were to use to disseminate the same to the selected villages. One FEW selected per group for the eight 2003 groups used during data collection and eight 2004 groups to be used to test the model. The FEWs were brought together, trained on the messages to be sent out and other relevant skills that improve their public relations. They were trained on the traditional channels of information to use for sensitization and for training. The channels used were those that were identified in the first part of the research as the most preferable and effective. The FEWs were involved in the creation of awareness to the communities and provide opportunities for other farmers to learn from them. Their role was also to facilitate community development at local level.

Testing of the communication Model

Farmer Extension Workers (FEWs)
During this time the FEWs were given structured forms on which to fill the details of each meeting they conducted. The forms help to collect information on what channels they had used, messages sent out, time taken to extend the messages, distance covered and number of people (men and women) attend the meeting. The FEWs were also given forms to help keep track of what was happening on the farmers who had received the information. The information collected here was on what information the farmers had received from the FEW and what they were doing with the information i.e. adoption. At the end of the trials the forms were collected and the information summarized in a report.

Tracking FEWs

Three weeks after training the FEWs, the research team visited each FEW to get to know how they were going on. In the process the, the research team engaged the FEW in a discussion geared towards collecting information on what constraints they are facing, their level of engagement, motivation, questions commonly asked during their meetings and any other reactions from the recipient of the information. The information collected was recorded on structure forms and keyed into MS Access files.

Spot Checks

This was done one and half months after the training of the FEWs. The purpose of spot checks was to follow up on the work done by the FEW. The research team visited the area within which the FEW was expected to cover. To help avoid influencing the information obtained from farmers, the vehicle was left at a distance and the team walked to the village, each person took a different direction and talked to at least three different people at different homesteads. During the discussion with farmers, the research team collected information on whether they had received any information on dairy goat management for the last one month and if they had, through which channel, who initiated the process/interaction, motivation in the message passed, level of community engagement, level of FEW engagement, the ability of the FEW to engage other institutions in passing the information, constraints that are likely to affect the FEWs work and other issues arising that may need follow up. This information was recorded on structured forms, entered into MS Access files, cleaned and coded. The data will provide a basis for evaluation of the model. Questionnaire interviews and focus group discussions will be conducted to evaluate the model.

Current results indicate that churches have been commonly used by most of the FEWs to send out messages. It has been observed that FEWs prefer working outside their groups where the messages have not penetrated. Most of the messages sent out are mainly on sanitization but trainings are also being done especially for set up groups (both FEW own group and new groups organized by the FEWs). FEWs are making linkages with extension staff and receiving messages on field days shows which they use to train/sensitize other farmers. Some of their motivation has been:

- Willingness to pass information to fellow farmers
- Certificate of participation offered to farmers
- Farmers interest to benefit from goat rearing
- Social status – popularity with fellow farmer
- Market creation – have created market for their own goats as they sensitize other farmers

Some of the constraints experienced are:

- Difficult to convince farmers on first encounter
- Poverty – lack of resources to start the enterprise
- Cover large areas
- High dependency syndrome – farmers have too many expectations
- As farmers FEWs have other commitments
- Lack of enough forums to meet farmers

Conclusion

Farmer-to-farmer dissemination practices developed under the current project will complement existing public and private sector services, which are under increasing demand for livestock information due to changes in livestock production such as intensification, crop-livestock integration, and increasing peri-urban production. Farmer-to- farmer approaches offer opportunity for participation and empowerment of rural communities. E.g. some of the FEWs have been empowered and have even been chosen to represent the community in other forums. Being grounded in the field realities and experiences, the approach can be used in different agro-ecological and socio-economic settings and is replicable in that sense. Its flexibility does allow farmers to work in their own way, build their own history and experience and learn from each other.

2.3.3 Socioeconomic factors affecting the adoption of Calliandra calothyrsus in Rwanda

L. Dusengemungu

Introduction. Calliandra has been promoted in Rwanda since the late 1980s but no study has ever been conducted on its adoption by farmers. The ICRAF/ISAR (Rwanda Agricultural Research Institute) project has been promoting calliandra for fodder, soil conservation, and stakes since 1994. The objective of this study is to assess factors affecting adoption in three contrasting sites that have received support from the project.

Methods. The three sites were selected based on their contrasting environmental characteristics (Table 1)

Table 1. Site characteristics and sampling

District	Province	Ecozone	Farmers selected
Save and Nyakizu	Butare	Plateau, 1400-2100 m	64
Mudawomwa	Gikongoro	Highlands, 1800-2800 m	30
Muvumba and Kahi	Umutara	Savannah, 1200-1600 m	30

In Butare Province, during 1997/98, the project distributed seedlings to farmers who had volunteered at village meetings to plant them. For the survey, we selected 17 farmers in Save District who had planted and 17 who had not planted. In Nyakizu District, we selected 17 planters and 13 non-planters. In Gikongoro Province, we selected four farmers near an ICRAF/ISAR demonstration plot who had planted some shrubs that had been left over when establishing the site. We also selected 26 other farmers in the village who had not planted. In Umutara, farmers were selected around a village nursery which had been set up to distribute seedlings to farmers. Eighteen farmers who planted and 12 who did not were selected. The overall sample thus included 124 farmers, of whom 56 had planted calliandra and 68 had not. The farmers were interviewed in April, 2002. Survey results were shared with farmers and this enriched the quality of the findings.

Results. Female-headed households made up 42% of the total sample. Females had significantly smaller farm size than men and were significantly poorer. Eighteen of the 56 farmers planting calliandra had received between 101 and 500 seedlings, 8 had received 51-100, and 27 had received between 1 and 50 seedlings. Farmers planted the seedlings mainly in fodder banks, that is pure-stand plots. Uses of calliandra varied among sites; farmers in Butare used the shrubs primarily for stakes and fodder while in Umutara, for fodder and fuelwood.

The factors significantly associated with planting calliandra included
1. Family size. Planters' family size averaged 5.6 as compared to 4.6 for non-planters.
2. Age. Planters average 46 years as compared to 40 years for non-planters.
3. Visits by extension staff. Planters tended to be visited more than non-planters but these visits may have been more a result of planting than a cause.

Several other factors were not associated with planting.
1. Farm size. Planters had slightly larger farm sizes
2. Gender. A slightly higher percentage of planters were male (49%) than non-planters (40%) (40%).
3. 75% of planters had attended school while 63% of non-planters had.

4. Wealth level. Farmers identified four wealth levels in their communities: rich, medium, poor, and very poor. There were no significant differences in the wealth status of planters and non-planters. Of the rich and medium-income farmers in the sample, 51% had planted calliandra while 40% of the poor and very-poor planted. Of the 16 very poor farmers in the sample, 8 had planted.

Farmers who had not planted stated that the main cause of non-adoption was lack of plants (62%), lack of land (23%), and lack of knowledge (12%). There were no differences among men and women respondents.

Conclusions. The planting of fodder shrubs in all three sites was based on the distribution of free seedlings to farmers. The ICRAF/ISAR project needs to empower farmers to learn how to establish nurseries so that they can increase their plantings and not be dependent on outside organizations. Neither gender nor wealth status was associated with planting; this is a very positive finding suggesting that women and the poor can benefit from the practice as much as high-income groups and men. Similarly, farmers with small farm sizes and no education also appear to benefit as much as those with bigger farms and education. The ICRAF/ISAR project should continue to promote calliandra adoption in Rwanda, so as to help farmers feed their livestock, provide stakes and fuelwood, promote soil conservation, and raise their incomes.

2.3.4 Herbaceous legumes for increased forage production on smallholder farms.

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Introduction

In central Kenya, dairy production is a major source of smallholder farm income especially in recent years after the collapse of coffee prices. Despite the high demand for dairy products, the predominant smallholder dairy systems are characterised by low weight gains in young stock and low milk production (Gitau *et al*., 1994). Recent farm surveys in the area have reported an average daily milk yield of between 5-6 kg animal^{-1} (Gitau *et al*., 1994; Staal *et al*., 1997). The low yields are attributed to inadequate year-round feed supply, protein and energy intake, as farmers have little cash to purchase supplementary concentrate feeds. The main source of forage is Napier grass (*Pennisetum purpureum*) grown in sole stands (Bayer, 1990; Gitau *et al*., 1994; Mwangi, 1994; Staal *et al*., 1997). Although Napier grass has a high yield potential when fertilisers are applied, yields on smallholder farms are often poor (Boonman, 1993; 1985) as farmers do not generally apply mineral or organic fertiliser to fodder crops.

A Napier grass/forage legume mixture can address the constraints to forage yield as forage legumes generally have a higher nutritive value compared with tropical grasses and also have the ability to fix atmospheric nitrogen through their symbiotic association with rhizobia (Giller, 2001). The mixture also has the potential to produce higher total dry matter yields, suppress weeds and improve soil fertility (Goldson, 1977). Therefore, the integration of forage legumes into a Napier grass fodder system may provide an effective means of increasing forage and dairy productivity for smallholders in central Kenya and other highland areas in Africa.

This paper presents a summary of results of work conducted at the National Agricultural Centre Muguga between 1996 -1999 aimed at integrating herbaceous legumes into the Napier grass fodder system in central Kenya. It also details efforts in scaling up the legume technology. The impact of the scaling up efforts are reported in another paper in the same volume. This paper will therefore, dwell on improved yield and nitrogen fixation benefits to the fodder system.

Selection of herbaceous legumes

The following criteria was used to select the legume species to be evaluated;

(i.) agro-ecology suitability
(ii.) compatibility with tall growing grasses.

Using this criteria a list of 'best bets' was developed and the three legume species; were selected for evaluation in ntercrops with Napier grass (*Pennisetum purpureum*); *Desmodium intortun, Neonotonia wightii* and *Macrotyloma axillare*

Research Sites

On-station work was conducted at the National Agricultural Research Centre Muguga
On-farm work was carried out with 15 farmers in Kandara division of Thika district.
A farmer survey where 33 farmers selected at random and 13 key informants were interviewed was carried out in Kandara. The key informants were farmsr who had experience with growing herbaceous legumes in the area through the National dairy Development project. Out of the 33 farmers interviewed none was growing herbaceous legumes. Out of the 13 key informants only 3 were growing legumes during the time of the interview. The main constraints site by the farmers for this low adoption were;
(i.) Lack of legume seeds
(ii) Poor legume persistency especially when grown together with Napier grass
(iii). Even when seed was available germination was poor

On-station work

The on-station work looked at the effect of the following factors

(i.) Legume species of dry matter yield
(ii.) Harvesting management (frequency of cutting and cutting height)
(iii.) Applying of manure, lime or triple super
(iv.) Biological nitrogen fixation
(v.) Effect of using stem cuttings on the establishment of the legumes

Selected results from the on-station work

Dry matter yield (9 harvests in 26 months)

The Napier grass intercrop with Macrotyloma and Neonotonia had significantly higher ($P<0.001$) that that with Desmodium (table 1) but hag significantly lower legume DM yield ($P<0.05$). The Desmodium and Macrotyloma mixture had similar total yields but were significantly higher ($P<0.05$) than that from the Neonotonia intercrop (Table 1)

Table 1: The effect of legume species on dry matter yield

Component	Desmodium	Macrotyloma	Neonotonia
Grass	30,150	42,260	35,380
Legume	15,760	7,200	3,460
Total	45,910	49,460	38,840

Harvesting the intercrop at 16 weeks drastically reduced Desmodium DM yield ($P<0.001$) but had little effect on the yield of the other two legumes (Figure 1). The yield in of Desmodium was reduced by 64% compared to only 18.5% and 15.8% for Macrotyloma and Neonotonia respectively.

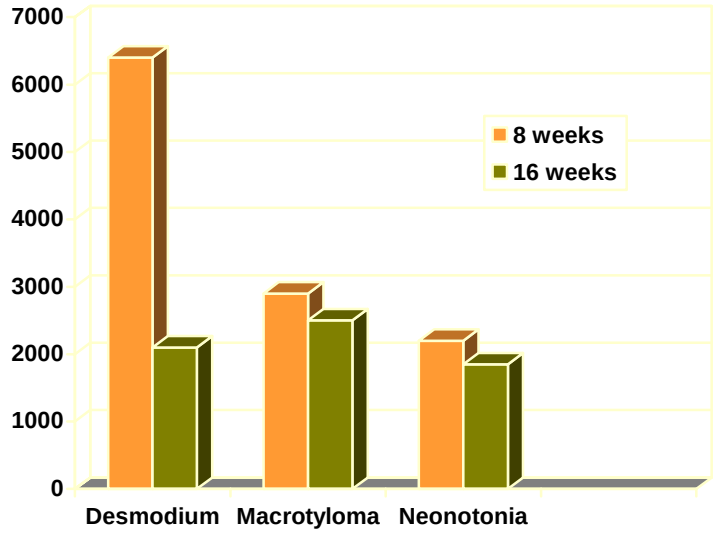


Figure 1: The effect of harvesting frequency on legume DM yield
Source on Nitrogen

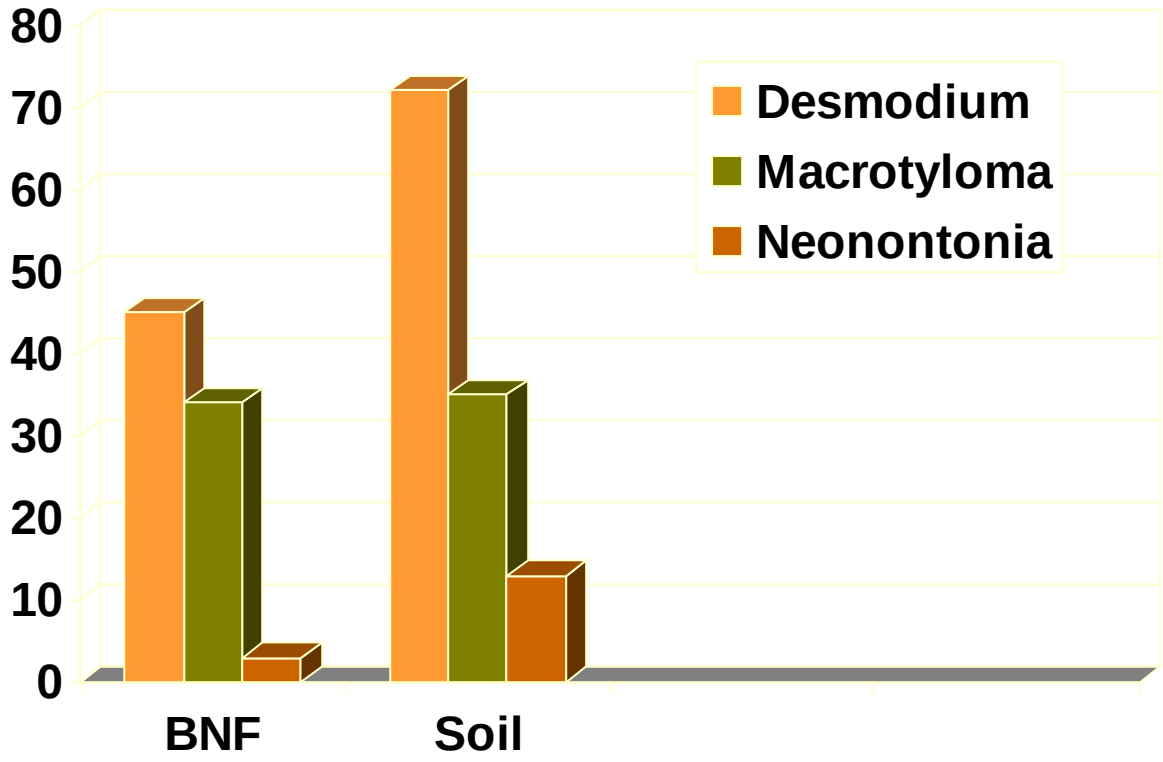
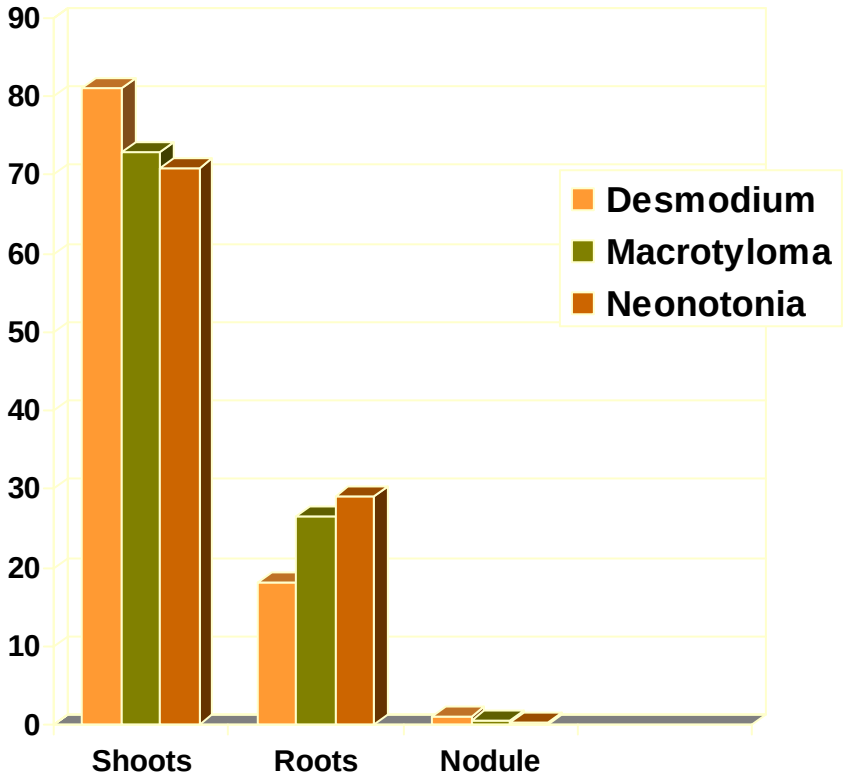


Figure 2: Source of nitrogen for the legume intecrops

Desmodium derived 45% of its nitrogen requirement from biological nitrogen fixation while Macrotyloma nd Neonotonia had 35 and 3% respectively (Figure 2). Although the legumes fixed a substantial amount of nitrogen, the largest amount was still derived from the soil. Therefore even with a legume intercrop the soil will be depleted of nitrogen unless a system to return some of the N back to the soil.

Over 70% of the N in the legumes was stored in the shoots (above ground) and only a small amount was in the nodules and roots (Figure 3). Although about 30% of the N is in the root this N is not readily available to the subsequent crop as the mineralization of N from the roots is slow.

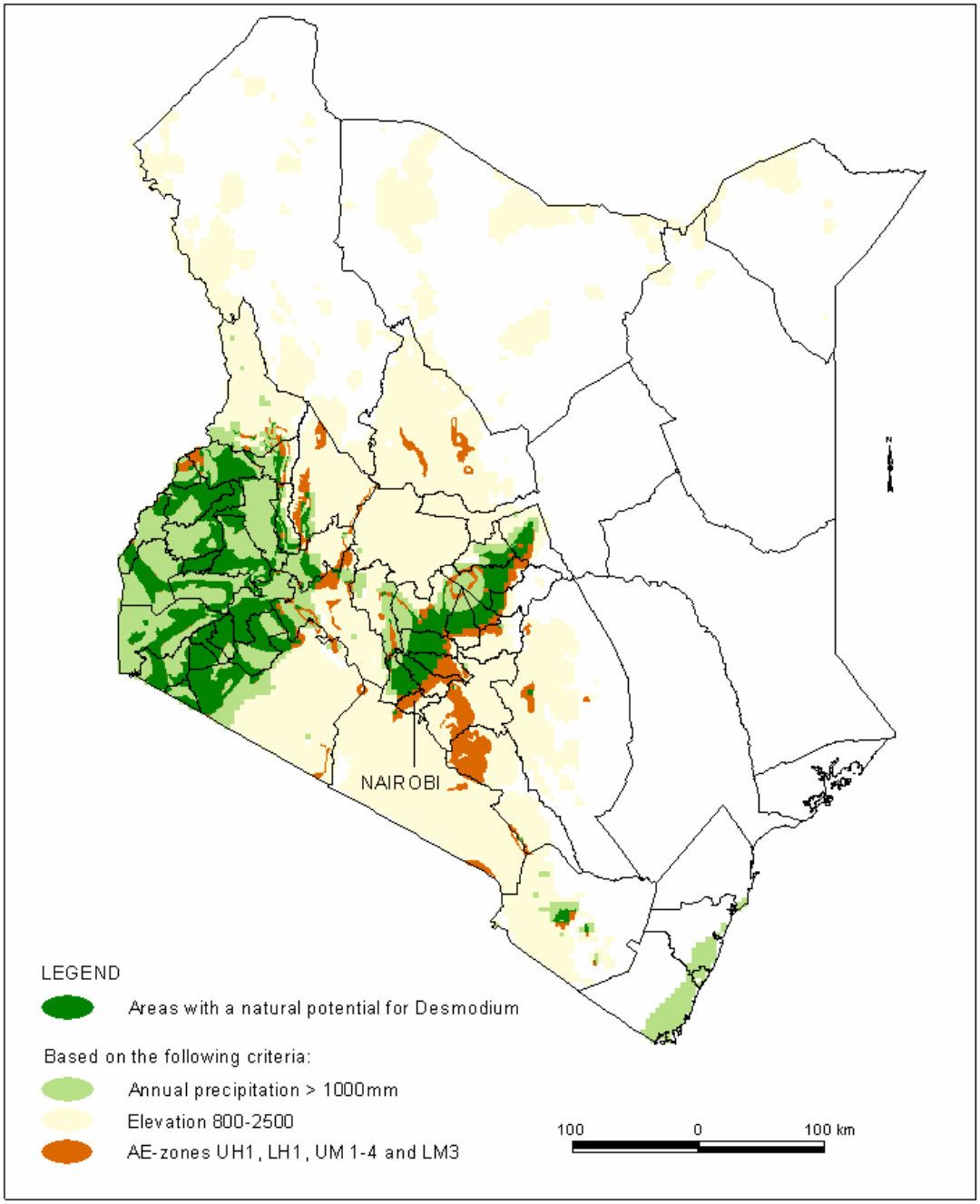


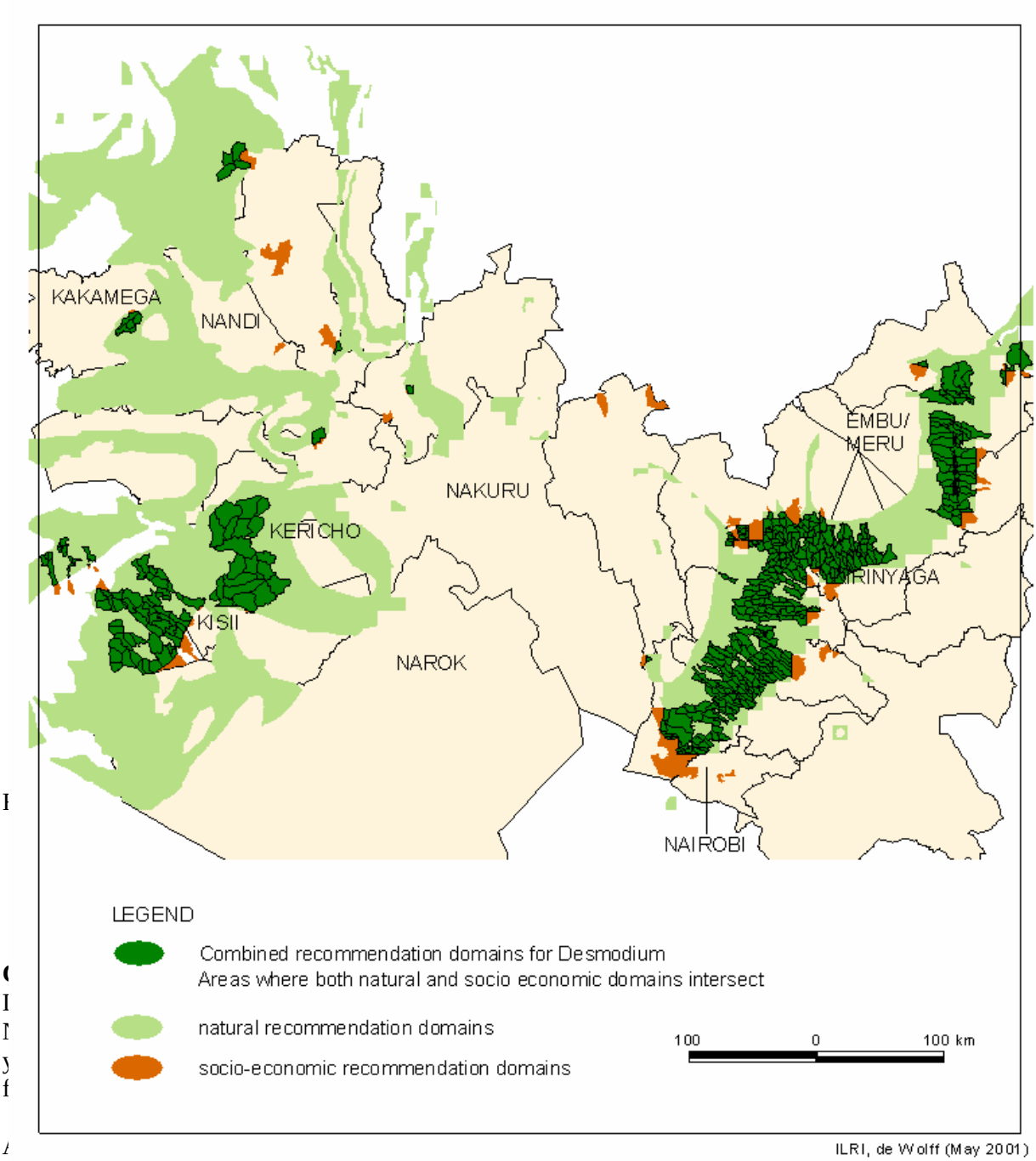
Scaling-up activity

The on-farm research work was only conducted with 15 farmers and scaling-up of the technology started with field days held on the farms of participating farmers. This activity was localised but a wider scaling-up was done.

Several issues were considered in the scaling up process. This help the team target the dissemination of the technology and therefore enhance uptake of the same. Targeting was done by first considering the bio-physical limits of the legume species (Figure 4) and then fine tuned but over-laying this with market access (Figure 5) as it was hypothesised that farmers with better access to the milk market will be more likely to adopt the legumes. Three areas Kandara (good milk market access, Kirinyaga (medium) and Embu (poor) were selected. In disseminating the technology in these areas, the project introduced the legumes to 14 farmer groups working with the systemwide livestock programme (SLP) on the dissemination of *Calliandra caloythrsus* and other MPTs. The effect of this approach is reported in another paper in this volume.

Figu


NAIROBI
LEGEND
Areas with a natural potential for Desmodium
Based on the following criteria:
Annual precipitation > 1000mm
Elevation 800-2500
AE-zones UH1, LH1, UM 1-4 and LM3
100
0
100 km
ILRI, de Wolff (May 2001)



requirement from the soil. Therefore even with a legume intercrop where the harvest index is high like in the cut and carry system of central Kenya, soil fertility must be maintained by adding manure or chemical fertiliser to the forage plots.

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2.3.5 Farmer to farmer dissemination of fodder shrubs in central Kenya

Steven Franzel, Charles Rufuata, Sabina Wangia, Tutui Nanok, Charles Wambugu

Introduction. The adoption of new technologies has been widely studied but few assessments have been made of farmer-to-farmer dissemination, that is, who in a community disseminates new technologies and how they do it. The objective of this study was to find out the degree to which farmer groups and their members in central Kenya disseminate fodder shrubs, what types of planting material they disseminate (seed, seedlings, and wildings) and to whom. With formal extension systems in decline throughout Africa, such information can help policy makers understand the degree to which farmer-to-farmer dissemination can substitute for or complement formal extension services and how to promote it.

Methods. During 1999-2001, ICRAF assisted 48 farmer groups in Central Kenya, comprising about 2,000 farmers, to plant fodder shrubs. Most of the groups were pre-existing; their main activities included dairy goat production, soil conservation, water tanks, and credit. ICRAF staff provided the groups with planting material and technical assistance. In 2002, three years after planting, a random sample of 14 farmer groups in Nyeri, Embu, Kirinyaga, and Maragua Districts was visited. Group leaders were interviewed about the dissemination activities of their groups. Ninety-four members (7 per group) were selected randomly from group lists and interviewed about their dissemination activities. Finally, from the interviews with these "first-generation farmers", farmers who received planting material and information from ICRAF, we drew up a list of "second-generation farmers", that is, farmers who received planting material from the first- generation farmers. From this list, we randomly selected and interviewed 55 farmers.

Results.
Farmer groups and members who disseminate. Group size averaged 18: 10 males and 8 females. All 14 groups reported that they reached out to non-group members with messages on fodder shrubs. Ten groups invited outsiders to group functions, five invited others to visit their farms, two held field days, and two visited schools to educate teachers and school children. Ten of the fourteen groups distributed or sold seedlings; overall, the groups gave out or sold seed and seedlings, on average, to 18 farmers. Two-thirds of recipients were male farmers and three-quarters were in the same village where the group was based. Four of the groups also gave out or sold seed to non-members.

In the member survey, 57% of respondents were males and 43% females. Respondents on average were 53 years old, had seven years of education, and 2.4 ha of land. Seventy-six percent had a dairy cow, 37% had a dairy goat. Farmers had an average of 352 fodder shrubs. Male farmers had significantly more shrubs than females: 454 for males as compared to 212 for females (t-test, $p<0.01$). Men also tended to have their own nurseries more often than women (39% vs. 18%), which may explain why they had more shrubs.

Over half (55%) of the group members gave out calliandra planting material to non-members. A slightly higher proportion of men gave out planting material than women and each tended to give out different types of planting material (Table 1). Female members tended to give out more seedlings that they had received from group nurseries than males. Male members gave out more seedlings from their own nurseries than females (all farmers received seedlings from group nurseries whereas men had more private nurseries than women). Both men and women gave out seed from their shrubs in roughly equal proportions. Most groups gave out seedlings from their nurseries, some also gave out seed (Table 1).

On average, each group member gave out calliandra planting material to 6.3 farmers outside their group. Of this total, individual members distributed material to 5.3 farmers while groups distributed to 1.0 farmers per group member. The most common types that farmers gave out were seed from their shrubs, seedlings from farmers' own nurseries and seedlings that they had received from group nurseries. (Table 1).

Dissemination was highly concentrated; five farmers (5% of the total) accounted for 66% of all dissemination. The eight who disseminated to 12 or more other farmers were a varied group. Five were male while three were female. Four were officials of their group while three were ordinary members. Their median age, farm size, and number of years of education were about the same as for the entire sample. The proportion that had been visited by researchers and extensionists was higher than for the sample, five out of eight instead of one-third. The strong disseminators had somewhat more trees, 454 vs. 352 on average, than the sample.

Second-generation farmers. Recipients of calliandra planting material were overwhelmingly male; women accounted for 37% of farmers disseminating but only 25% of the farmers receiving planting material (Table 2). Apparently, even if a woman brings seed or seedlings onto the farm, men often give out planting material to others, and they tend to give to other men. Recipients of seedlings received on average 38-49 seedlings if the source was a nursery and 8 seedlings if the source was wildings. Farmers tended to give out seedlings from group nurseries to relatives whereas other types of planting material, seedlings from own nurseries, wildings, and seed from own shrubs were given mostly to friends. Other persons, that is, those who were neither friends nor relatives, accounted for between 5% and 40% of recipients, depending on the type of planting material.

Seedlings obtained from group nurseries were in almost every case given away for free. Private nurseries emerged somewhat later and 15% of second generation farmers receiving seedlings from private nurseries paid for their seedlings. Seed became available from farmers' own shrubs 1-2 years after the nurseries were started and 40% of those receiving tree seed from farmers' own shrubs paid for the seed. This increasing trend in commercialization of planting material over time probably reflects the perceived increased value of fodder shrub planting material.

Fifty-one of the 55 second-generation farmers interviewed had fodder shrubs and one-quarter had over 100 shrubs, indicating their success in planting. Their high success rate may be due in part to sampling bias, because first-generation farmers were probably hesitant to give us the names of those who failed in planting shrubs. Most second generation farmers were unable to get as much planting material as they needed; 42% had fewer than 20 shrubs. The low numbers may also have reflected farmers' wishes to experiment with the shrubs before planting a lot of them.

Factors affecting dissemination. A series of farm and household characteristics were assessed to see if they were associated with farmer-to-farmer dissemination (Table 3). Three variables had significant associations: farmers with larger numbers of fodder shrubs those who were visited by extension staff and by ICRAF staff tended to disseminate more than others. On the other hand, most household characteristics, such as gender, wealth, education, and age did not affect whether farmers disseminated or not. Surprisingly, farmers who had had nurseries did not disseminate more than those who had never had them.

Conclusion. The study demonstrated the importance of farmer-to-farmer dissemination in spreading the adoption of fodder shrubs in central Kenya. Whereas men and women are both active in disseminating, most of the planting material tends to go to males. Groups play an important role in dissemination but group members, acting as individuals, do far more in distributing information and planting material than do the groups themselves. Contact with research and extension appears to be an important motivating force in farmer-to-farmer dissemination. More information is needed on which farmers account for most of the dissemination and how to motivate the groups and their members to disseminate more actively.

Table 1. Farmer-to-farmer dissemination: proportions of group members and groups giving out planting material and mean numbers of farmers receiving different kinds of planting material

	% of group members and groups giving out planting material to nonmembers			Mean no. of farmers receiving planting material		
Source of planting material	% of men members	% of women members	Total % of members	men farmers	Women farmers	Total no. of farmers
Individual group members						
-Seedlings farmers received from group nursery	28	38	32	0.6	1.8	1.1
-Seedlings from farmers own nurseries	17	10	14	2.6	0.3	1.6
-Seed from farmers own shrubs	22	20	21	3.1	0.7	2.0
-Wildings	15	5	11	0.3	0.1	0.2
-Seed from farmers who got seed from group	9	8	9	0.6	0.2	0.4
Groups						
Seedlings from group nurseries	-	-	71	0.6	0	0.5
Seed from group	-	-	28	0.7	0	0.5
Total	61	48	-	8.5	3.1	6.3

Table 2. Recipients of planting material by gender

	Recipients of planting material		
Source of planting material	No. of men	No. of men	Total no. and % of recipients
Individual group members			
-Seedlings farmers received from group nursery	45 (75)	15 (25)	60 (100)
-Seedlings from farmers own nurseries	33 (80)	8 (20)	41 (100)
-Seed from farmers own shrubs	26 (87)	4 (13)	30 (100)
-Wildings	7 (87)	1 (13)	8 (100)
-Seed from farmers who got seed from group	9 (64)	5 (36)	14 (100)
Groups			
Seed or seedlings from group nurseries	39 (68)	21 (32)	60 (100)
Total	159 (75)	54 (25)	213 (100)

Table 3. Factors associated with the giving out planting material to others

Significant association (p<0.05 for a chi square or t-test):
Number of fodder shrubs planted
Visited by extension staff
Degree of contact with ICRAF staff

Marginally significant association (0.05<p<0.10)
No variables

No significant association (p > 0.10)
Gender
Age
Years of education
Farm size
Wealth level
Ranking of dairy enterprise
Number of seed producing shrubs
Ever had own nursery
Ever hosted nursery for group
Membership in other groups
Whether or not holds office in group

2.3.6 Estimating the numbers of farmers planting fodder shrubs in Kenya

Steven Franzel

As the number of farmers planting fodder shrubs in Kenya increases, so does the difficulty in counting them! We use several different methods to estimate numbers of farmers planting fodder shrubs, depending on the circumstances.

1. In areas where we know there is a relatively high density of farmers planting, say over 10%, we use sample surveys. For example, Wanyoike (not funded by our FRP project) sampled 300 farmers in 30 clusters of Embu District where we knew planting was relatively high. He found that 11% of the farmers in one division had planted and 21% in another. This cluster sampling approach is not valid in areas of low adoption because we know that farmers tend to plant in clusters, many in 1 village, none in many other villages. A sample survey would have a high likelihood of overestimating numbers (if some of the sample villages landed in clusters where planting was taking place) or underestimating (if all landed in villages with no planters)

2. Lists or records of numbers of farmers who plant, collected by partner organizations. Many of our partners keep such lists and records. We are very careful about making sure that such lists or records are valid. For example, we ask to see the lists or records. We also make sure that the numbers can be broken down, if an organization is working in three districts and says that 800 farmers have planted, then they have to be able to tell us how many farmers have planted in each district. In several cases, we have declined to use numbers provided by certain organizations because they have not been able to convince us that the numbers are valid.

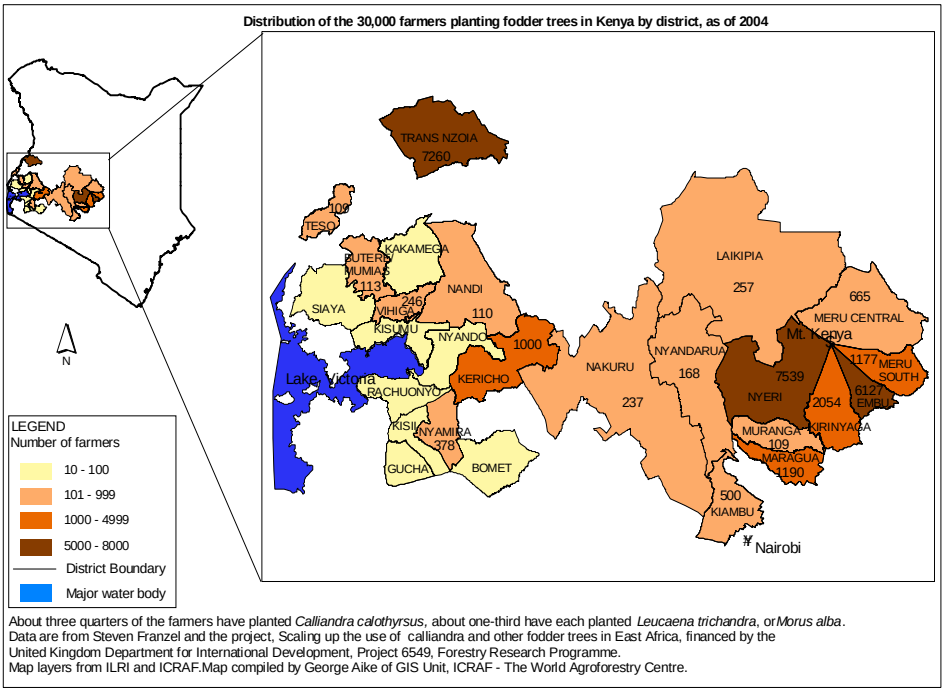
3. In one case, we have been able to estimate "domino effects", that is, numbers of farmers who disseminate to other farmers and the numbers that they disseminate to. From a list of 150 farmer groups with 2,600 farmers, we selected 13 groups at random. From each group, we randomly selected seven farmers. We thus interviewed 94 farmers and found that, three years after planting, each had disseminated on average to 6.4 other farmers. We interviewed a random sample of the farmers they had disseminated to and found that about three-quarters had successfully planted. But we cannot assume that farmers in other areas or countries will disseminate at this rate. It is likely that many different factors affect farmer-to-farmer dissemination rates. For example, in western Kenya, less than 10% of farmers have improved dairy animals; those adopting will likely disseminate at very low rates because few of their neighbors have dairy cows.

How many farmers are planting? Using the above methods, we developed charts of farmers planting (Table 1) and mapped the farmers by district. We have sound evidence that 30,000 farmers have planted in Kenya. We know that the total is underestimated, because we have not been able to get data from many partners that we know have been involved in fodder shrub planting, nor from places where we know fodder shrubs have been planted. In some cases the problem is that no one has kept records, no sample surveys were conducted, or a project has ended and no data are available. In other cases, partners may be keeping records but we haven't visited them to find out. We expect our estimates to increase rapidly in the next few years, because we will find out more about past plantings and because more and more farmers are planting the shrub.

Table 1. Example of a monitoring table on farmers planting fodder shrubs, Kenya

District	Partners	No. farmers	Trees/ Farmer	Species	Info source	Method
Trans-Nzoia	Vi AF project	7260		Sesb, Call.	Vi 2001	Random sample survey
Western (16 districts)	Heifer Int., MOA, Send-a-cow	1298	178	Call, LT, Mulb	Hellen Arimi, 2003	Farmer group lists

Map 1: Adoption of fodder shrubs in 26 districts of Kenya:



2.4 Economic Impact

2.4.1 Socio-economic and environmental impacts *of Calliandra calothyrsus* in Mukono and Kabale districts

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Abstract
The overall objective of the study was to determine the potential and perceived socio-economic and environmental impacts of Calliandra, a tree species that has been promoted in Uganda since 1987. Specifically, the study investigated main reasons for planting, benefits, cost of seedling production, economic impact of its use as fodder; and farmers' perceptions of its impact. The study involved a survey of 93 households, economic data collection on nine Calliandra nurseries and farmer workshops in the two districts. Calliandra has often been promoted and planted to improve soil fertility. However, 44% of farmers sampled in Kabale consider fodder as Calliandra's main benefit. Supplementation of basal feed with Calliandra and substitution of dairy meal with Calliandra is a profitable venture. Supplementation can realise a net present value (NPV) of US $ 133 to 173 and a net benefit per year of US $ 62 to 81 after the first year. For the substitution scenario, a higher NPV of US $ 195 to 209, and a net benefit per cow per year after the first year of US $ 97 to 104, were realised. Two extra litres of milk produced per animal per day would give the highest positive percentage change in NPV and annualised net benefit of 55% and 59% respectively. Most farmers in both districts experienced positive economic, social and environmental benefits from Calliandra. However, a few (11% in Kabale and 4% in Mukono) mentioned negative effects such as competition with other crops, topsoil hardening, and harboring of birds acting as pests on other crops. Calliandra is a useful multipurpose shrub in Uganda whose promotion should be encouraged in order to realise its full benefits in rural livelihoods.

Key words: Calliandra, impact, fodder, economic analysis, NPV

Introduction
There are up to 51 organisations/ programs promoting Calliandra in Uganda.In 2001, 2002 and 2003, a total of 1,574, 1,197 and 2,309kg respectively of Calliandra seeds were distributed by Vi Agroforestry project alone.(Source: Vi - Reports).

Calliandra can be fed to livestock such as goats, cows sheep, rabbits and chicken.
Calliandra is used in soil fertility management and conservation using different methods which include; use as green manure, increasing soil water holding capacity and bulk density (Rosecrance et al., 1992); b) erosion control and stabilisation of soil conservation structures using hedgerows (Angima et al. 2001; ICRAF, 2001; O' Neill et al., 2001) Calliandra use in fallow-improved fallows or rotational woodlots of Calliandra grown for two years have also been observed to replenish soil fertility, and subsequently to increase crop yields on degraded terrace sections (Agroforestry Trends, 1999). Environmental Impacts of Calliandra is that increased availability of firewood on-farm that reduces human pressure on surrounding bush land and forests. Calliandra trees are planted around state forestlands to protect timber trees from being destroyed. The environmental benefits of Calliandra relating to soil and water conservation, as well as improvement of soil quality.

Methods
A reconnaissance survey of the state of Calliandra adoption was made. Questionnaires were pre-tested on 10 farmers in each district. Farmers who had established Calliandra-based agroforestry systems were considered as adopters.

Structured questionnaires were used for data collection was administered to 93 adopting households for the formal survey in Kabale. The questionnaire sought for information on the demographic and socio-economic data such as own resources, household composition by age, gender, education, household head, decision making, sources of income, access to agricultural services and land tenure. Information on use, management, impacts and seed/seedling sources was also collected. Respondents who could not read and write were interviewed and the responses recorded verbatim. A total of nine out of nineteen nursery owners was randomly interviewed in Kabale to get investment data. The farmers' recall method and researcher observation were employed to estimate enterprise payments. All inputs and outputs were identified, quantified and valued using current market prices.

Three farmers' workshops were held in each of the study districts to determine farmers' own perceptions on Calliandra use, and its impacts. A total of 59 and 52 farmers in Mukono and Kabale respectively. Indicators that farmers would use to evaluate the impact of adoption. Focus group discussions were held and key informant interviews were conducted with local leaders, government extension officers and agencies, parish production committees, NGOs and ICRAF/AFRENA staff engaged in promoting Calliandra.

Data analysis

Descriptive statistics were used; analysis of household wealth status using wealth ranking (analysis was based on a scoring system on a scale of 1-5, the poorest being 1 and the richest 5, for each of the indicators. For economic analysis Net Present Value (NPV) and Sensitivity Analysis (SA) were used.

RESULTS
Socio-economic characteristics of households with Calliandra, Kabale
The sample size of ninety-three farmers was interviewed in Kabale, the results using wealth ranking and categorization using indicators show that most (77%) of the farmers with Calliandra were in the medium wealth category, 16% were rich and 7% poor. Most (81%) households with Calliandra in Kabale were from male-headed and married households.

Benefits derived from Calliandra
The primary reasons for planting Calliandra in Kabale were animal fodder (44%), soil fertility (20%), soil erosion control (20%), stakes (11%), firewood (3%) and commercial benefits (1%). In Mukono, the benefits from Calliandra also included attraction of bees, for pollination. There were up to 22 benefits derived from Calliandra in Kabale.

Economics of Calliandra production
There were potted (N=5) and bare root (N=4%) seedling nurseries. The cost of raising a seedling was Ug. shs 43 (US $ 0.023) and Ug.Shs 18 (US $ 0.010) per seedling for potted and bare rooted seedling respectively. (Kabale results; no individual nurseries were found in Mukono).

Use of Calliandra as fodder

In Kabale many respondents (81%) fed livestock on Calliandra, *Leaucaena trichandra and Acacia angustissima* fodder. Calliandra (91%) was the most used fodder crop because it enhanced quantity and quality milk. One farmer said the lactation period for indigenous cow had increased from three months to eight months.The farmers reported that the increase in the quality of milk helps in marketing of milk faster than that of animals not fed on Calliandra. In both Kabalea and Mukono, farmers who have crossbred animals fed on Calliandra reported averages milk yields of 1.14 litres.

4.6.3 Economic Impact of Calliandra on milk production

Calliandra can be used to supplement or to substitute for the farmers' basal dairy animal feed. Partial budget analysis results of supplementary feeding of Calliandra resulting from an average milk increase of 1.4 litres per animal per day in Kabale.

In Kabale, the establishment cost for the shrubs was Ug shs 32,788 (US $ 17.43) if potted seedlings are used. In Mukono the cost of seedlings, establishment (transportation to the field and planting) and maintenance is Ug shs 40,850 (US $ 21.72).

Partial budget economic analysis showed that in the case of supplementation a net present value (NPV) of Ug shs 264, 274 (US $ 140.50) and a net benefit per year after the first year of Ug shs 124,205 (US $ 66.03) is realized. In this case the annualised net benefits, considering establishment cost as depreciation, is Ug shs 113,242 (US $ 56.91). Under good management, the net benefit of US $1.35 can also be realised in the first year. In the substitution case a higher NPV of Ug shs 387,562 (US $ 206.04) and a net benefit per cow per year after the first year is Ug shs 192,319 (US $ 102.24). In this second scenario the annualised net benefits considering establishment cost, as depreciation is Ug shs 181,355 (US $ 96.41).

Partial budget analysis results of supplementary feeding of Calliandra resulting from average milk increase of 1.1 litres per animal per day in Mukono. The NPV in Mukono for the supplementation situation is higher than that in Kabale by US $ 40.05, and for the substitution case by US $ 14.64.

In addition to the increase in milk production observed as a result of feeding animals on Calliandra, income can also be generated through the sale of Calliandra seeds (1 kg for Ug Shs 20,000 = US $ 10.63). On the other hand, costs of establishment and management are high. Management includes watering, weeding, manure application, protection, labour minimum Ug Shs 15,000 a month. However, this is a cost to the farmers who plant Calliandra but a benefit to the labourers. Farmers commented that this labour cost is not only for Calliandra, but also for all the other crops they may have on the farm.

Sensitivity analysis

The effects of variations (uncertainty) in the prices of milk and diary meal; in discount rates (10% and 30%); and in level of milk increase per animal per day, using an average lactation period of 305 days (the average in the study is 240 days in the case of Kabale and 248 days in Mukono) and a life span of the project of 10 years (the discounting uses a five year period). The results show an increase in NPV of 107% in Mukono in case milk production increases to 2 litres per animal per day where the average farm gate price of milk is Ug shs 400 and 55% increase in NPV in Kabale where the price is Ug shs 250. Extra milk production of 0.5litres per animal per day reduces the NPV by 98% in Kabale while in Mukono it reduces by 80%.

The results of the sensitivity analysis show that the lowest percentage increase in annualised net benefit (ANB) in Kabale is given by the increase in the period of analysis from five to ten years while the highest is given by extra milk production of 2 litres per animal per day while in Mukono the same extra milk production gives the lowest increase in ANB while the highest is given by a discount rate of +30% .

Commercialisation of Calliandra
Small-scale commerce of fodder firewood, seed, seedlings and stakes for climbing beans was observed. In Mukono five farmers had left some Calliandra to grow for seed production (about 100 trees). Those farmers said that they sell a kilo of Calliandra seeds at Ug Shs 4,000 (US $ 2.16).

Conclusions
Calliandra is a multiple use shrub that has been embraces by many farmers in both Kabale and Mukono. Some farmers have taken up Calliandra as an economic enterprise. Using an economic analysis, the cost of Calliandra seedling production is worthwhile investment.

Including the cost of production of seedlings in the, the use of Calliandra as a supplement to basal feed diet or for diary meal substitution increases the incomes of the households that use it.

Calliandra was said to improve lactation from livestock. Soil conservation, economic enterprise, sale and make money.

Promotion of Calliandra use as fodder, and other social and ecological use and non-use values, should be incorporated in government's PMA.

2.4.2 Socio-economic analysis of fodder legumes: The case of Calliandra and Desmodium in smallholder dairy farms of Embu District, Kenya

By Samuel Koech

Summary

Introduction
The central highland of Kenya is characterized by small land holdings, and as the size of land holdings continue to decline due to subdivisions, most livestock feeds will have to come from cropped land. World Agroforestry Centre (ICRAF) together with partner institutions have introduced fodder legumes (*Calliandra calothyrsus* and *Desmodium intortum*) with the aim of alleviating feed shortage. Work carried out in central Kenya has shown that calliandra and desmodium can be integrated into the existing farming system resulting in substantial benefits. Integration of these legumes into the smallholder dairy farms would increase animal performance e.g. in terms of milk production in addition of other numerous unquantifiable benefits.

Objectives

The purpose of the study was to examine the economic benefits of fodder legumes (Calliandra and Desmodium) when they are used as supplement for increasing milk production in Embu district, Kenya. Current uses of the fodder legumes and farmer innovations based on farmers' experience with the technology were assessed. In addition, factors affecting farmer innovation were analysed.

Methodology

Formal personal interviews using questionnaires were carried out with a sample of 60 randomly selected farmers who have adopted Calliandra and Desmodium in order to develop an understanding of the performance of these legumes from farmers' perspective. Purposive sampling was used to select 20 farmers with more than 500 calliandra trees (which are needed/ cow/ year) for determination of its net benefits, whereas multi stage sampling method was used to select desmodium farmers. The first stage involved selection of 24 desmodium farmers from the sample frame, and then 20 of them were selected and used in determining its net benefits. Farmers/groups having calliandra nurseries was established where ten nurseries were identified and all interviewed in order to determine the cost per seedling.

Partial budgets (which is appropriate for practices that have less or limited impacts on the costs and returns of an enterprise) were used to analyse data to determine the net benefits when fodder legumes are used as a supplement under different scenarios. Gross margins for major enterprises (maize and coffee) were evaluated using secondary data. The sets of data were then combined in a linear programming model in order to determine the maximum yearly net return of fodder legumes. A logit model, a commonly used method in adoption literature was used to determine the association between farm and certain household characteristics and farmer innovation.

Results

The study showed calliandra as the most commonly distributed fodder legume in the district, as 60% of the selected farmers had it compared to only 7% who had desmodium. 33% had both types of fodder. The average number of calliandra trees per farm was 607 (s.d.=884; median =300) with 23 % of them having less than 500 while the average area of desmodium planted was 846 square metres (s.d=1061). The cost per seedling was $US 0.005 and $US 0.01 for bare-rooted and potted respectively (appendix 1).

By supplementing 4.4 kilograms of fresh calliandra (cut and weighed) to cow's normal diet (which includes dairy meal) resulted in an increase of 1.09 (s.d =0.38; median =1.0) kgs of milk per cow per day. This is equivalent to an increase of 1.62 Kg of milk per 6 Kg of fresh calliandra, which is recommended per cow per day. The net benefits amounted to $US 44.87 per cow per year. The net benefits varied from scenario to scenario. For example, were much higher in female managed farms than male managed ones; the net benefits per cow per year were $US 53.76 and $US 38.84 respectively. The benefits were also high under high cattle management level; $US 45.26 and medium management level were $US 43.27. Also farmers who are more than 2 kilometres from the main road obtained higher net benefits ($US 48.35) than those close to the road ($US 43.71). However due to small sample size, the differences were not significant.

For desmodium, by supplementing 4.5 kilograms of fresh desmodium (cut and weighed) increases milk production by 232 kilograms per cow per year (an increase of 0.77 (s.d =0.34; median =0.75) kilograms of milk per cow per day. This is equivalent to an increase of 0.25 Kg of milk per Kg of fresh desmodium. The net benefits were $US 22.23 per cow per year. Unlike in the case of calliandra, higher net benefits were realised in male - managed farms ($US 22.60)

than female- managed ($US 21.53). Medium cattle managed farms obtained higher net benefits ($US 26.47) than higher level ($US 18). Like in the case of calliandra, farmers who are more than two kilometres from the main road obtained higher net benefits ($US 29.84) than those closer to it ($US18.13). Also due to small sample size, the differences were not significant.

The maximum net benefits per hectare per year when linear programming method was used were $US 124.48 and $US 118.77 for calliandra and desmodium respectively. Alternative enterprises, which were also considered, were maize and coffee. Maize enterprise in both cases (calliandra and desmodium) showed positive reduced costs (shadow prices); implying that for this enterprise to enter into the solution, its cost of production has to be reduced by $US 84.03 and $US 80.50 per hectare respectively. The optimal solution in both cases showed capital as the only resource that was not fully utilized; there was a surplus of $US 20.21 and $US 20.95 in case of calliandra and desmodium respectively. Land and labour were fully utilized. These results suggest a promising future for a combined production of agricultural and fodder legumes by small- holder dairy farmers.

In addition of being used as a fodder, the most important benefits farmers derived from calliandra were: utilization as firewood (50%), improvement of soil fertility (48%) and improvement in the health of the animal (38%). Other benefits include: control of soil erosion, acting as fence, creamy milk and source of revenue through sale of either fodder or planting materials (seeds). Desmodium farmers also obtained some extra benefits in addition of increase in milk. These were: erosion control (38%), fertility improvement 33% and weed control 17%. Other benefits include: improvement in the health of the animal, creamy milk and source of revenue through sale of either fodder or planting materials (seeds). Farmers varied considerably in the way they used monies from the sale of milk. 68% of the farmers reported the use of money for the purchase of every day commodities with 37% of them ranking it as the most important use of the money. 37% of the farmers reported the use of money to purchase livestock feeds with 25% ranking it as important. Between 10% and 24% used the money for payment of school fees, payment of hired labour and health care.

Farmers also noted that fodder legumes had some advantages when compared to the dairy meal. 57% of calliandra farmers reported it as readily available on the farm, 51% claimed it to be cheap, as money was not needed to obtain it. While desmodium farmers reported its advantage as readily available (63%) and 38% as cheap.

Only few farmers found fodder legumes to have negative effects. The only negative effects of calliandra cited were bloat (reported by 9 farmers), which is due to excessive feeding of the animal with fodder leaves and its negative effect on adjacent crops, reported by 3 farmers. The only negative effect of desmodium was its nature being weedy and thus expands to other areas if not checked, reported by only 2 farmers.

Most (77% for calliandra and 63%) for desmodium claimed that they face some constraints while trying to expand fodder on their farms. Lack of planting material-seeds /seedlings was the main problem reported by (27%) of calliandra farmers while it was not a problem to desmodium farmers. This is because the legume is mainly established through stem cuttings (vines). Also farmers could easily relate to the planting of stem cuttings, as this is similar to planting sweet potato vines, which they do all the time. 25% and 21% cited shortage of land, for calliandra and desmodium farmers respectively. Other constraints cited were shortage of labour, reported by 20% and 21% for both calliandra and desmodium respectively.

Farmers' management of the fodder legumes differed considerably from researchers' recommendations. 26 Calliandra and 11 (46%) desmodium farmers had made innovations, which

were either direct or indirect[2]. Most innovations, which were done, involved calliandra (mainly on its uses) as compared to desmodium. Some of the direct innovations mentioned include drying calliandra and mixing with bran and using it as cattle or poultry feed. The effect was increase in milk, like when dairy meal is used and poultry grow faster when fed with the mixture. During the rainy season when there are excess leaves due to faster re-growth of the legume (Calliandra), and in order to maintain pruning height, leaves are cut and left to decay especially those intercropped with napier grass or other crops in the farm. The effect was noted in the appearance of the napier grass or crops compared to other crops or napier grass where the practice has not been carried out. The change in appearance due to new practice implies that the legume can improve the fertility of the soil. Also it can be harvested then dried and stored and used later especially during the dry season/during shortages. One farmer dried calliandra and mixed with indigenous fodder ('Muthatha or Mumbembu') and used it to feed goats, which was found to increase milk. Also when used as firewood, the resulting ashes can be used to control maize stalk borer, which were found to control pests to some extent. Some reduced spacing (30 cm) of calliandra in order to make a fence /hedge (live). The innovation has the advantage as being acting as fence and when trimming it, the leaves are used as fodder.

Other innovations identified by the researcher/investigator and which were not part of recommendation package include: intercropping calliandra and desmodium in internal and external boundaries, use of hand to harvest calliandra, use of calliandra wildings transplanted in tubes which were found to grow faster. Others used fodder during milking, like dairy meal they are used to calm the animal.

Because of the positive effect of the innovations, most farmers decided to continue with their 'newly' acquired knowledge depending on the circumstances e.g. if they had excess fodder. Researchers need to carefully monitor farmers' own experiments. These changes (innovations) are presented as measures that researchers and farmers elsewhere can explore to help improve the adoption of fodder legumes.

Only one factor was found to significantly influence the decision to innovate in calliandra while none was found in the case of desmodium. The level of education of the farm manager (negative effect) was the only variable identified (in the case of calliandra) and it was significant at $p = 0.05$. The negative sign of age, rank of the dairy enterprise and extension service showed that probability of innovating decreases with increasing age and as dairy enterprise becomes less important. Also the incidence of local experimentation is inversely related to the level of contact that farmers have with formal research system; extension would stifle local experimentation. The logit results also showed that innovation is high with farmers having more experience with the legumes, who are well off in terms of wealth and on medium cattle management level.

Conclusion and recommendation

Whereas the benefits of the legume have been demonstrated in this study, its actual potential benefits are still higher. The findings also show that the net benefits in female managed farms did differ from male managed ones. This finding highlights the importance of disaggregating farmer assessment data by gender. The findings also highlight the great potential of fodder legumes for enhancing the well being of poor and female households. But availability of planting material and information are also critical for promoting adoption, so that farmers can clearly see these benefits as demonstration of positive economic impact will form the basis for increased adoption. Therefore the following issues are important for future work.

- More information dissemination on techniques of collection, propagation, and nursery

[2] Direct innovations; farmers themselves claimed they have tried on their own, while indirect innovations; practices which farmers undertook which were identified by the researcher/investigator and were not part of recommendation package.

raising is needed

- Farmer field visits should be encouraged. Seeing and discussing fodder legumes with farmers can be an effective means of promoting fodder planting and also provides forum where farmers can learn about its growth, management and uses.

The study identified one source of innovation, farmer-innovation.

Issues:

- The innovations need to be encouraged and carefully monitored through continued interaction amongst farmers, extensionists and researchers, so that farmers' collective findings can be disseminated more widely to other farmers under similar conditions.
- Promoting farmer innovation through visits to other areas and amongst farmers is effective in making the farmers aware of local innovation and principles behind them. Types of visits and exchange visits
  - Farmer innovators visiting other innovators to learn from each other,
  - Ordinary farmers visiting farmer innovators to learn from their experience, and
  - Farmer innovators visiting other farmers to inform them and train them.

  Through shared experiences, their complementary strengths can be effectively exploited and integrated at a reasonable cost.
- Encouraging farmers to experiment with and modify the practices to their needs and circumstances by 'widening' the decision making horizon of farmers or increasing the information available to farmers on possible alternatives.

As it has been noted that in cases where participatory research has been of collegiate or empowering type, farmers are thought to have increased their rates of experimentation. Farmer innovations and feedback have played an important role in modifying the extension messages shared with farmers.

Appendix 1: Comparison of establishment costs of seedlings using different types of nurseries.

	Bare rooted seedlings		Potted seedling	
Activity/ inputs	Average cost ($US)	No. Incurring the cost	Average cost ($US)	No. incurring the cost
Nursery establishment.	0.52	7	2.10	3
Nursery maintenance	7.10	7	9	3
Fertilizer cost	0.02	3	0.05	2
Manure cost	1.10	6	0.34	2
Cost of seeds	4.68	7	0.65	2
Cost of wildings	0	0	0.20	1
Cost of tubes	0	0	0.81	3
Totals	13.52	7	13.21	3
Number of seedlings established	2692	7	695	3
Cost per seedling	0.005	7	0.01	3

*Standard deviations are in parenthesis

Appendix 2: Coefficients and prices used when calliandra is used as a supplement for increasing milk production, Embu District, Kenya.

Item	Values	Data sources
Coefficients		
Lactation period	300 days	Assumption
Days fed calliandra	365 days	Assumption
Dairy meal per cow per day	1.3kg	Assumption
Days fed dairy meal	365 days	Assumption
Period of analysis	10 years	Assumption
Fresh calliandra quantity fed /cow/day	4.4 kg	Farmers
Calliandra planting labour	20 plants per hour	Franzel *et al*., 2002
Calliandra cutting and feeding labour	18 minutes per day	Farmers
Discount rate	20%	Assumption
Average seedling survival rate	76.5%	Franzel *et al.,* 2002 and Wambugu 2001
Prices (Ksh)		
Milk price	$US 0.18/kg	Farmers in 2003
Seedlings cost-bare rooted	$US 0.005/seedling	Farmers in 2003
Labour cost	$US 0.15/hour	Farmers in 2003
1 $US = 76 Kenya Shillings		Average exchange rate, 2003
Annualised value for fixed cost for seedling establishment for 358 shrubs	91	Capital recovery formula* Spencer *et al*., 1979

*$K = (rv)/(1-(1+ r)^{-n})$, Where K is the annual service user cost, v is the original cost of fixed capital asset, r is the discount rate, and n is the expected life of the asset

Appendix 3: Coefficients and prices used when desmodium is used as a supplement for increasing milk production, Embu District, Kenya.

Item	Values	Data sources
Coefficients		
Lactation period	300 days	Assumption
Days fed desmodium	365 days	Assumption
Dairy meal per cow per day	0.88 kg	Assumption
Days fed dairy meal	365 days	Assumption
Period of analysis	10 years	Assumption
Fresh desmodium quantity fed /cow/day	4.5 kg	Farmers
Extra milk /cow/day	0.77 kg	Farmers
Desmodium planting labour	340 sqm per hour	Farmers
Desmodium cutting and feeding labour	24 minutes per day	Farmers
Discount rate	20%	Assumption
Prices (Ksh)		
Milk price	$US 0.20/kg	Farmers in 2003
Average cost of vines (cuttings)/ handful	122	Farmers
Seedlings cost-bare rooted	$US. 1.6/handful	Farmers in 2003
Labour cost	$US 0.15/hour	Farmers in 2003
1 $US = 77 Kenya Shillings		Average exchange rate, 2003
Annualised value for fixed cost for fodder establishment (882 square metres of desmodium).	46	Capital recovery formula* Spencer *et al., (1979)*

*K =(rv)/(1-(1+ r)$^{-n}$), Where K is the annual service user cost, v is the original cost of fixed capital asset, r is the discount rate, and n is the expected life of the asset

2.5 Extension

2.5.1 Scaling up fodder trees in Western Kenya:

Hellen Arimi

- **Scaling up:**
  "Bringing more benefits to more people over a wider geographical area more quickly, more equitably, and more lastingly

Challenges

- Low quality and quantity of feeds
- Livestock types
- Group dynamics
- Erratic rains
- Survival of seedling on farm

Approaches

- Focus: Farmer groups and concentration areas
- Emphasis: Participatory approaches
- Sensitization & awareness creation
- Developed strategic partnerships especially with dairy projects

- Capacity building and empowerment
- Deliberate efforts to commercialize production and distribution of planting materials

Partners

- MOA and ML&FD
- HI-Kenya
- CPDA
- AFRICA NOW
- VI-AF
- CBOs (CHURCH, UGUNJA, MICH**)**

Results of Partners

Farmer groups	**Men planting fodder trees**	**Women planting fodder trees**	**Partners**
51	**606***	**564***	**8**

Success stories

Story 1

- 'I have seen the sweetness of Dairy goat'. Thanks to Africa Now for providing the dairy goat and ICRAF for providing fodder trees.
- My goat is producing 2 litres of milk/day.
- When I take tea, made from goat milk fed calliandra I don't need lunch Says Janet.

Story 2

- "A cow has become my husband" says one group member from Samaki Women group.
- Thanks to HI-K for PASSING GIFTS and ICRAF for providing fodder trees

Story 3

- Magwagwa focal area agroforestry group. "We used to give fodder tree seedlings to our customers free of charge to create awareness, today we are selling to them at 3 shillings each"
- Nyaboma women group: Had a problem of feed quality and through fodder tree interventions, the group is feeding quality feed to their animals which members have confirmed an increase in milk yield.

Future plans

- Scale up fodder trees in entire District
- Capacity building on utilization
- Farmer to farmer dissemination
- Seed bulking- planting material

2.5.2 Scaling up the adoption of fodder shrubs in Central Kenya

Charles Wambugu-ICRAF, Esther Karanja-FIPS and Peter Mwangi-MOA- Kiambu District

Introduction

Dissemination activities that involve passage of information and distribution of planting materials of fodder shrubs is spread in parts of central province, the environs of Nairobi and parts of Rift Valley. The fodder shrub project carries out the dissemination activities through partner in extension and research institutions as well as the farmers themselves. The extension and research service providers are in the government, Non-governmental organizations, private extension providers, farmer associations and individual farmers.

The project laid lots of emphasis on linking up the seed demand and the supply ends. Calliandra seed producers in central region were linked with commercial nursery operators, stockists, extensionists and farmers who needed the seeds.

The scaling up strategy and approaches

The project goal is to scale up the adoption of fodder shrubs technologies that would help the small-scale farmers to increase their income and improve their nutritional status. This is achieved through efficient and effective distribution of germplasm and information to the farmers using the most convenient and accessible routes that include the extension service providers, farm input stockists and seed dealers.

Seed is packaged into 30g using small medicine packets that are cheap to buy and are easy to get. It is well labeled with instruction on how to sow the seed. This approach has made it easy for the project to distribute seed to as many farmers as possible and it targeted for both individual farmers and groups. It was also aimed at putting commercial value to the seed with the ultimate aim of distributing it through the private sector. Some of the farm inputs stockists in Thika, Kiambu, Maragua and Muranga districts are now selling calliandra and trichandra seed packed in small packets.

Elements of the promotion strategies

The promotion strategies aimed at scaling up the adoption of fodder shrubs by smallholder dairy farmers in the region.

Some of the strategies included the following:

- Building partnerships and linking different stakeholders in dairy sub sector by involving the IARS, NARS, GOs, NGOs, private sector and farmer organizations
- Institutional strengthening involved creating awareness and building the technical capacity of extension staff and farmers on fodder shrubs production and utilization. It involved training, field days, demonstrations, and exchange tours that aimed at empowering the extension staff and farmers. It also involved experimenting with farmers on species performance, appropriate methods for propagation, management and feeding. Innovations by farmers were captured, validated and incorporated into extension messages that were disseminated to other farmers in the region and also to other project sites in the East African region.

The project deliberately strived to extend its reach and impact to new horizons through forging partnerships and alliances with other stakeholders. There seems to be an emerging interest in fodder shrub technologies by private extension providers which may be a good indicator for sustainability and an avenue for ICRAF to address the wider agroforestry aspects. In addition, the promotion process through the public and private sector creates synergies that assist in reaching many farmers.

- Mass awareness programmes was used to facilitate the sharing of knowledge and information among the farmers and extension staff from different localities. A local radio programme was used to promote the use of fodder shrubs as a mechanism to safe on production costs while at the same time the farmer increases the milk production. The radio programme was sponsored by Ultravetis; an agrovet company based in Nairobi. Public awareness was also created through pamphlets and articles appearing on farmer magazines that the project staff authored.
- The project extended experiences gained from SLP activities to other sites. Mass awareness programme has been very effective in creating demand for fodder technology

- The project tried to influence changes on policy as it relates to seed distribution in Kenya. However, the big question is how far the project should go into the role of policy advocacy.
- The project is able to respond effectively to increasing demands for fodder shrubs through the linkages and partnerships it is promoting. Through this process it is also able to improve on the relevance and impact of agroforestry by active involvement of partners
- Institutionalizing the promotion of fodder shrubs as key component in extension – i.e. making it "part of our partners business"
- A gradual and well calculated exit strategy from pilot sites
- Exploring new horizons such as:

    1. Getting the seeds into the formal marketing channels. Attempts have been made to approach authorities in KEPHIS with an aim to have the requirements for a phytosanitary permit to stock and sell tree seed by farm input stockists made easy. The permit costs about Ksh 70,000 which an ordinary stockist cannot afford. The farmers would easily access the seeds if it was stocked in farm input shops. The project experimented with this approach and the trial clearly indicates that this might be the future strategy for agroforestry seed distribution. This would in addition impact positively on wide scale dissemination and sustainability aspects. The project impacts and benefits are now reaching many people through the mini-packs strategy. Distributing seeds through farm inputs stockists has great potential as it has proved to be a reliable dissemination pathway.

    2. Getting the leaf meal into livestock feeds processing industries. The project approached feed processors willing to take risks in incorporating the leaf meal into livestock feeds formulation. It is yet too early to confidently state whether it will qualify the nutritional, economic, and technological requirements. Several stakeholders are on board and are sharing information and exploring the possibilities.

    3. Farmer-to-farmer extension process is providing an appropriate dissemination avenue for reaching many farmers at a minimal cost.

- Improving Monitoring and Evaluation process- Due to targeting of large numbers of farmers in the dissemination process it is difficulty to keep track of the exact number of farmers benefiting from the project.

Challenges

- Policy barriers – the requirement by KEPHIS for the stockists to have permits to retail tree seeds. The permit is too expensive for ordinary stockists.
- It has proved difficulty to get main commercial seed dealers to develop interest in tree seed due to its low demand and profit margins if compared to food crops
- There has been very low remittance of cash from seed sales by extension and farmers. There is need to develop mechanisms for dept collection.
- Entrenched "culture of free things" is a big hindrance in privatizing the seed sales. Some farmers and staff are not yet acquainted to the concept selling tree seed.
- "Wait and see culture" slows down the technology uptake. This requires intensive interactions and persuasions to influence speedy uptake.
- The need for putting in place adequate monitoring systems where frequent and effective monitoring and feedback take place.
- More trials are needed to screen species that are appropriate to frost prone areas especially along the slopes of the Aberdares and Mt Kenya where the current demand is quite high due to intensive dairy production in the area.

- **Farm Inputs Promotion Services (FIPs)-Africa: Our role in fodder shrubs dissemination**

FIPs is mainly involved in availing the appropriate farm inputs that include, seeds, fertilizers and chemicals that increase agricultural production for small scale farmers. The organization works in partnership with ICRAF in the central region of Kenya. We are working in collaboration with ICRAF in the following districts: Kiambu, Thika, Maragua, Murang'a, Nakuru and Nyandarua Districts.

FIPs assist ICRAF in seed packaging and distribution, conduct joint activities such as creating awareness, training and monitoring the field activities. It has also helped to link ICRAF to other stakeholders (farm inputs stockists, extension organizations and farmer groups).

Summary of seed distribution

District	Division	Contacts	Calliandra (pkts)	Trichandra (pkts)
Nakuru	ACK diocesan Hqs	ACK	450	300
Nakuru	Subukia	Farmers Federation	150	37
Nairobi	Westlands	MOA	60	59
Murang'a	Kangima	Stockists -Stage Hardware	237	demo plot
Murang'a	Kiharu	MOA	102	
Thika	Gatundu North	MOA	152	103
Thika	Gataundu North	Stockist -		
Thika	Gataundu South	MOA	30	
Kiambu	District office	MOA	187	20 & demo plot
District	Division	Contacts	Calliandra (pkts)	Trichandra (pkts)
Kiambu	Githunguri	MOA	18	58
Kiambu	Githunguri	PCEA church		
Kiambu	Kikuyu	MOA	50	20
Kiambu	Kiamba	MOA	32	20 & demo plot
Kiambu	Lari	MOA	44	
Kiambu	Lari	Africa Cons. Trust	2kg	2kg
Nyandarua	Kipipiri	Umbrella women groups	2kg	2kg

Constraints in dissemination of fodder shrubs:

The following factors may have contributed towards low adoption of fodder shrubs:

- General lack of information and skills related to production and use of fodder trees among the farmers.
- Scarcity of seed- it is difficulty to access adequate amounts of seeds to meet the farmers needs.
- Most of the seed dealers retail their seed in large quantity (from 1kg). Hence most small scale farmers can't afford the seed.
- At the moment only a few retail outlets are distributing the fodder shrub seed. The presence of only a few farm input stockists dealing with tree seed implies that the seed distribution mechanisms is insufficient.
- The seed distribution system is not yet well organized and hence limited in its response to meeting the farmers' needs.
- The resources are inadequate for frequent and effective follow up and monitoring of the project performance in the field.

MOA-kiambu District: Fodder Shrubs Promotion Activities

The background

- Past promotion efforts by National Soil and water Conservation Programme.
- Seed was procured by central administration in Nairobi and supplied to all districts implementing catchment approach. Seed was issued freely with no cost attached.
- Main species included *Leucaena leucocephala*, *Sesbania sesban*, *Calliandra calothyrsus* and *Grevillia robusta*.
- Low adoption and massive loss of seedlings in catchment nurseries due to lack of knowledge, poor tree value attachment at farm level, competing land resources uses.

Current status

- Focal area approach is crucial in increasing tree planting through promotion of opportunities like availability of livestock fodder, need for feed supplementation to increase milk production, increasing fuelwood supply to households and AF for soil conservation.
- Seed availability and supply is through limited sources. The farming community had limited information on alternative feed sources such as calliandra. Thus the current fodder shrubs promotion initiative is very crucial.
- The closure of forest for grazing and supply of forest products has necessitated increased tree planting at farm level.

Joint MOA/ICRAF initiative

- Towards the end of 2002, the two institutions launched aggressive promotion activities in Kiambu district
- Full support on operative mechanism has been accorded by the ministry's district office
- Full participation of the district office level has involved coordination of supply of points of use or areas where opportunities are promoted.
- Dependency syndrome has been avoided through small fee on the calliandra and *Leucaena trichandra*. The fee has also introduced value attachment of propagated material.

- Three divisions are noteworthy in dissemination activities. These are Kiambaa, Kikuyu and Githunguri. Awareness creation and training on the use of fodder shrubs and the value of Agroforestry practices is required in the remaining four divisions of Kiambu District.

Approaches in the fodder dissemination initiative

- Staff to farmers
- Individual farmers
- Focal area
- Farmer groups

Constraints

- Few awareness forum
- Insufficient monitoring and evaluation
- Inadequate literature material
- Low private sector involvement

- **The way forward**
  - Increase the awareness creation
  - Increase retailing outlets
  - Institute effective monitoring and evaluation processes
  - Facilitate a more focused distribution system
  - Approach on the cohesive groups
  - More learning and information sharing through stakeholders workshops
  - Mounting demonstrations (e.g. green belt movement) which could eventually become gene banks
  - Feeding value statistical analysis
  - Promote alternative uses such feeds to chicken to improve the color of the egg yolk

***Calliandra calothyrsus* and *Leucaena trichandra* seed distribution in 2004**

Division	30g sachets	Monitoring mechanisms
Githunguri	76	focal areas, working units
Kiambaa	264	focal areas, individual farmers
Minicipality	22	focal areas, individual farmers
	25	working unit, individual farmers
Limuru	35	focal areas, youth group
Kikuyu	65	Focal areas, groups, individuals
Ndeiya	80	focal areas, individual farmers
FTC	51	Germplasm bulking
Total	618	

- A focal area has about 400 farmers and operations takes place for 1 year.
- A working unit is the smallest area allocated to a frontline extension worker.
- *Calliandra calothyrsus* is more popular than *Leucaena trichandra*
- Promotional posters are more preferable for dissemination
- Farmers tours to KARI Embu and other sites where adoption rate is high would assist in information transfer and subsequent uptake

2.5.3 Scaling up the promotion of Calliandra in Northern Tanzania

By M. Kingamkono[1], C. Lyamchai[1] , P. Latonga[1], E. Kweka[1], G. Sayula[1], R. Marandu[2], C. Wambugu[3], J. Stewart[4] and S. Franzel[3]

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Overview of livestock nutrition in Kilimanjaro

The high population density and continuing land fragmentation in the northern highland of Tanzania, have reduced the land holdings to between 0.5 and 1 acre on average. Free grazing is no longer possible and even pasture establishment is quite limited (Fernandes et al 1984, Lyamchai et al 1998, Lyimo et al 1999). The main fodder resources available are the banana

pseudo stems and leaves, local fodder trees, grasses collected from the lowlands, roadsides and riversides. Commonly used fodder trees are Avocado, Grevillea, Mango, 'Mengele', 'Mawonu', Masale (Dracaeana steudeneri), 'Maringiri', Mmarie (Bridelia micrantha), Mfifina (Commiphora zimmermanni) and Helimu (Eriobotrya japonican). These trees contribute significantly to dry season feeding especially for goats and sheep. In the dry season, animals are fed on crop residues, such as maize stovers and bean haulms, which are normally low in quality and digestibility (Laurent, C. and Centres, J.1990). In general, the livestock diets lack protein and mineral sources which can only be obtained by supplementing the diets with concentrates. Unfortunately, most farmers cannot afford buying the commercial concentrates due to low availability and high prices. All these problems caused low animal productivity and consequently reduced average number of animals per household from 15 in the 70s to 7 in the late 90s (Lyamchai et al 1998, Lyimo et al 1999). Such low productivity in livestock has contributed to poverty to the majority of farmers. It is against this background that the Selian Agricultural Research Institute in collaboration with AFRENA–ECA embarked on introducing high quality fodder trees and grasses in Kilema and Marangu wards in Kilimanjaro in 1999. The species that were distributed to farmers included Calliandra callothyrsus, Sesbania sesban, Flamingia macrophyla, Napier and Desmodium spp. Unfortunately this activity stopped the same year due to lack of funding. However, a visit to Marangu and Mshiri sites in September 2002 revealed that the farmers were still growing, utilizing and sharing Calliandra amongst themselves despite researchers absence. It was therefore decided that dissemination of Calliandra be re-initiated and implemented in two stages namely, i) conduct an informal survey to capture the farmers' processes, experiences and opinions, biomass yield, planting and feeding patterns of Calliandra. Other factors to be captured included, whether it competing with other crops, demand by their neighbors or friends, advantages and problems associated with Calliandra and it's utilization in conjunction with other forages; ii) continue with dissemination.

Informal survey

The informal survey was conducted in May 2003 in Masaera, Marawe-Kyura, Mshiri, Ashira, Rauya and Makuyuni villages. A summary of the survey results is as follows.

Survey Results: Forty two (42) farmers were interviewed 18 out of which were female. Each interviewed farmer has an average of 2 to 3 cows and 3 to 4 goats. 67 % and 23 % of these households have improved cows and goats respectively. Calliandra established well above 1000 m.a.s.l contour line and was attributed to high moisture availability, zero grazing system and highly interested farmers. Common niches where Calliandra and Trichandra were planted are along the walkways, farm boundary and around the homesteads for the majority of the farmers. The interviewed villages are endowed with a large variety of indigenous fodder trees such as Avocado, Mango, 'Mengele', 'Mawonu', *Dracaeana steudeneri*, 'Maringiri', *Bridelia micrantha*, *Commiphora zimmermanni*, *Eriobotrya japonican*, banana pseudo stems and leaves etc. They are mixed with Calliandra when feeding.

69% of the farmers got 5 to 20 seedlings. The rest got between 100 and 250 seedlings. Despite researchers absence, farmers went ahead with taking care of the introduced fodder and feeding their animals. Having fed their animals, they reported increased milk quantity by 1 to 2 L/day and also increased butter content as they get higher ratings of their milk at milk collecting centers. 44% of the interviewed farmers mentioned Calliandra to have reduced the use of commercial concentrates by 50% and reduced time for looking for fodder as more fodder is available around the homestead. As a result, farmers increased the number of trees and management. For instance manure that is normally applied to high value crops namely banana, coffee and vegetables is now applied to Calliandra (Figure 1). 43% of the farmers had attempted to increase the population of

Calliandra in their farms especially those who went to Kenya for a visit and saw how beneficial it was to the Kenyan farmers. It was also noted that some farmers had started collecting the seeds (Table 1), shared with neighbors and friends and tried their own nurseries. Some of the comments by farmers are shown on Box 1

Table 1: Amount of Calliandra seeds collected.

Name	**Village**	**Amount collected**
Mrs Jovita Shayo	Marawe-Kyura	4 Litre container full
Mr Raymond Mnenei	Ashira	¼ kg
Edward Kwimbere	Marawe-Kyura	Very small (about 1 handfull)
Mrs Kalebi Mosha	Mshiri	¼ kg
Mr Frank Shayo	Mshiri	½ kg

Figure 1. Manure is normally applied to high value crops like coffee, banana and vegetables but currently it is also applied to Calliandra.

Some few farmers started feeding Calliandra to local chickens and goats and realized that there are increased growth rates. They also tried several strategies to fight against pest and diseases on Calliandra and Trichandra such as a mixture of cow urine and dung against scales, wood ash and Tithonia solution against ants, scales and mites and Tephrosia against moles. There were also some negative experience such as blotting of animals to the extent of killing when fed on Calliandra alone, not good for staking as it is too weak and it is easily attacked by scales, ants, mites and moles.

Box 1: Some quotes from farmers pertaining to the advantages and disadvantages of Calliandra

Calliandra advantages

Fausta Lazaro: - "It saves costs because when there is no money to buy commercial feeds, Calliandra can do"

- "the soil underneath the plant turns black and the roots of Calliandra, hold the soil; not easily moved downslope by runoff".

- Regarding the palatability she said "The animals like the fodder very much; they eat almost every part of it".

Sabila Pual Shayo: "Hopefully Calliandra is going to cut down the costs I used to incur on buying maize bran very soon".

Mrs Samweli Kimei: "I have also noted that Calliandra is a good fire wood as it catches fire even if it is not dries enough. It also sprout quite quickly making it available even in dry season when other forages are in scarce"

Mrs Glory Matowo: "Calliandra sprouts well even in dry season and it is very palatable to animals because, in a mixture with other fodder, animals do rush, select and eat Calliandra first".

Raymond Mneney: "Given the stories I have heard and the little experience I am having on Calliandra, I have noted that I do not have enough of it. I am ready to uproot other unwanted trees, to create some space for Calliandra".

Disadvantages of Calliandra

Victoria Desideri: "The major disadvantage I have experienced on Calliandra is that it is easily attacked by scales and ants (sisimizi)" she said. Also from **Mrs Grace Nyange**: "scale infestation is our biggest worry; scales can wipe out all the plants in a month"

Mr Voice Abisai Mtui: "The only disadvantage I have noted with Calliandra is that it is easily attacked by 'Kisoori' (Fusarium)"

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

Dissemination strategies.

Sensitization meeting and trainings: A series of sensitization meetings and trainings to disseminating Calliandra and other high quality fodder and empower the farmers with the skills on management and utility were conducted since May 2003. Currently, only 44% have less than 100 trees which can be attributed to both availability of seeds and the approach having a full time extension staff in the villages who keeps interacting with farmers. A total of 7 kg of Calliandra, 6.5 kg of Trichandra and 250gm of Tree Lucerne (*Chamacytisis polmesis*) were distributed. At the end of each training the farmers were provided with 30gm packets of seed for establishment of nurseries. The seeds included *Calliandra callothyrsus, Leucaena trichandra* and Tree Lucerne (*Chamacytisis polmesis*). Land and labor to sow the seeds and manage the nurseries were offered

by farmers as their contribution. 157 farmers from Masaera, Marawe-Kyura, Mhiri, Ashira, Kondeni, Rauya, Mulala and Nronga villages were trained between July and August 2003, out of which 112 were males and 45 were females. Since then, there has been some door-to-door sensitization, training, dissemination of seeds and data taking. This has been very much effected by the contracted field office and, as result, the number of farmers that have been trained and are now growing these fodder has risen to 182.

Farmer disseminators: Two excelling farmers who had been a source of information and planting materials since 2000 to other farmers, namely Mrs Kalebi and Frank Shayo were selected to establish nurseries so as to sale seedlings to other neighboring villages. These were assisted by the village extension staff.

Full time extension staff: In March 2004, a local extension agent was contracted to make close and frequent follow-ups on the progress and offer assistance where necessary. Occasionally, research staff visits the sites for monitoring and evaluation and technical backup. The number of farmers visited, trained and their data taken has increased from 59 to 182 since March 2004.

Use of Extension materials. Available extension materials on Calliandra and other improved fodder trees were collected and used to train farmers. These included "Shamba la malisho (ICRAF Shinyanga 2001),Ongeza Uzalishaji wa Maziwa kwa kulisha miti ya malisho, mikunde na vyakula vya ziada (SARI Publication 2003), Jinsi ya kupanda miche ya miti ya malisho kutoka kwenye kitalu (SARI Publication 2002) and Uzalishaji wa Ng,ombe wa maziwa (SARI Publication 2003). A Swahili brochure specifically on Calliandra is under preparation.

Establisment of database: A Calliandra database was established where all farmers dealing with Calliandra and Trichandra are recorded. Source of planting materials, number of trees planted, livestock type and number owned, farm size, village etc are some of the parameters entered. The database is used as a monitoring tool. Currently the database has 182 farmers, 60% of which have a total of 24,568 full grown Calliandra and/or Trichandra plants. The rest have either sown seeds or seedlings in the nursery. 41 % of these farmers have less that 100 trees as depicted in Figure 2. There are more farmers in the upland zone with Calliandra and Trichandra trees than in the other zone (Table 2). This is probably due to better rainfall conditions and low pest and disease incidences.

Table 2. The majority of farmers with Calliandra are based in the highlands

Zone	Altitude (m.a.s.l)	Rainfall (mm)	Households with Calliandra and/or Trichandra
Highlands	1,200 to 2000	1000 to 1800	126
Intermediate	900 to 1,200	700 to 900	39
Lowlands	Below 900	650 to 750	13

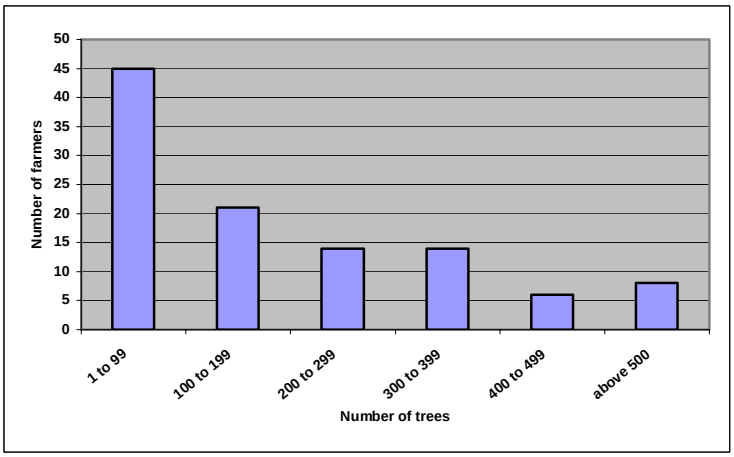

Figure 2. A large number of farmers have fewer than the recommended 500 plants per animal for a year.

Partnerships. The dissemination of Calliandra and Trichandra has been conducted in partnership with different organizations and institutions. These include Himo Environmental Management Trust Fund (HEM), Kilimanjaro Environmental Development Agency (KEDA), Heifer Project International –Tanzania, community based organizations (Kilimo Hai Kirua Vunjo), churches, schools and the extension system. Common interest, same geographical coverage and related activities strengthened the partnership between Selian A.R.I (SARI), ICRAF, HEM, and KEDA. While KEDA and HEM contributed their experience in community mobilization in Kilimanjaro, SARI and ICRAF provided scientific knowledge and physical resources (seeds, transport and fund). Since we all had a common goal of increasing productivity in Moshi Rural district, implementation was relatively easy and cost effective. A good example is KEDA accepting to commit one staff to be fully engaged with interacting with farmers in promoting the fodder trees. On one hand this has significantly reduced the number of costly trips from SARI to the study area and on the other hand it has increased the number of farmers trained and given seeds by three fold. Another example is that SARI did not have to forge partnership with HPI because KEDA had already established a strong relationship and were already distributing dairy goats and catle in the study area.

Problems

Lack of seeds. Calliandra pods do shatter very fast thus it was not easy for farmers to collect their own seeds. The majority of them were transplanting the wildings. Farmers need to be trained on identifying mature pods, harvesting, processing and sowing.

Pest and disease infestation. In some areas especially in the intermediate zone, Calliandra is easily affected by scales, ants, mites and moles. A mixture of cow urine and dung, Tithonia solution and wood ash were some of farmers' own initiatives used to treat and reduce the infestation.

Lack of funding. Given the large number of farmer demanding for these fodders, there should be some concerted efforts to raise more resources. Efforts are underway in submitting proposals to different funders. We have tried FARM-Africa Nairobi but failed. We are preparing another one to be submitted to Research on Poverty Alleviation (REPOA-Tanzania).

Poor follow-ups in Arumeru: There is a pressing need for full time local extension agent on slopes of mount Meru in Arumeru district.

Conclusion and Way forward

There is high potential for fodder shrubs in the upland and intermediate zones due to high moisture availability, zero grazing system and highly interested farmers. However, more species diversification is needed to minimize the risks of pest and diseases and improve animal nutrition. Economic analysis is also required to quantify the benefits of these shrubs to farmers and environment. The upland and intermediate zones are endowed with a large variety of indigenous fodder trees and shrubs but very few of them have been studied and documented. It is therefore important to study them to understand their best management, propagation, nutritive values and utilization in conjunction with the exotic ones. Those farmers who participated in farmers exchange visits were highly motivated and are currently among those with more than 500 plants. They are also good dissemination agents in their villages. Selecting more enthusiastic farmers and train them of seed harvesting and processing, management and utilization would accelerate the promotion of the intended fodder trees.

There is still a wide variation amongst farmers in the number of trees, management and utilization of the new fodder trees. Continuation of the training, sensitization and distribution of seeds is recommended. Nevertheless, given the large number of farmer demanding for these fodders, there should be some concerted efforts among the relevant stakeholders to raise more resources

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2.5.4 Dissemination of agroforestry fodder for improved dairy production in Uganda's Lakeshore

By : Kugonza Jane

Background

On-farm livestock production for milk is one of the promising farm enterprises, which can improve nutritional security, and the socio-economic welfare of rural smallholders in Uganda
.

DFID/RELMA have initiated a project to scale up the use of fodder trees in Mukono, Wakiso to boost nutritional security and the socio-economic welfare of smallholder farmers.
Applied research, development and capacity-building activities are proposed in the context of this project to enhance the productivity and diversity of fodder production systems in the Lakeshore area

Objectives

Main Objective
To scale up the impact of Calliandra in the lakeshore region (Mukono and Wakiso districts).

Specific Objectives

- To disseminate Calliandra, Leucaena and Gliricidia in appropriate locations.
- To establish on-farm fodder group nurseries and field demonstrations.
- To increase collaboration with partner NGOS for the enhancement of livestock production systems.
- To procure and distribute quality germplasm to partners in ways to increase local capacity for local sustainable high quality fodder tree seed production.
- To monitor the uptake of fodder trees by farmers, their species preferences, problems and uses of trees.

To make observations on growth rates, seed production, pests and diseases and palatability to animals.

Hypotheses:

- Decentralized technology demonstrations are effective tools for promoting the adoption of fodder agroforestry technologies
- Technology dissemination through active research-development partnerships is key to increasing farmer adoption.

Methodology

- Dissemination of the fodder technology in appropriate locations
- Procurement and supply of quality germplasm
- Supporting farmer groups and farmers to establish fodder nurseries
- Establishment of fodder banks and seed stands
- Encouraging farmer to farmer diffusion of fodder technology

Approach
A demand-driven approach promoting farmer involvement in resource management, technology dissemination, monitoring and evaluation, as well as complementary partnerships with livestock-promoting organizations supported by local governments are effective tools for promoting adoption.

Farmers who are accessing zero-grazing livestock through animal production programmes of partner development organizations, yet have limited access to high quality fodder are specifically targeted.

Technologies were promoted by the project through existing or new partnerships with development organizations, which have developed their network of rural clients.

Partner NGOs

- Selected farmers to start with Established on-station /central nurseries an Organized new or existing groups who started nurseries while ICRAF/FORRI
- Trained trainers and farmers on fodder technology and nurseries,
- Supplied quality germplasm
- Backstopped and monitored technology implementation
- Exchange visits for trainers and farmers for practical field exposure.

Species and provenances that have been promoted include *Calliandra calothyrsus* (Embu local and Patalul), *Leucaena trichandra, L. pallida, L. diversifolia,* and *Gliricidia sepium*

In some cases demonstrations have been managed in part/exclusively as seed stands in order to maximize their effectiveness and sustainability.small
To some extent the project has assisted farmers in linking seed producers to suppliers such as NTSC,NGOs and the project itself has tried to buy some of the seed.

Diversity of species in stands managed for fodder production has been encouraged and cross-fertilization has been avoided Rhizobia has been procured from Makerere University to inoculate seeds and at times seedlings.

Results •

Output	**#**	**Comment**
Trainers trained	57	Extensionists,model farmers,scientists
Calliandra eed stands	34	In five subcounties of Mukono
Lueceana seed stands	38	In five subcounties of Mukono
Gliricidia ss	2	ARDC and Kifu station
Workshops	5	Mainly for trainers and stakeholders
Exchange visits/Field days	5	Local, within area of operation
Publications	4	Press releases,Scientic paper,poster
Seminars	4	Simple and organized at parish/village level
Study tours	1	Maseno

Over 600 farmers are using agroforestry fodder to complement livestock diets and are reporting increased milk quantity and quality. Other benefits mentioned include improved cow health, shorter calving interval, improved soil fertility from high-quality manure, and a higher availability of firewood, fencing material, stakes for climbing beans. A number of challenges related to nutritional, economic and social factors need to be addressed for successful dissemination to take place.

2.5.5. Scaling up the promotion of Calliandra and other fodder species in the Southern Rangelands - Southwestern Uganda

By Sande Dickens , Peter Alele and Henry Mutabaazi

Introduction
The southern rangelands are characterized my a mixture of crops and livestock farming systems. The average land holdings per household is estimated at 2.5 acres(Ntungamo District estimates). Most land is fenced off by the well-to-do farmers leaving limited pasture land for the poor majority.

Introduction of supplementary fodder species in the Southern rangelands started in 2002 August by the Agroforestry Programme of FORRI-NARO-ICRAF. It was intended to support farmers to improve their incomes through increased milk production and ensure sustainable quality fodder supply throughout the year since some of the shrubs are green throughout the year.

At this site the project collaborates closely with an agroforestry project funded by the European Union through NARO, which also operates from the Kabale NARO/ICRAF office. The EU project operates in two districts of the Southern Drylands: Mbarara and Ntungamo. Its remit covers a wide range of agroforestry interventions and at some of its sites (e.g. in Ntungamo) fodder has a lower priority than other technologies such as soil conservation. Its focus is on adaptive research, although it also accommodates strategic research and has a dissemination component. In Isingiro South, however, there is a strong focus on fodder tree promotion, with inputs provided mostly by R6549, with substantial additional support from the EU project. The rationale for the focus on fodder in Isingiro is that HPI have recently started distributing improved goats to farmers, as usual with the condition that the recipient has established enough fodder for their maintenance. They have so far distributed goats to 155 farmers, mostly Boers (for meat), but including 24 Sanaan (dairy) goats.

Dickens Sande (who is funded by the EU project) is managing both projects' field activities. In addition a field technician, Dixon Beinomugisha, (also Eu-funded) focuses on activities in Isingoro South, and his transport and partly other operational costs are also covered by the project. Another technician, Peter Alele, has been recruited to assist Dixon with his growing workload: his costs are covered by the EU project and attends to general agroforestry research for development.

The first step in ensuring sustainable fodder planting, the establishment of seed sources was thought as the most strategic entry point. So far, about 20 seed sources (5 in Ntungamo, 15 in isngiro South) have been established. Along with these, the Agroforestry Programme is working in partnership with about 50 farmer groups (22 in Isngiro South, 28 in Ntungamo).

Given the small land holdings per household, limited farmer knowledge about the fodder technology, limited capacity for agroforestry staff to closely, regulary and effectively meet the demand and lack of quality seed inputs, fodder bank establishment and management has generally been slow. Even where some attempts have been made, the establishment and management has not been to the expected standards.

Experiences with different extension strategies
The following are some of the extension strategies and approaches that have been tried in the Southern Rangeland areas.

1. Local leadership led agroforestry scaling up
2. Direct farmer training
3. Group seed source establishment
4. Farmer-to-farmer and Farmer group-to-farmer group exchange visits
5. Joint Collaborative and coordination monitoring with partners
6. Establishment of Sub County Joint central nurseries for germplasm production
7. Advocacy and lobying for inclusion of agroforestry into the development plans

Details of strategies

i. Local leadership led agroforestry scaling up

With the current decentralised government structures in Uganda, a huge opportunity exits for local leadership led agroforestry scaling up. Uganda is administratively governed in 56 Districts on a decentralised form of government. Each District is Sub divided into several Sub Counties and under the Subcounty, there are two levels of administration. The local government act of Uganda (Uganda, 1997) defines some of the functions and services of the district and other lower administrative councils , e.g. the Local Council III (3) has the following functions as regards management of natural resources: -

1) Providing agricultural auxiliary field services such as extension services to the farming communities
2) Controlling soil erosion and protecting local wetlands
3) To protect the environment in general
4) To prevent and contain food shortages and provide germplasm

All these functions and services are relevant to wide spread adoption of agroforestry in general and fodder is one of the demanded technologies of agroforestry. As such therefore, local leaders can be instrumental in the following areas: -

a. Farmer mobilization by local councilors into action
b. Prioritizing agroforestry enterprises in the allocation of PMA funds
c. Establishment of legislation and enabling policies for agroforestry

Advantages of working with and through local leaders

1) The local community does not view it as a "foreign" idea or project leading to acceptability and adoption
2) It reflects demand driven technologies if promoted by the local leaders
3) The local community has confidence in their elected leaders and would take up (adopt) most of the introduced improved farming technologies
4) Local leaders are eager to work for their electorate so that they are voted next time

Disadvantages of working with and through local leaders

1) A local leader may not be popular with the electorate (local communities)
2) Politicians are less reliable and can sometimes lead to unrealistic decisions
3) There is a high likelihood that they dominate most decision making on behalf of farmers
4) They can potentially create excessive demand that can not be met

ii. Direct farmer group training and partnerships

As an extension strategy, capacity building has been done through training farmers in various topics such as:

1) Nursery establishment and management
2) Fodder bank establishment and management
3) Seed stand establishment and management
4) Seed collection and post-harvest handling

Advantages of direct farmers training

1) One trained farmer acts as an extension agent in a locality hence facilitating knowledge and skill dissemination
2) when farmers are trained in a group few resources are used hence being economical
3) Indigenous knowledge and cultural values of farmers is tapped and inculcated in the extension process
4) Farmers always know what they want; working skills gained from trainings if acceptable are always put to use in the field
5) Early adopters always become trainer of trainees(TOTs) and help in monitoring progress of other farmers

Disadvantages of direct farmer group training

1) Monitoring individual members of group adopters is significantly difficult
2) Limited capacity as to how many farmers one organisation can effectively train in various stages of a technology
3) There is always disagreements between members and work gets stalled
4) In case of nurseries, never enough seedlings ever produced

3 Group seed source establishment

Farmer groups have established seed sources in their areas to enhance sustainable germplasm supply for scaling up promotion of fodder trees. Ensuring reliability and availability of seed supply in a locality is paramount in wide scale promotion of fodder shrubs.

Advantages of group seed source establishment

- Sustainable germplasm supply is ensured for scaling up fodder promotion
- Enables the adoption by farmers to be easily monitored in the group
- Shared responsibility and collective learning sites
- Local availability of seed that is affordable encourages farmers to establish fodder sources/ banks
- Availability of fodder due to increased seed sources encourages local leaders and development organisations to provide livestock to farmers, enhancing household incomes

Disadvantages of group seed source establishment

1) establishment of group seed sources normally requires communal land which is not readily available. This retards availability of germplasm hence slackening promotion of fodder shrubs
2) normally group establishments are always mismanaged. Group seed sources yield less if the group leadership is not visionary
3) Collective ownership may be less effective in scaling up adoption than individual ownership as farmers are less likely to invest individual resources

Disadvantages of direct farmers training

1) Different perceptions of ideas by farmers due to different levels of understanding capacities results in distortion of disseminated information
2) There is a tendency of expecting hand-outs/ allowances after training. In cases where such expectations have not been met, extension of knowledge and skills has been hampered
3) Individual farmers and partners farmers are far apart in the field thus expensive to reach them given the inadequate resources at hand

4) Group dynamics especially group size, e.g.,

a. 3 to 6 People	Everyone speaks
b. 7-10 People	Most people speak Quiet people say less Some may not speak
c. 11-18 People	5-6 people say a lot 3 join in occasionally
d. 19- 30 People	3-4 People dominate

5) Farmer-to-farmer and Farmer group-to-farmer group exchange visitsThis has been done by identifying the Model farmers or farmer groups, and either referring the interested farmers to these sites or taking them there. But due to limited resources, the former has been more widespread.

Advantages of farmer-to-farmer and Farmer group-to-farmer group exchange visits

1) Farmers are presented with the opportunity to interact at farmer level with other farmers
2) Farmers can share indigenous knowledge and experiences
3) Farmers can have positive influence on each other due to next neighbour effect

2.5.6 Mentors Farmcare Ltd.
By Julius P. Maina

Mentors Farmcare Ltd is a private company that offers technical advice on commercial consultancy basis.

Our mission is to empower our farmers to demand and acquire the needed information, inputs and infrastructure in Agro business development

The firm's area of operation is Thika District and neighboring areas and as far as Subukia, Nyandarua, Embu, Kirinyaga and Kiserian.

- We offer consultancy service on "pay as we visit" basis and for the small scale farmers we join with other interested development partners i.e. seed and chemical companies, government extension and research institutions to finance the trainings in this sector. Where possible, we target groups to attain economies of scale on our use of resources .
- We sell chemicals from our shop and we don't charge consultation fee at the shop when a farmer visits us.
- We also visit our farmers in our key target areas of operation to promote new innovations and enhance our products sales.

Dairy Industry in Central Kenya

Is well developed and is the most demanded enterprise by the farmers currently because of the revival of KCC and private dairies.

The dairy sector guarantees our farmers a regular monthly income and most of the animals are improved or exotic breeds and thus are able to give reasonable milk yields as can be seen in the example of the statistics for Thika District for the year 2003 below.

Estimated Dairy Cow Population per Division

Division	Mature	Immature
Gatundu	13440	5760
Gatanga	18200	7800
Kamwangi	17675	8890
Kakuzi	1642	704
Thika	1480	700
Ruiru	3100	1100
Total	54057	24954

Pastures Situation in Ha. Year 2003

Division	Natural	Established
Gatundu	510	28
Gatanga	180	6
Kamwang	430	40
Kakuzi	500	28
Thika	1800	190
Ruiru	8300	180
Total	14720	477

Fodder Establishment

More napier is being established as more people adapt zero-grazing. "Tubukiza" method is currently the most popular method since napier performance is guaranteed during the dry periods.

Division	**Fodder (Ha) Year 2003**
Gatundu	1450
Gatanga	580
Kamwangi	2015
Thika	170
Ruiru	950
Kakuzi	350
Total	5515

Estimated Milk Production based on Cattle Population

Division	Mature Cattle	MilkYield
Gatundu	13,440	12,579,840
Gatanga	18,200	17,035,200
Kamwangi	17,675	16,543,800
Thika	1,480	1,385,280
Ruiru	1,642	1,536,912
Kakuzi	,100	1,216,800
Total	54,057	50,597,352

We have assumed that 60% of mature cattle produced an average of 5.2 litres per day for 10 months.

Goats Production in Thika District

- Thika district had an estimated 42095 meat goats and 4839 milk goats in the year 2003 kept by farmers in self-help groups mainly the German alpine and their crosses with local goats**.**

Fodder Crops Promotion

Central Kenya has most of the farmers with dairy animals having relatively small herds i.e. less than ten animals because of the small farm sizes.

Food deficiency in both energy and proteins is a common feature and more so during the dry seasons.

Promotion of fodder trees growing and use as a primary source of proteins is therefore playing a very significant role in livestock growth and milk production.

The varieties we promote include:-

Calliandra, Leucaena and Malberry

Calliandra Promotion

- The fodder tree has high productivity under repeated cutting i.e. 3000 – 5000 kg of fresh leave per year.
- The fodder tree is palatable and has high Proteins Content (20-25% crude protein).
- Improves the soil through nitrogen fixing as it is a legume

- Provides firewood, and
- Establishes easily when planted.
- Calliandra has deep roots which means it is a good dry season fodder crop.

Calliandra Adoption

- The need for a Crop that won't require extra land has meant that fodder trees planted as "edible hedges" created by planting lines of trees on the internal and external farm boundaries and around farmsteads has offered the best solution for our farmers to raise their income from their dairy herds by providing the needed protein feed.
- Because of the small land sizes, this has been the most successful extension strategy in adoption of fodder trees in the region.
- We also encourage farmers to plant the trees along the upper sides of the fanya juu terraces and also as wind breaks in their farms.
- The flowers of calliandra are very beautiful and thus the crop is good as ornamental and shade around the homesteads as well as for bees for honey production.
- Intercropping of calliandra with other crops offers the other crops the benefit of the nitrogen fixed by calliandra.

Feeding of Napier & Calliandra

Most of the farmers in the region are growing Napier grass for energy. Calliandra feeding will thus enhance milk yield and 3 kg of fresh calliandra is estimated to give an equivalent milk yield of 1 kg commercial dairy meal.

The potential for dissemination of fodder trees

- The NDDP had done some extension work in some districts in Central and Western Kenya. The effort failed to bear fruits when milk prices went down and farmers couldn't make a living on dairy farming for some years.
- Efforts to have the adoption of calliandra trees is thus bound to take effect now that the situation on the ground is ripe for the different extension agents to pass over their message to the farmers who are now seeking cheap sources of protein feed.
- Our company sees this as an opportunity for us to raise our seeds and seedlings sales and we plan to have our farmers plant 3 million calliandra trees and at least 500,000 mulberry cuttings in the next two years.

Mentors Farmcare Strategy of Promoting Fodder Shrubs

From the above background, we seek to:-

- Ensure that our farmers know how and where to plant the seeds or seedlings we sell to them by offering technical information at our shop and participation in farmers field days in collaboration with other extension agents in the district.
- We are also to pass over the information on fodder crops harvesting and feeding to ensure that the farmers know how to best utilize his crop for maximum benefits. Alongside the fodder tree crops seed and seedlings, we do offer for sale a wide range of seeds for energy feed e.g.
  - Yellow Maize/Baby corn
  - Kow candy for hay
  - Rhodes grass for hay

- Sudan grass for hay and napier grass

Technical advice on feeding of dairy animals is offered free at the shop to our farmers as they buy our products and where we don't have the information we link the farmers to the best sources of information for the same e.g. on good genetics and animal breeding.

Currently, we are training farmers on feed preservation in silage bags and hay making to ensure that we utilize feed when we have gluts and store it for seasons with scarce feed supplies.

We have farmers with 4-6 months stocks of silage and we hope to have farmers with silage for even longer periods to ensure that our farmers have better milk yields throughout the year making them profitable clients at all times as this will regularize their economic power which also translates into a stronger customer base for us.

Sourcing and Packaging of Seeds

Small packages of seeds have proved to be popular for small scale farmers. We pack calliandra in approx. 700 seeds packet which is adequate for a hedge to feed 1 cow per year occupying 250 meters at 125 m of land if planted in single row hedge or is double – row hedge respectively, if we feed 6 – 10 kg of fresh leaves per cow per day.

Source of seeds and planting material had been one of the limiting factors in calliandra promotion and we see ourselves as the link the farmers need to improve their dairy enterprises as we have offered them the seeds plus seedlings in the package they needed.

The farmers who produce seed have also a market for their seeds for an extra income.

Other extension strategies we are using to reach farmers

- We organize field days with agrochemical companies, ministry staff and research liaison staff from research institutions. Every year, we attend not less than 5 major field days with attendance of over 100 farmers and many farmer groups training days with 20-50 farmers in attendance.

Our extension approach is mainly commercial where farmers pay for our visits and buy our products. For the small scale sector our partnership with other interested parties enables us to source funds from them to subsidize our effort of extension to this group and also recover our costs when they buy our products.

Our Future plan in Extension

- We plan to implement our ultimate goal of opening a model teaching farm where we can implement hands-on training to ensure that we can prove to the farmers that they can do it themselves especially in dairy animals management and horticulture where experience is needed with a mentor at hand.
- Farm care follow-up schools are also to be set up at the village level by our technical camping staff who will camp on the target farms and ensure that we offer practical advice to our farmers.
- Our programmes are to be demand driven and we are to partner with other stake holders where need be.
- The duration of the farmers trainings will be maximum 1 week and this is to be combined with visits to other successful farmers before we let them go home and implement the same for 1 month after which a field camp is organized to the farmers target fields for an open learning

environment where the trained farmers and their neighbors are trained on their farms.

- The training schools are expected to expose farmers to the latest practical agro-developments in many aspects of farming in crop and animal production and homecare.
- We have programmes on agro-forestry where we expect to cover propagation and utilization of
  - Fodder tree crops
  - Giant bamboo for irrigation, training of crops and housing
  - Grevillea and eucalyptus culture for firewood, timber and posts.
  - Neem trees culture
- Latest organic farming techniques are also to be taught to the farmers and technologies for farm health & hygiene e.g. water treatment

Challenges we face in Private Extension

- The biggest challenge is to implement a pay as we visit system of extension where free government extension is still available. This has meant that we target mainly farmers who we charge visiting fee and our customers who buy farm inputs from our company.
- Many farmers have not yet accepted to pay for services offered by private extension staff in agronomy.
- In fodder trees production the farmers knowledge on the utilization of fodder trees is limited and requires a long term approach for it to bear fruits and we are bound to have an approach which pays if we are to heavily invest in it or other partners have to subsidize our costs to use our forum which is very strong for passing over information as we deal with farming as a business vs. as a food security activity.
- Farmers are more likely to be stimulated in activities which have good returns vs. in government extension where the staff may not mind the positive feed back mechanism.
- Private extension thrives on positive feedback mechanisms and we have to give stimuli we know does so for our survival and that of the “goose that lays the golden eggs”.

The other challenge is the availability of the necessary infrastructure to reach out to our clients.

- We need to be connected to the internet to improve our access to latest developments information in our area of expertise and this is our target in the current year.
- Funds for our agricultural school is our main challenge at the moment and we plan to look for a facility we can hire on a long lease e.g. 10 years first and later buy land and develop our own infrastructure. In the meantime we continue with the field days and farm visits to educate our farmers and also use our dairy unit and some farmers farm for our trainings.

Our achievements in the Private Extension Sector

We are proud to be associated with many farmers and farmers groups whose standards of living has improved considerably because of our development interventions in their farms in:

- Horticulture i.e. in food crops for export and flowers
- Coffee production
- Passion fruit culture etc.

Currently I am a member of a committee producing the Thika Farmers Journal, a magazine we hope will enhance the communication of agricultural development information to the farmers in the district.

- We are also members of the district extension stake holders group which meets to offer a forum for stake holders to share experiences in extension in the district.
- The company also runs a dairy unit where we have of dairy animals and a farm where we grow

Atemisia (an antimalaria drug) for East African botanicals, birds eye chillies, amaranthus and other crops for local and export market.

We also run demonstration plots for seed companies and interested parties e.g. Farm Input Promotion Services (FIPS) with whom we are doing a demonstration plot for zero tillage and Horticulture Development Centre (HDC) which is supporting the birds eye chillies project

2.5.7 Fodder Shrubs Promotion Activities
By Peter Mwangi

Background

- Past promotion efforts by National Soil and water Conservation Programme.
- Seed was procured by central administration in Nairobi and supplied to all districts implementing catchment approach. Seed was issued freely with no cost attached.
- Main species included *Leucaena leucocephala, Sesbania sesban, Calliandra calothyrsus* and *Grevillia robusta*.
- Low adoption and massive loss of seedlings in catchment nurseries due to lack of knowledge, poor tree value attachment at farm level, competing land resources uses.

Current status

- Focal area approach is crucial in increasing tree planting through promotion of opportunities like availability of livestock fodder, need for feed supplementation to increase milk production, increasing fuelwood supply to households and AF for soil conservation.
- Seed availability and supply is through limited sources. The farming community had limited information on alternative feed sources such as calliandra. Thus the current fodder shrubs promotion initiative is very crucial.
- The closure of forest for grazing and supply of forest products has necessitated increased tree planting at farm level.

Joint MOA/ICRAF initiative

- Towards the end of 2002, the two institutions launched aggressive promotion activities in Kiambu district
- Full support on operative mechanism has been accorded by the ministry's district office
- Full participation of the district office level has involved coordination of supply of points of use or areas where opportunities are promoted.
- Dependency syndrome has been avoided through small fee on the calliandra and *Leucaena trichandra.* The fee has also introduced value attachment of propagated material.

Multiplication

- Three divisions are noteworthy in dissemination activities. These are Kiambaa, Kikuyu and Githunguri. Creation of more awareness on the use of fodder shrubs and the value of Agroforestry practices is required in the remaining four divisions of Kiambu District.
- Approaches in the initiative
    - ❖ Staff to farmers
    - ❖ Individual farmers
    - ❖ Focal area
    - ❖ Farmer groups

- **Constraints**
  - Few awareness forum
  - Insufficient monitoring and evaluation
  - Inadequate literature material
  - Low private sector involvement

- **Way forward**
  - Increase the awareness creation
  - Increase retailing outlets
  - Institute effective monitoring and evaluation processes
  - Facilitate a more focussed distribution system
  - Approach on the cohesive groups
  - More learning and information sharing through stakeholders workshops
  - Mounting demonstrations (e.g. green belt movement) which could eventually become gene banks
  - Feeding value statistical analysis
  - Promote alternative uses such feeds to chicken to improve the colour of the egg yolk

Calliandra calothyrsus and *Leucaena trichandra distribution in* 2004

Division	**30g sachets**	**worth**	**Remarks**
Githunguri	76	760	Not remitted
Kiambaa	264	2640	Remitted
Minicipality	22	220	Remitted
Lari	25	250	Not remitted
Limuru	35	350	Remitted
Kikuyu	65	650	Remitted
Ndeiya	80	800	Not remitted
FTC	51	510	Remitted
Total	618	6180	

- Note: *Leucaena trichandra* has not been as popular as *Calliandra leucocephala*
- Promotional posters are highly recommended for information dissemination

Farmers tours are to KARI Embu and other sites where the rate of adoption is high would assist in information transfer.

2.6 Seed Systems

2.6.1 Kagarii Catchment

By Gerald Juma

Introduction

Kagarii catchment is an area in our village which the Ministry of Agriculture funded to do soil and water conservation in 1999. It has a committee of ten members. With the introduction of calliandra by Mr. Wambugu from ICRAF, we expanded to form 15 group plus 2 catchment areas; Gaciriro and Githagara. All the groups were given seeds and we started growing calliandra.

Calliandra

Calliandra is a fodder for our livestock especially dairy cows and goat. It is used as firewood, source of honey, soil erosion and soil fertility, stake and pods, seeds and seedlings.

Planting

Nursery:

We prepare a nursery with manure, soak seeds for two days 48 hours cold water then saw seed at least half apart make a shade and water dairy twice morning and evening. After 3 to 4 months the seedlings are ready for planting.

Areas for planting are found from internal and external boundaries farm contours in Napier grass or field. Dig holes 0.5m (11/2') apart, put manure and plant. This is done during rainy season or if you have irrigation water. It grows rapidly – 12 months it will be a big plant. By this time you prune. You leave some apart for seed. You cut back the tree to a height of 15cm (6") so as to increase the shoots after which you can cut at about 1m or so according to your wish to ease harvest.

Calliandra for milk production:

For fresh calliandra leaves, you feed a dairy cow 6kg which is equivalent to 2kg dairy meal for milk production it produces the same as feeding dairy meal. To feed one cow you need 500 trees.

Findings:

It can resist drought.

You can boil water then soak seeds and saw the seeds immediately (make sure you do not boil seeds).

Seeds and seedlings production and marketing with the help of the Ministry officials and Mr. Wambugu we are connected to the needy farmers. The price of seeds vary from seller to buyer. We have found that trees in our area can produce a lot of seeds but due to trees being delicate you get few seeds in a tree i.e. 1 kg – 2kgs per tree. The pod split and seeds scatters. The scattered seeds germinate and then problems in market.

- Farmers are reluctant to new fodder
- Ways of advertising
- The cost of seeds are high due to production cost.
- Hard to harvest seeds
- Most of the sales are done through officers – especially through Mr. Wambugu
- Flow of seeds in the market is slow causing inactive by farmers selling seeds
- Seriousness by farmers on planting
- Follow-up is necessary.

SALES TABLE

	Name of buyer	Date	Quantity	@	Shs	Cts
1	Birithis Secondary School		½ Kg	1,500	750	00
2	Mr. Muriithi (for farmers)		11/2 Kg	1,500	2,250	00
3	Mr. Mukuha (for farmers)		1 Kg	1,500	1,500	00
4.	Mr. Muraguri (for farmers)		1 Kg	1,500	1,500	00
5.	Karindi (field day)		½ Kg	1,500	750	00
6.	At Wanyinyi's (field day)		½ Kg	1,500	750	00
7.	DALEO Nyeri (for farmers)	25/11/02	2 Kg	1,500	3,000	00
8.	DALEO Nyeri (seedlings)	25/11/02	20	5	100	00
9.	Kahaini (ICRAF officials)	10/4/03	18 (65gm)	100	1,800	00
10.	Mr. Karia (for a farmer)	25/4/03	400	5	2,000	00
11.	Farmers from Nakuru	-	465 gm	100	600	00
12.	Mr. Muoki (Nairobi)	Oct. '03	2 Kgs	1,500	3,000	00
13.	Mr. Karia (for a farmer)	29/11/03	600	5	3,000	00
14.	Mr. Muoki (Nairobi)	4/2/04	2 Kgs	1,500	3,000	00
15	Mr. Kofi (Nairobi)	1/3/04	1/3/4 Kgs	1,500	2,600	00

What we do

1. **Organise education tours on farming:**
   - Embu –Kiawanja on calliandara
   - Naromoru – cut flowers
   - Kiambu – cut flowers and dairy farmers
   - Kari Thika – Tissue Bananas (Nursery Management)
   - Mr. Nyage – Dairy Goat (Mukurweini)

2. **Receiving visitors on farm education tours:**
   - Embu (Kiawanja farmers)
   - Meru
   - Nakuru Tanzania – officers
   - Americans
   - Othaya (farmers)
   - Tutors and students from university

3. Hosti**ng Students:**
   - Mr. Kim – from University

4. **Organise and host field day:**
   - Mr. Wanyinyi's farm – twice (Mr. Wambugu)
   - Wangithi Primary School – twice (Jayne)
   - Karindi – (Ministry of Agriculture)
   - Mukirweini – by Unga feeds
   - Mukurweini –
   - Mr. Kiromo's farm – (Livestock Mukurweini)
   - Kahaini, Thika – ICRAF visit - Mr. Wambugu
   - Asst. Chief's farm – Mang times – Mr. Wambugu
   - Mr. Muiru – KARI, Thika (tissue Banana)

5. **Seminars on farming:**
    - Classic hotel – by Ministry of Agriculture
    - Ibis hotel – seeds distribution and marketing – Mr. Wambugu
    - Wambugu Farm Training Centre – Ministry of Agriculture

2.6.2 Fodder shrubs seed distribution in Central Kenya
By: Esther Karanja (FIPs)

Farmers in central Kenya have developed a lot of interest in use of fodder trees and our promotion efforts are really appreciated by majority of these farmers. This alone had been good motivation to carry on the promotion work despite the numerous constraints that we face in our work.

Personally I really look forward to a time when thousands of farmers will have adopted the tree fodder technologies to the extent that they will start to make more money and savings on the scarce resources at their disposal. This will happen when the farmers in the area will realize higher milk production and will no longer need to buy the commercial daily feeds. At the moment, the retailed dairy meal is very expensive making many farmers to be unable to buy enough for their livestock. So, when I preach the gospel of the fodder trees, I look at it as a sure way of eradicating poverty affecting thousands of farmers that I meet every day.

Why farmers do not use fodder trees

- Lack of information and knowledge related to fodder trees
- Scarcity of seed
- Retail of seed in large quantity (from 1kg) which is not affordable by many farmers
- Too few retail outlets especially the farm input stockists at the moment hence insufficient distribution mechanisms
- The distribution system is not yet well organized

Seeds distribution

District	Division	Contacts	Calliandra distribution (pkts)	Trichandra Distribution(pkts)
Nakuru	ACK diocesan Hqs	ACK	450	300
Nakuru	Subukia	Farmers Federation	150	37
Nairobi	Westlands	MOA	60	59
Murang'a	Kangima	Stockists -Stage Hardware &1 demo plot	237	
Murang'a	Kiharu	MOA	102	
Thika	Gatundu North	MOA	152	103
Thika	Gataundu North	Stockist -		
Thika	Gataundu South	MOA	30	
Kiambu	District office	MOA & 1 demo plot	187	20
Kiambu	Githunguri	MOA	18	58
Kiambu	Githunguri	PCEA church		
Kiambu	Kikuyu	MOA	50	20
Kiambu	Kiamba	MOA & 1 demo plot	32	20
Kiambu	Lari	MOA	44	
Kiambu	Lari	Africa Cons. Trust	2kg	2kg
Nyandarua	Kipipiri	Umbrella women groups	2kg	2kg

2.6.3 Calliandra calothyrsus seed production and marketing: Options for matching demand and supply

Steven Franzel, Charles Wambugu, and Pauline Mwangi

Calliandra calothyrsus is a fast growing, nitrogen-fixing leguminous shrub principally used for animal fodder, soil stabilization and amelioration, stakes for agricultural crops such as climbing beans and fuel-wood. In Kenya, its main use is for fodder and since dissemination began in the late 1990s over 30,000 dairy farmers have planted the tree. Adequate and sustained supply of planting materials is a problem wherever calliandra planting is expanding. A study carried out by Technoserve/Kenya and ICRAF explored the development of sustainable planting material distribution and marketing systems for *Calliandra calothyrsus* (Technoserve and ICRAF 2003). Forty-four interviews were conducted of dairy farmers, institutional key informants, commercial seed farmers, seed vendors, seedling sellers and farmer groups in central and western Kenya.

The private sector in western Kenya was effective in providing seed for sale to institutional buyers but not to farmers (figure 1). In central Kenya these institutional buyers supplied farmer groups with free seed. The groups then established group nurseries to supply seedlings for their members. Farmers were encouraged to leave some trees uncut for seed production in their farms; this practice may ensure that followingtr adoption, areas with calliandra could be self-sustaining in terms of seeds. This approach may work well if farmers can be encouraged to collect seed from a sufficient number of trees to ensure maintenance of genetic diversity.

However, it will be much more difficult for the private sector to provide seed to new areas, where calliandra is not found and is not known. For example, seed vendors in western Kenya have been unable to sell all of their seed, and yet there is a lack of seed in many areas of central Kenya. Currently, there is little private sector involvement in producing and marketing tree seeds in central Kenya, where most of the demand is. There appears to be insufficient incentives for the private sector to undertake calliandra seed distribution, especially given that so much seed is given away free. In some areas, the poor performance of the milk marketing system discourages farmers from testing new technologies.

Demand for calliandra seed needs to be developed by raising awareness and training of farmers on calliandra management and use. A subsidized seed distribution and marketing system is still necessary and the following marketing options are being explored (figure 1):

- Link seed marketing to other economically attractive activities like milk collection, crop seed companies, and stockists. Thus far, we have been unsuccessful in attracting dairy and seed companies to sell calliandra seed. We believe there are two main reasons that they do not get involved: calliandra seed is too low in value relative to crop seeds and unlike most crop seed, a farmer does not need to buy calliandra seed every year.
- Develop and/or strengthen partnerships with organizations and institutions in dairy development to help publicize fodder shrubs and promote seed demand. One private company has planted fodder shrubs with the intention of exploring the profitability of seed marketing. Some of the dairy development organizations that we have built partnerships with include Land O' Lakes in Kenya and Uganda, Heifer International in Kenya, Uganda and Rwanda, and Send a Cow in Kenya and Rwanda.
- Explore and initiate pilot private sector seed distribution systems in areas where calliandra planting is expanding. ICRAF and KARI are currently assisting private nurseries and seed vendors in central Kenya, where demand is rapidly expanding, to link with small-scale farmers and institutions interested in buying seed. Our main task is simply providing contact information to buyers and sellers about each other. We have records of private seed dealers selling 70 kg of seed from western Kenya to farmers and organizations in central Kenya during 2004. An NGO is making calliandra seed available in small packets to agricultural extension agents in Kiambu District, who in turn sell the seed, and provide information on fodder trees to farmers.

Several areas for future development include:

- Helping seed dealers to form an association. The objectives may be to share information, to improve access to seed, and to lobby policy makers.
- Providing training in entrepreneurship and business skills to seed producers and dealers.
- Persuading policy makers to allow calliandra seed dealers to be exempted from the steep licensing fees that are charged to crop seed dealers.

An important lesson learned is that the biggest reason behind the lack of available seed is a lack of information about calliandra, both the potential of the shrub as a livestock feed as well as how to harvest, store, and market seed and seedlings to farmers who want to buy it. A DFID-financed project managed by the Oxford Forestry Institute and ICRAF is promoting the adoption of fodder trees throughout East Africa. A key to success is promoting the role of the private sector in producing and marketing seed.

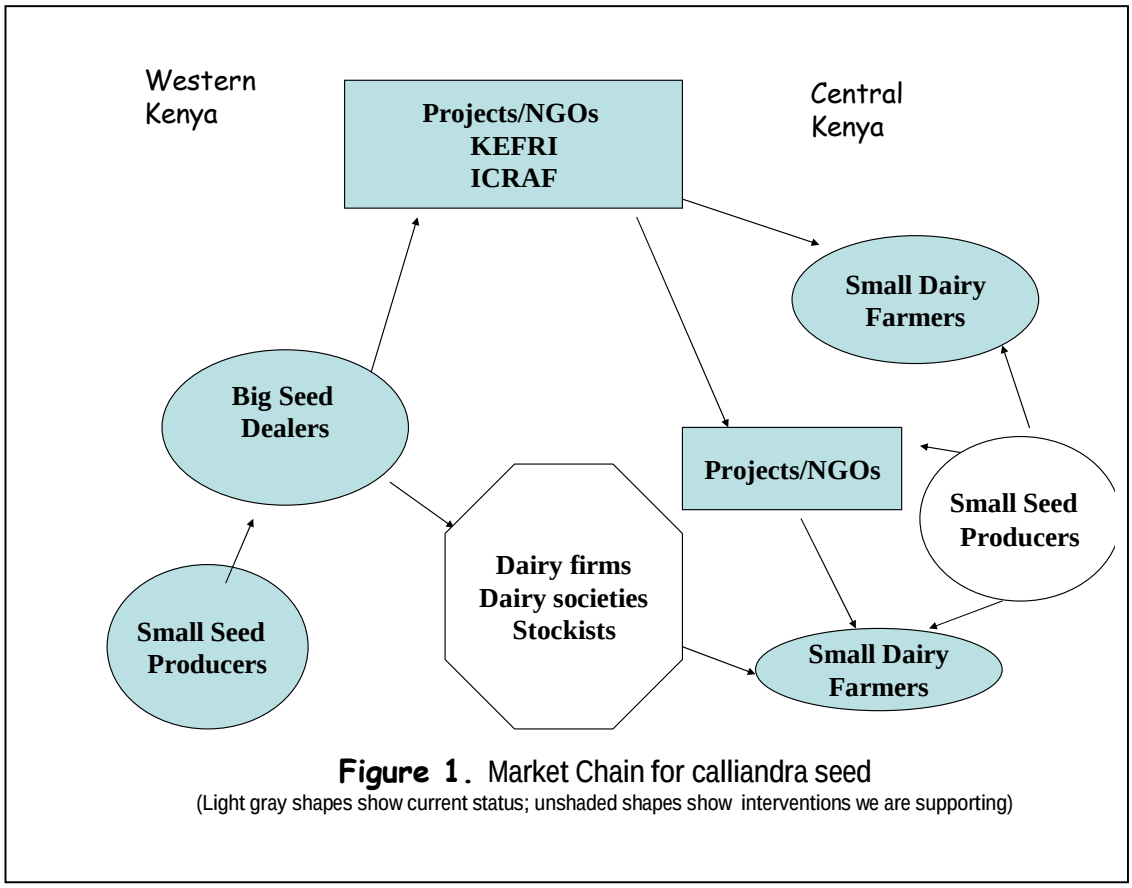

Figure 1. Market Chain for calliandra seed
(Light gray shapes show current status; unshaded shapes show interventions we are supporting)

3. Exercise

3.1 Interview drama exercise: Farmer interviewing skits[2]

Steven Franzel

A. Objective: Promote good interviewing techniques by facilitating the exchange of information and experiences among participants. This exercise is especially important if the participants are going on a field visit during the workshop to interview farmers.

B. Method: Actors act out bad and good interview skits, using the scripts below. They are of course encouraged to modify them as they wish. Following the skits, workshop participants discuss the good and bad interview techniques they have witnessed.

[2] Adapted from *Diagnosis in farming systems research and extension*, Franzel, S., M. O'Dell, and L. Walechsa (Eds.) Farming Systems Research and Extension Training Unit Volume 1, (Gainesville, Florida: University of Florida, Farming Systems Support Project, 1986).

Before starting, tell participants that they will be viewing two skits of researchers visiting farmers and that during the skits, they should note on paper the good and bad interview techniques that are used. Three people are needed for each skit. If time allows, distribute the skit to volunteers among the participants at least 24 hours before showtime; they may then want to rehearse although this is not necessary. They are free to use the scripts when presenting. Try and supply the actors with props (especially for the bad interview!) including dark sunglasses, funny hats, walkman, cigarettes, etc.

After the skits are finished, start a discussion on what the good and bad techniques are that they viewed. List the lessons learned from the exercise on the board. A sample list of lessons is presented at the end of this note. Make sure lessons are stated in a positive way, that is, participants should not just state what was done wrong but should be clear on what should have been done.

C. Script for mock bad interview

FARMER ENTERS, BEGINS WORKING

1. Farmer: Oh, that sun sure is hot!

   INTERVIEWER ENTERS

2. Interviewer
   I'm here with the government—Department of Agricultural Extension—and I've come from Kampala to talk with a few small farmers. Are you a small farmer? How much land do you have here?

3. Farmer:
   Where did you say you are from? The Department of Agricultural Extension in Kampala? I have a cousin who works there. Samuel Basiga, do you know him?

4. Interviewer
   No, I don't know him. Do you plant tomatoes?

5. Farmer:
   Yes

6. Interviewer:
   Do you use insecticides on your tomatoes?

7. Farmer:
   Well, ah, uh, yes. You know, we have a big problem out here with the credit program. We filled out forms about three months ago and--------

8. Interviewer (*sharply!*)
We are not here for the credit program. Say, you really should have planted those Leucaena trees closer together, they are so far apart.

9. Colleague:
You know, there may be good reasons for planting Leucaena like that. If she wasn't able to get enough seedlings to plant she will maximize the biomass production using a wide spacing. Or maybe she lacked cash for buying seedlings or did not have enough labor to plant them.

10. Interviewer: (*turning his back to farmer*)
Yeah, but at that density there won't be any effect on soil fertility. Research has shown that. She has to plant at a higher density so that there will be enough nitrogen supplied from the cuttings.

11. Colleague:
How do you know she has planted the trees in order to improve her soil fertility? Maybe her intention is to provide feed for her livestock?

12. Interviewer:
That may be true, we'll check it out back at the research station. Say, what kind of fertilizer do you use?

13. Farmer:
I'm not sure of the name, I bought it in town.

14. Colleague:
How about potatoes, do you grow potatoes?

15. Farmer:
I used to but not anymore

16. Interviewer:
Did you stop because of marketing problems?

17. Farmer:

Yes, that was the reason

18. Interviewer:
You know that these Leucaena trees you have improve the fertility of your soil. How have they performed here?

19. Farmer:
They've improved the fertility of my soil.

20. Interviewer:
Yes but you have so few trees, why don't you plant more?

21. Farmer:
Oh you know, I haven't had time. You know, we farmers are very lazy.

22. Interviewer:
Heh, its late, we have to go!

D. Script for a mock good interview

1. Interviewer:
Greetings! My name is _____and this is _____ from the Mbale Research Center. Yesterday we were over talking with Mr. Okwang your extension agent, and she said you'd be weeding your potatoes today. We thought you might be able to help us out a bit with some work we are doing on soil fertility.

2. Farmer:
Well, I've got to finish this row up first…

3. Interviewer:
Well, I can give you a hand and then maybe you can take a break for a few minutes. Is that OK?

4. Farmer:
Sure!

(ten minutes later)

5. Farmer:
Why did you say you are here?

6. Interviewer:
I've started working recently with the _____Research Center. Have you ever been over there?

7. Farmer:
Been by there, but never really had a chance to visit.

8. Interviewer:
We are interested in finding out about a certain tree that is grown together with crops. Do you have trees like that in your farm? Oh, I see that you have a Leucaena hedge along the boundary of that maize field over there. Can we go take a look? When did you first plant these trees?

9. Farmer:
Two years ago now

10. Colleague:
What do you see as the good and bad aspects of these trees?

11. Farmer:
Well, its an excellent fodder for my cows and goats, it increases the milk they produce. And I think it even increases maize production in the field next to the hedge.

12. Colleague:
But the maize next to the Leucaena hedge looks the same as the maize in the middle of the field, I don't see any apparent effect.

13. Farmer:
That is because I put cow manure in the field but not next to the hedge. My neighbors even commented that it looks like I had applied manure throughout the field.

14. Interviewer:
That's pretty interesting. You don't mind if I take some notes do you? So I don't forget.

15. Farmer:
Go right ahead.

16. Colleague:
Do the cows like the taste of the Leucaena?

17. Farmer:
Oh yes, that is not a problem at all. At the beginning when I first planted leucaena, the cows did not want to eat it but by adding small amounts to their grass they eventually got used to it. And now I think they actually like it!

18. Colleague:
Some people complain that the trees hurt the maize planted next to it. Have you had this problem.

19. Farmer:
Yes, my first year I let the trees grow too high, up to here (shoulder-level), and it really hurt my maize. And I didn't side-prune either. But since then I side prune and cut back earlier, when they are about this high, and it doesn't hurt the maize.

TWENTY MINUTES LATER.

20. Interviewer:
Well, thanks a lot for your time. We have been asking you so many questions, do you have any questions you would like to ask us?

21. Farmer

Yes there is one, I wanted to know where I could buy some improved mango seedlings, some farmers in our village obtained them from an NGO but they are no longer working here. I am willing to buy them but I don't know where I can get them.

22. Interviewer

Yes I think we can get that information for you and forward it to Mr. Okwang, your extension agent. But you may have to travel some distance to get them. We will let Mr. Okwang know who is selling them. Do you have any other questions?

23. Farmer:

No, I cannot think of anything else.

24. Interviewer

We don't want to take too much time so we will be leaving now. It was really very informative for us, we learned a lot from your experience.

E. Lessons that participants raise after the interviewing exercise

1. Show respect and empathy for the farmer.
2. Begin with an introduction. Explain who you are, where you are from, and why you are visiting the farmer.
3. Avoid if possible, sensitive questions about land and income. If necessary raise them late in the interview after you have gained the farmers' confidence.
4. Avoid leading questions; do not suggest an answer as part of a question
5. Ask permission to take notes.
6. Do not interrupt the farmer. Do not only discuss what you are interested, pay attention to what the farmer is interested in.
7. Probe for details
8. Avoid use of technical language
9. Do not lecture to the farmer. Usually avoid giving extension advice unless the farmer specifically asks for it.
10. Avoid discussions between yourselves which leave the farmer out. Save these discussions for after the interview
11. Reasons for non adoption and expansion are sensitive, approach them in alternative ways, e.g., through group interviews to discuss why many members of the community are not adopting, expanding.
12. Be specific. Instead of asking do you use fertilizer, as if you have used fertilizer during the last year.

13. Try to use local names for inputs

14. Many of your questions should come from what you see, not only from what you hear.

4. Working group output: Key themes and lessons

4.1 Seed

Key Issues

- GP establishment
- GP composition
- Training
  - seem to be enhancing only through the GPs
  - give a range on options to choose
- Fodder species grown.
- Number of trees on farm.
- GP constitution.
- Distribution of plant materials.
- Spread of technology. GP – GP sharing of information.
- Seed harvesting – tall trees.
- Exposure of GP leaders.
- Alternative feed sources.

General Comments

- Agroforestry success – a lot of Grevillea.
  - Agroforestry design – trees arrangement on farm
  - Integration of Agroforestry technologies to address agriculture systems as a whole – Is this possible in the area visited?
  - Soil conservation and fertility management is a priority.
  - Soil acidic PH4-4.5
  - Partnerships.
- No farmer observed feeding Calliandra (GP1).
- Appreciation of ICRAF for provision of planting materials and training.
- Sustainability – age of farmers
- Shrub management – cutting technology
- Constraints – seed harvesting
- Pests and diseases –termites (observed) – Leucaena Psyllid.
- Futures
- Breeding animals (goats)
- Milk production – (quality of goats, quantity and quality of feed and animal housing)
- Gender
- Cooperation among GP members.
- Recycling (manure) lacking?
- Feed conservation

4.2 Pests and diseases

Weaknesses and strengths
Identity of pest and diseases as well as the pathogens-causal agents.

- There is some information both lit. and indigenous.
- In most cases information is lacking. Many pests and diseases not identified – we need to identify them.
- More research on identity is required.

We need to distinguish between pests and disease related problems and environmental related problems.

Surveys on a wider scale is needed.

Dynamics of Pests and Diseases.

- Population i.e. How population changes over time e.g. in dry and wet Season, how it varies, when it increases or decreases.

- Epidemiology = intensity of diseases vs. time.

Control of the Pests and Diseases

- We take into account indigenous knowledge we need to verify indigenous knowledge exceptionally.
- Fodder extensionists lack technical know how – we need capacity building.
- Farmers have focus on pests and diseases of crops more than those of trees.
- Extension materials lacking e.g. pests and diseases manuals.
- Sharing information on pests and diseases.
- Diversification should be encouraged . Prevention should me encouraged other than discouraged.
- Farmers are good monitors and should be encouraged.

We need to handle pests and diseases issues on case by case basis e.g. Kenya case is different from Uganda case.

4..3 Extension

2. <u>Continue Farmer-to-Farmer</u>

- Document lessons learnt and benefits derived.
- Disseminate correct findings use all major languages.
- Tie to information flow among all actors.

3. <u>Value of Group Approach</u>

- Common interest groups whose 1% objective is complementary to fodder trees. e.g. bee-keeping.

4. <u>Gender Participation</u>

- Whole household: HH head, female spouses, workers.
- Youth groups: primary Schools, secondary Schools, colleges, post-Schools.

5. **Demonstrate value/benefits**
   - Demonstration sites: all aspects – establishment, use, benefits.
   - Record keeping to demonstrate value/benefit/advantages: costs, production, profits.

6. **Sociology Social Standing**
   - People likely to share: group officials community leaders.
   - Training: capacity-building.

7. **Partnerships**
   - Involve local authorities, other leaders in fodder tree use.
   - Advocacy. Creating awareness of activities in community plans.
   - Facilitate useful actors-extension.

8. **Monitoring**
   - Record keeping.
   - Participatory group approach.

9. **Private Extension**
   - Support business initiatives and investment in fodder tree establishment in fodder tree establishment and use.

IMPACT ASSESSMENT

1. Record keeping.
2. Participatory group monitoring.

4.4 Partnership

Key Issues to Consider

1. Identification of key partners e.g.: fodder seed producers and distributors, extension service providers, dairy dealers etc.

2. Collaborative meetings for:
   - creating rapport, introductory
   - familiarization
   - Sharing project objectives and activities, goals, mandate, area of operation. (This should be done for each identified partner).

3. Identify areas of collaboration – develop an MOU spelling out roles to played by each partner.

4. Develop a collaborative implementation action plan involving all key actors e.g. field workers of partners, farmers, local leaders, extension staff of Government, opinion leaders etc.

Advantages of Partnerships

- Helps avoid duplication of work in same area.
- Enhanced resource use through sharing.

- Information flow and sharing enhanced
- Opportunities for fundraising through joint proposal development.
- Dissemination of developed technologies made easy.
- Powerful bargaining/lobbing power developed.

Disadvantages of Partnerships

- When funds are exhausted for one partner it affects the whole partnership.
- Change of objectives, goals of one partner affects the other.
- Personal differences (personalities, ideologies etc.) affects partnership.

5. Working group outputs: Country Business Plans

5.1 Kenya: *developing a business plan for Kenya*

DELIVERABLES

1. Scaling up.
    a. From 30,000 households having an average 50 – 300 fodder shrubs to 100,000 with an average 500 shrubs (diverse species) in the next 5 years.

2. Germplasm availability.
    a. Sustainable seed production and supply systems developed.

3. Research

4. Participatory monitoring and evaluation.

ACTIVITIES

1. Scaling up:
    a. Capacity building:
        i. Extension: farmer, extension personnel, partners.
    b. Networks: Strengthening linkages
        i. Research extension
        ii. Networks
        iii. Workshops, planning
        iv. Resource centres
    c. Awareness creation
        i. Mass information.
        ii. Literature: information leaflets, brochures, barazas, etc.
    d. Demonstration sites
        i. Seeds available
        ii. Training
        iii. Utilization

2. Sustainable seed production established.
    a. Capacity building: seed stand
    b. Collection, handling and storage
    c. Network establishment
    d. Institutionalizing seed quality checks.
    e. Policy influence and advocacy.

3. Research:
    a. Screening of species
    b. Nutritional values
    c. Dissemination mechanisms
    d. Impact assessment
    e. Addressing constraints raised, etc.

4. Participatory monitoring and evaluation
    a. Capacity building
    b. Setting values for monitoring
    c. Establishing committees
    d. Back-up multidisciplinary team

5.2 Uganda: *Country fodder business plans*

1. **Research**
    - **a. Meta-analysis of literature**
        - i. Compilation of available literature on various fodder species
        - ii. Synthesize and archive reference manual
    - **b. Diversification**
        - i. Survey available species
        - ii. Compile and prioritize
        - iii. Acquire quality known germplasm
    - **c. Propagation**
        - i. On-station and,
        - ii. On-farm trials
    - **d. Feeding trials/utilization: Integrated system-wide approach**
        - i. Multi-use of fodder species
        - ii. Laboratory analysis and,
        - iii. Animal feeding trials
    - **e. Germplasm**
        - i. Appropriate production methods of sustainable germplasm
        - ii. Phonological studies of appropriate germplasm
            - o Pollination ecology
            - o Flower and fruit phonologies
            - o Leaf phonology
        - ii. On-station and On-farm trials
            - o Seed/fruit production
        - iii. Germplasm marketing and distribution channels
            - o Document existing markets
            - o Develop linkages with key stakeholders and potential customers
            - o Support quality germplasm control strategies
        - iv. Evaluation of post harvest practices for priority fodder species
            - o Harvesting methods
            - o Appropriate storage
            - o Viability tests
    - **f. Evaluate appropriate extension approaches**
        - i. Farmer-to-farmer
        - ii. Diffusion/adoption studies

- Site and farmer selection
- Farmer capacity building

iii. Institutionalizing into Local government Development plans
iv. Stakeholder analysis and engagements
- Partnership meetings
- Joint monitoring
- Feedback and budget meetings

g. Economic analysis

i. Socioeconomic studies
ii. Cost-benefit analysis
- Estimation of costs and inputs
- Calculation of benefits and outputs
- Data analysis and reporting

h. Evaluation of appropriate establishment and Management of priority fodder species

i. Management regimes for optimal production
- Pure species stands
- Mixed plantings and management
- Cut and carry versus browsing and Paddocking
- Restricted free grazing

ii. Evaluate establishment methods of priority fodder species
- Direct seed sowing
- Use of cutting cuttings and or budding
- Bare root or potted nurseries
- Wildlings collecting
- Tissue culture lab germplasm

iii. Sustainable harvesting practices of priority fodder species
- Cutting heights
- Cutting frequency
- Pruning versus pollarding

iv. Optimum tending operations of priority fodder species
- Weeding
- Thinning

i. Value addition and Processing

i. Quality improvement
ii. Preservation
iii. Marketing purposes
iv. Mixing ration trials
v. Feeding blocks
vi. Dry-feeding, silage making
vii. Appropriate packaging
viii. Market preference research

j. Pests and diseases management

i. Identification and management of pests and diseases
ii. Evaluation of control methods
- Indigenous
- Conventional

iii. Evaluate preventive measures specific to fodder species

k. Developing a participatory monitoring and evaluation system

i. Farmer record keeping capacity building
ii. Appropriate datasheet development
iii. Pre-test monitoring system
iv. Refinement of the monitoring system
v. Promotional strategy for the monitoring system

l. Promotion and scaling up

i. Stakeholder analysis and engagement
   - Stakeholder analysis
   - Development of promotional approaches
   - Partnership promotional meetings
   - Stakeholder engagement and participation
   - Monitor and evaluate adoption and level of scaling up

ii. Stakeholder capacity building
iii. Development of promotion and extension materials
iv. Enabling policy issues
   - Policy reform and advocacy
   - Linking research, policy and development

5.3 Rwanda

I. Objectives

1. Dissemination – existing technologies
   - New
2. Improve seed production and distribution – mechanisms.
3. Capacity building
4. Research on animal nutrition and impact
5. Collaboration and partnership

II. Outputs

- Targeted farmers : 3000 – 1000/province
  - 1000
  - 1000
- Trainings : Technicians : 50
  Farmers : 500
  Extension staff : 150
- Seed shops : 50

III. Activities

Objective 1: **Dissemination**

a) Sensitization – stakeholders
   - meetings
   - seminars
   - workshops

b) Development of training and extension materials (posters and leaflets, …)

c) Trainings
   - exchange visit
   - study tours
   - on-farm demonstrations

Objective 2:
a) Encourage the farmers to produce seed stands (collectively, individuals)
b) Promote the private producers (farmers associations, businessmen.
c) Facilitate the decentralization of seed and distribution through ISAR stations.
- seed shops
- quality control

Objective 3:
a) Training of researchers, field staff, Government extensionists workers, farmers representatives
b) Organize workshops, seminars, study.
c) Facilitate the researchers and technicians for international conferences and workshops.

Objective 4
<u>Research</u>
a) Identify the indigenous species for improving milk production.
b) Study on animal nutrition.
c) Study on marketing process (seed, milk, fodder)
d) Socio-economic impact assessment.

IV. **Resources**
- Human
  - Researchers
  - Technicians
  - Ministry of Agriculture
  - (ONGs) – NGOs staff
  - Farmers
- Material
  - Means of transport
  - Germplasm
  - Pots + nursery equipment
  - Training materials

5.4 Tanzania

<u>OUTPUT 1.</u>
3000 households are growing at least 500 Calliandra/Trichandra trees

ACTIVITIES

1. Hold sensitization and training meetings for farmers and extension staff.
2. Acquire seeds (i) from our collaborators e.g. ICRAF, Uganda and Kenya. (ii) train farmers on own seed production.
3. Verification, documentation and dissemination of farmers IPM strategies on Calliandra/Trichandra.
4. Forge partnerships with interested groups and institutions in the targeted areas.

OUTPUT 2.
At least 10% of the targeted farmers get dairy animals.

ACTIVITIES

1. Identify farmers who have met the conditions of being given an improved animal.
2. Capacity building of the identified farmers (management of the animals)
3. Distribute animals through our partner (HPI)

OUTPUT 3.
Farm enterprises related to Calliandra diversified.

ACTIVITIES

1. Train farmers on value addition on milk, bee keeping, leaf meal production.
2. Identify market channels.

OUTPUT 4.
At least four extension materials on fodder trees developed.

OUTPUT 5.
Report on adoption and impact of fodder trees produced.

ACTIVITIES

1. Conduct adoption and impact study

OUTPUT 6.
Report on indigenous fodder trees produced.

ACTIVITIES

1. Study of the indigenous fodder trees (management, nutritive value, identify)

6. Workshop evaluation

6.1 Evaluation: positive aspects

- Excellent logistics.
- Good well thought presentations.
- Good organization and participation.
- Meals were good.
- Conference hall excellent.
- Active participation.
- Got a chance to learn what is happening with use of fodder trees within my country and neighbouring countries.
- Site, food and organization were excellent.
- Good conference hall facilities.
- Full participation.
- Sharing experiences (country to country).
- Well organized forum for effective sharing ideas.
- Organization was excellent.
- Participation was very good.

- Logistics were good.
- Calliandra well covered.
- Good participation.
- Excellent mix of participants (research, extension, and development).
- Sharing of farmers experiences.
- The activities went so well as scheduled I did not imagine it would be so.
- There was good atmosphere that allowed free participation.
- Backgrounds (countries) offered a gauge on strategies similarities and differences with good results by farming communities.

6.2 Aspects that need improvement

- Logistic.
- Information mechanism.
- Accommodation.
- Frequency of such forums.
- The presentations should have organized into more complete scripts with more details.
- "out of pocket" allowance was too low needs to be doubled.
- Time management.
- Few species discussed (mainly Calliandra).
- Time.
- Problem of power point projector.
- Time constraints limiting discussions on key issues.
- Since workshop was at ICRAF, accommodation should have been in centre of town.
- Representation from each country should have been from research and development and education just like Kenya.
- Adoption studies need improvement.
- Venue of workshop should be near the residence hotel.
- More time days for such exchange forum.
- Better accommodation facilities.
- Next time there should be more time to discuss more issues.

Annex 1: List of Participants

Workshop on scaling up the promotion of fodder trees

World Agroforestry Centre

Nairobi, 7 – 10 June 2004

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