More shrubs mean more milk in East Africa

RIU

Validated RNRRS Output.

Two million small farmers in East Africa could increase milk production simply by planting fodder shrubs—as an extra high-protein feed for cows and goats. The shrubs don't take up valuable land. They can be planted alongside paths, on field boundaries and banks. Plus, not a lot of labour is involved. About 48,000 farmers in Kenya, 33,000 in Uganda, 11,000 in Rwanda and 8,000 in northern Tanzania now grow fodder shrubs because they quickly reap substantial benefits. Farmers consistently report an increase of around 1-2 litres of milk per animal per day. So, the market for seeds of fodder shrubs is thriving. Over 40 dealers now market seed and seedlings across Kenya.

Project Ref: **FRP43:**
Topic: **2. Better Lives for Livestock Keepers: Improved Livestock & Fodder**
Lead Organisation: **CABI, UK**
Source: **Forestry Research Programme**

Document Contents:

Description

FRP43

Research into Use
NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

Kenya, Rwanda, Tanzania, Uganda,

Target Audiences for this content:

Livestock farmers, Forest-dependent poor,

A. Description of the research output(s)

1. Working title of cluster of outputs:

Factors affecting nutritive value of *Calliandra calothyrsus*.

Preferred title: Scaling up the promotion of fodder shrubs in East Africa.

Note: R6549 had two phases. The output title in the RIUP Output Listing reflects Phase 1 (*Investigation of factors affecting the nutritive value of Calliandra calothyrsus as fodder for ruminants*), while the outputs with greatest potential for further impact come from Phase 2 (*Scaling up the promotion of calliandra and other fodder shrubs in East Africa)*.

2. Name of relevant RNRRS Programme(s).

DFID Forestry Research Programme (FRP)

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities.

The principal project described in this proforma is R6549, but this project built upon the outputs of several previous, supporting projects. R4485 carried out range-wide provenance collections of *Calliandra calothyrsus* Meissn. ("calliandra") in Central America, which were subsequently evaluated in multi-locational agronomic trials throughout the tropics under R5728 and R6535. For *Leucaena* species (which have also been promoted under R6549) project R6524 investigated resistance and tolerance to the psyllid pest *Heteropsylla cubana*, using a range of species and provenances collected in Mexico and Central America under an earlier FRP project, R4524. Projects R6524 and R6535 are also included in the FRP Output Listing, so their contact details are included below.

R6549:

Project Manager:
Janet Stewart
Oxford Forestry Institute
University of Oxford
South Parks Road
Oxford OX1 3RB
Current email contact: j.stewart@cabi.org

Institutional partners Phase 1:
John Kang'ara,
Kenya Agricultural Research Institute (KARI)
Embu Regional Research Centre

Embu
Kenya
Email: jkangara@kariembu.org

Paul Tuwei
Kenya Forestry Research Institute (KEFRI)
Email: ptuwei@yahoo.com

Carlos Lascano
Centro Internacional de Agricultura Tropical (CIAT)
AA 6713
Cali
Colombia
Email: c.lascano@cgiar.org

Institutional partners Phase 2:
Steven Franzel & Charles Wambugu
World Agroforestry Centre (ICRAF)
PO Box 30677
Nairobi
Kenya
Emails: s.franzel@cgiar.org; c.wambugu@cgiar.org

Bueno Dickens Sande
Forestry Resources Research Institute (FORRI)
National Agricultural Research Organisation (NARO)
P.O. Box 311
Kabale
Uganda
Email: bdsande@yahoo.co.uk

Philip Nyeko
Faculty of Forestry and Nature Conservation
Makerere University
P.O Box 7062
Kampala
Uganda.
Email: nyeko@forest.mak.ac.ug

Charles Lyamchai & Margaret Kingamkono
Selian Agricultural Research Institute (SARI)
P. O. Box 6024
Arusha
Tanzania

Emails: clyamchai@sari.co.tz; mkingamkono@sari.co.tz

David Kagoro
ICRAF-Rwanda
PO Box 7239
Kigali, Rwanda
Email: d.kagoro@cgiar.org

Rwanda Agricultural Research Institute (Institut des Sciences Agronomiques du Rwanda, ISAR)
Butare
Rwanda

R6524:

Project Manager:
Roger Day
CABI Africa
PO Box 633-00621
Nairobi
Kenya
Email: r.day@cgiar.org

Institutional partner:
World Agroforestry Centre (ICRAF) – Kenya, Malawi & Tanzania

R6535:

Project manager:
Joanne Chamberlain
Centre for Natural Resources and Development
Green College
Woodstock Road
Oxford
Current email contact: jochamber1@aol.com

Institutional partners:
Centro de Mejoramiento Genetico y Banco de Semillas Forestales
La Leona
Carretera Managua
Leon
Nicaragua

CONSEFORH/COHDEFOR
Apdo 314

Comayagua
Honduras

Herbario Nacional, Department de Biología
Mexico

Instituto Nacional de Bosques
INAFOR
Edificio Galerias de España
71 Ave 11-63 Zona 9
Guatemala

Tony Simons
World Agroforestry Centre (ICRAF)
PO Box 30677
Nairobi
Kenya
Email: t.simons@cgiar.org

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? ***(max. 400 words)****. This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.*

There are an estimated 1.8 million **smallholder dairy farmers** in **Kenya**, and smaller but still substantial numbers in **Tanzania** (124,000) **Uganda** (100,000), and **Rwanda ***. Many dairy animals fail to realise their genetic potential for milk production because of shortage and poor quality of fodder, especially during the dry season. Most farmers cannot afford adequate supplementation with purchased concentrates. In the 1980s, exotic **fodder shrubs** with high-protein leaves (**calliandra**, several **leucaena** species, **mulberry**, **gliricidia**) were introduced to the East African region to address this 'quality gap'. Calliandra was the most promising of the species tested, but little was known about how to manage it to optimise its feeding value. By the late 1990s, uptake was largely restricted to Central Kenya and pockets in other parts of Kenya and Uganda.

* Data from Kenya, Tanzania, and Uganda are from (1) The Uncertainty of Cattle Numbers in Kenya. Smallholder Dairy Project Policy Brief no. 10, ILRI, Nairobi. (2) 2002 Tanzania National Dairy Census. And (3) Staal, SJ and Kaguongo, WN, 2003. The Uganda Dairy Sub-sector: Targeting Development Opportunities. ILRI, Nairobi.

Phase 1 of R6549 (1996-2001) consisted of on-station and laboratory research into ways to optimise the **fodder quality** of calliandra. In Phase 2 (2001-2006), the project's emphasis shifted to **scaling up** the adoption of calliandra and other fodder shrubs in East Africa, at the same time ensuring that the outputs from Phase 1 were disseminated as widely and effectively as possible. The research on psyllid resistance under R6524 contributed to the selection of the leucaena species now being promoted (*L. trichandra, L. pallida* and *L. diversifolia*).

Output 1: Optimised fodder shrub technology for smallholder dairy farmers (technology)
The findings from Phase 1, optimising the utilisation of calliandra, have been incorporated into extension

messages promoted by R6549. The research on management and utilisation of fodder shrubs (by both R6549 and a range of other projects and institutions) has enabled the development of a robust, replicable **technology** which is attractive to farmers because it is simple to use and delivers a clear, tangible benefit (increased milk production) over a short time frame.

Output 2: Facilitation of the scaling up process (methodology, service)
The **methodology** we developed for scaling up was informed by studies of **adoption** in Rwanda and of **farmer-to-farmer dissemination** in Kenya; assessment of the **economic impact** of calliandra in Kenya and Uganda; and documentation of farmers' experiences in Uganda and Tanzania. A key element of the approach was the *dissemination facilitator*, an extension specialist who backstopped 20-30 governmental, non-governmental (NGO), and community based organisations (CBO) over an area of several districts. The dissemination facilitator's role involved value addition to existing activities by working mainly through **partnerships** with other stakeholders promoting fodder shrubs, including the national agricultural research system (NARS), governmental extension providers, national and international NGOs and CBOs; enhancing their activities through **training of trainers** (ToT) and **technical backstopping**; and working with farmer **groups** at the community level.

Output 3: Extension manual/DST and other dissemination materials (product)
To capture the experiences and lessons from our scaling up activities, we produced an **extension manual/ decision support tool (DST)** for extension providers in East Africa, as well as a range of other extension materials (booklets, leaflets, posters, banners).

Output 4: Improved seed system for fodder shrubs (policy)
Seed supply has proved to be a major constraint to uptake of fodder shrubs, for reasons relating largely to policy constraints to the functioning of seed markets. R6549 included a study of the **market for calliandra seed** in Kenya, which helped us develop an improved seed marketing system, building the capacity of community seed vendors and linking them to NGOs, extension partners, farmer groups and other stakeholders.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	***Technology***	***Service***	***Process or Methodology***	***Policy***	***Other Please specify***
X	*X*	*X*	*X*	*X*	

The definition of the outputs in terms of these categories is shown in (5).

6. What is the main commodity upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

R6549 focused on animal fodder, primarily for dairy, and therefore by extension on milk production. The outputs relating to fodder quality (Phase 1) are specific to the fodder species *Calliandra calothyrsus* (calliandra), but the findings of the supporting research into the dissemination process would be applicable to any commodity within the East African smallholder context. Similarly the extension manual/decision support tool, though it relates

primarily to fodder shrubs, includes a section, *Making Decisions about Extension Approaches*, which is applicable to any type of agricultural extension with smallholders. The output on seed systems is relevant for seed in other tree enterprises, such as timber, fruits, fuelwood and medicinal plants.

7. What production system(s) does/could the output(s) focus upon?
Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	***High potential***	***Hillsides***	***Forest-Agriculture***	***Peri-urban***	***Land water***	***Tropical moist forest***	***Cross-cutting***
X	*X*	*X*	*X*	*X*			

Most of our work with fodder shrubs has been in high potential highland areas, often peri-urban (as dairy enterprises depend on access to a market for milk). Calliandra, the species we focused on in Phase 1 of R6549, does not thrive in semi-arid environments with rainfall <1000 mm, though it can survive rainfall as low as 800 mm provided the dry season is no longer than 3-4 months (e.g. Isingiro South, Uganda). However, there has been successful adoption of other fodder species (*Leucaena pallida, L. diversifolia, L. collinsii, Acacia angustissima* and *Gliricidia sepium*) in the semi-arid areas of Shinyanga and Tabora, Tanzania, and all the outputs of R6549 are equally applicable in this context.

8. What farming system(s) does the output(s) focus upon?
Please tick one or more of the following options (see Annex B for definitions).
Leave blank if not applicable

Smallholder rainfed humid	***Irrigated***	***Wetland rice based***	***Smallholder rainfed highland***	***Smallholder rainfed dry/cold***	***Dualistic***	***Coastal artisanal fishing***
X			*X*	*X*		

Most adoption of fodder shrubs to date has been in smallholder rainfed humid and highland systems. In irrigated and wetland rice-based systems, higher value crops can be grown and farmers generally prefer to concentrate on these. Most of the fodder species on which we have focused so far do not tolerate frost, but a new species, *Chamaecytisus prolifer* (tagasaste, or tree lucerne) is showing promise in frost-prone highland areas of Kenya. This extends the applicability of the outputs to the smallholder rainfed dry/cold farming system.

*9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**).*

Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

Improving uptake

A large number of projects from RNRRS programmes other than FRP (e.g. CPP, LPP) have explored aspects of dissemination and scaling up of a range of different agricultural innovations in East Africa. Among these, the

farmer field school (FFS) approach, applied successfully to integrated pest management in Kenya by CABI under CPP projects R8299 and R8454, would be highly applicable to fodder shrubs. The insights into the mechanisms of farmer-to-farmer extension from the study *Improving information and comunication for smallholder farmers* by Farm Africa, commissioned by DFID, are also very relevant to our approach. Each of these is the subject of a separate proforma.

The SCALE (System-wide Collaborative Action for Livelihoods and the Environment) methodology is another (non-RNRRS) innovative and effective approach to scaling up, which is currently (2006) being successfully applied by ICRAF in Kenya (see also (19) and (23)). SCALE brings civil society stakeholders together to plan and implement campaigns to promote new practices. By engaging with a wide range of stakeholders, representing all aspects of a given system (in this case, dairy production), SCALE generates change across many levels and sectors of society, using a combination of different social change methodologies including advocacy, mass communication and social mobilisation.

Improving seed supply

FRP Project R6535 (Genetic improvement of *Calliandra calothyrsus* – Phase II), and its precursor R5728, provided essential supporting research to R6549 by identifying two high-yielding calliandra provenances (Patulul, Guatemala and San Ramón, Nicaragua) to be evaluated in detail in terms of nutritive value. R6535 also supported the establishment of seed orchards of these provenances in Kenya. However these stands alone cannot meet the present high demand for planting material, so that most seed for scaling up currently has to be sourced from local land race material. Value could be added by a targeted programme of multiplication of selected calliandra provenance material in group, community, institutional and private sector seed orchards. Providing training to seed vendors and helping them link with private and public sector buyers (Output 4) has been effective in increasing adoption.

Validation

B. Validation of the research output(s)

*10. **How** were the output(s) validated and **who** validated them?*

*Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the "who" component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation **(max. 500 words)**.*

Output 1

The most compelling validation of the technology is the fact that adoption rates are high across the region: about 100,000 farmers have planted (see (16) below) and very few abandon the technology after planting: for example, a survey of 94 farmers in Kenya, three years after they had planted fodder shrubs, found only three who no longer had any shrubs. The real value of fodder shrubs lies in their profitability; and the key to the continuing

uptake and expansion of this technology is the clear increase in milk production observed by farmers. Farmers consistently report an increase of around 1-2 litres/day; and this positive perception by the project's ultimate beneficiaries is an important aspect of the validation of the technology. Farmers also appreciate the fact that the shrubs require no extra land (they are grown along boundaries, pathways, and along soil conservation structures across the contour), little labour, and no capital. These perceptions were captured in studies conducted under R6549 in Uganda [1] and Tanzania [2]. A large majority of farmers in the Uganda study, as well as in an earlier one in Kenya [3], expanded their plantings of fodder shrubs over several years. The profitability of fodder shrubs is also reflected in the economic impact assessments [4] [5] carried out under R6549 (see also (20) below).

[1] Nyeko, P., Stewart, J., Franzel, S. and Barklund, P. (2004). Farmers' experiences in the management and utilisation of *Calliandra calothyrsus*, a fodder shrub, in Uganda. *Agricultural Research & Extension Network (AgREN) Network Paper* 140. Overseas Development Institute, London, U.K. 14
[2] Kingkamkono, M. & Lyamchai. C. (2003). Dissemination of *Calliandra calothyrsus* in Marangu, Mshiri, Masia villages in Moshi Rural District, Tanzania. SARI, Arusha, Tanzania. Unpublished report. 17 pp.
[3] Wambugu, C., Franzel, S., Tuwei, P. & Karanja, G. (2001). Scaling up the use of fodder shrubs in Central Kenya. Development in Practice 11, 487-494.
[4] Mawanda, F. (2004). Socio-economic and farmers' perceived environmental impacts of *Calliandra calothyrsus* in Uganda *(A case study of Mukono and Kabale Districts).* Unpublished M.Sc.Thesis, Makerere University, Kampala, Uganda. 131 pp.
[5] Koech, S. (2004). Socio-economic analysis of fodder legumes: the case of calliandra and desmodium in smallholder dairy farms of Embu district, Kenya. Unpublished M.Sc.Thesis, Egerton University, Kenya. 87 pp.

Output 2
The effectiveness of the technology itself, of the strong extension network, and of the extension approaches developed under R6549 has been proved by the expansion of fodder shrub planting in the project's target areas. Uptake was closely monitored through careful record keeping by the project partners at the five sites where the project was active: see (20) and (21).

This validation data applies to the smallholder dairy farmers in the project target areas. Land holdings are generally 1 ha or less and most farmers have 1-2 dairy cows or dairy goats. At the project sites where gender data is available (Western Kenya, Central Kenya and Uganda Lakeshore), the proportion of women planting fodder shrubs was 54%, 43% and 57% respectively.

These data represent only the six areas within the target countries where R6549 was active. There is great scope for replicating the approaches we have developed in other parts of these countries and more widely across the region and in other parts of Africa: see (14).

Output 3
The draft extension manual and DST, originally produced as two separate documents, were validated through a review workshop attended by extension professionals and researchers from the four target countries. This rigorous review resulted in the two documents being combined into one, and extensively re-written to simplify the language and make the presentation more attractive and easy to use.

Output 4
A pilot scheme was set up under R6549 in central Kenya, during 2004-2005, to test whether the fodder shrub seed market could be developed by making seed available to farmers to purchase locally, initially at subsidised rates and in small packets. The high demand for seed sold in this way validated our advocacy of policy reforms to

make this practice replicable across a wider area, through relaxation of licensing restrictions. Over forty vendors are now marketing fodder shrub seed and seedlings across Kenya, and in central Kenya alone they sold 783 kg of seed and 151,000 seedlings over a five month period.

11. ***Where and when*** *have the output(s) been validated?*

Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above ***(max 300 words)****.*

R6549 was active at six sites in four countries: Central and Western Kenya, SW Uganda, Uganda Lakeshore (Kampala peri-urban), northern Tanzania and Rwanda. In Rwanda, the project was active in several areas across the country: Byumba, Gisenyi, Kigali peri-urban, and Butare. Data on fodder shrub planting (see (20) below) was collected regularly from 2002 to late 2005 by project partners at these sites. The fodder shrub technology which the project was promoting is targeted specifically at poor smallholder farmers with dairy cows or dairy goats, specifically (a) those who are moving from semi-extensive grazing and tethering feeding systems to zero grazing as land holdings get smaller, and (b) those who are acquiring improved dairy animals from NGOs (e.g. Heifer International, World Vision, Farm Africa, Send-a-Cow) and need additional fodder as a condition for receiving them.

The greatest potential for fodder shrub promotion is in **high potential, hillside** and **peri-urban** production systems, corresponding to **smallholder rainfed humid** and **smallholder rainfed highland** farming systems.

Current Situation

C. Current situation

12. ***How and by whom*** *are the outputs currently being used? Please give a brief description* ***(max. 250 words****).*

The fodder shrub technology itself (Output 1) is being used by smallholder farmers to provide high-protein supplementary feed, mainly for dairy cows and goats. The shrubs are usually planted in otherwise under-utilised niches on the farm such as path sides, boundaries or along soil conservation structures. 500 shrubs provide enough supplementary feed for one crossbred dairy cow; a dairy goat needs about 100 shrubs.

While fodder for ruminants is the main use of these species, across the region, there is a range of other locally important uses. These include feed for non-ruminants, in particular chickens and rabbits, which are important food sources for the very poor: see (22); fuelwood; bee forage; soil conservation structures (see (24)); and stakes for climbing beans. The latter is particularly important in Rwanda and SW Uganda.

A survey of fodder shrub promotion in Kenya, Uganda, Tanzania and Rwanda, under R6549, identified 224 organisations which promote or have promoted fodder shrubs. These include community-based organisations,

international and national NGOs, government organisations, and private companies. An analysis of the factors affecting the impact of fodder shrub extension, as perceived by the organisations themselves, showed that the most important factor was that fodder shrubs met farmers' needs. Other key factors were that the fodder shrubs were profitable, that effective extension approaches were used, and that partnerships with other organisations facilitated success. This reflects several of the aspects given emphasis in the extension methodology developed during the project (Output 2).

The extension manual/DST (Output 3) was published in March 2006. Ten thousand copies were printed of which half have already been distributed. The book is targeted at extension providers, both managers and field staff. There has also been unexpectedly high demand from universities and agricultural colleges, and from the higher echelons of governments in the region, up to Permanent Secretary and ministerial level.

The manual is also available online, both through the DFID R4D portal:
http://www.research4development.info/projectsAndProgrammes.asp?OutputID=170899

and on the World Agroforestry Centre website:
http://www.worldagroforestrycentre.org/downloads/publications/PDFs/DST%20R6549-FTR-Phase%202%20Output%206-Wambugu%20et%20al%202006.pdf

13. ***Where*** *are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used* ***(max. 250 words).***

The demand for fodder shrubs continues to increase throughout the East African region, but at present adoption tends to be concentrated in areas where projects or organisations have focused on this technology. The highest rates of adoption are still in the Central Highlands of Kenya, where up to 20% of smallholders have planted fodder shrubs in some parts of the district. The geographical distribution of fodder shrub usage in Kenya and Uganda (2004-2005 figures) is shown in Maps 1 and 2 at the end of this document.

14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading ***(max 250 words).***

The first area in East Africa where the intensive use of calliandra and other fodder shrubs was promoted, during the mid-1990s, was Embu District in the Central Highlands of Kenya. At the time that Phase 2 was designed (2001) the popularity of calliandra had spread in Kenya from Embu to other parts of central Kenya [3] and its potential had been demonstrated by pockets of adoption in other parts of the region, including the Lake Victoria Basin (western Kenya and southern Uganda) and the area around Mt. Kilimanjaro in northern Tanzania. The uptake of the technology in these areas, and in Rwanda, has spread both through the project's activities (see (21)) and through many other projects and programmes (see (12)). A survey carried out in 2006 estimated that about 48,000 farmers have so far planted in Kenya, 33,000 in Uganda, 11,000 in Rwanda, and 8,000 in northern Tanzania: see (16) for more details. However, the number of smallholder dairy farmers using the technology is still a small fraction of those who could potentially benefit; the total recommendation domain for fodder shrubs is over two million smallholder dairy farmers in the East African region. The technology is also appropriate for farmers with improved breed dairy and meat goats, and for a range of other uses: see (12).

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? ***(max 350 words).***

We have identified several key factors accounting for the success of fodder shrubs:

- Demand from farmers is high, mainly because the shrubs save cash and need only small amounts of land and labour.
- The species promoted are fast growing and easy to establish and manage.
- Market access is relatively good in the areas where adoption has occurred, so farmers are able to sell surplus milk.
- Participatory methods were used to design the fodder shrub technology. Most on-farm trials were designed and managed by farmers, encouraging them to innovate and adapt the practice to their needs and circumstances.
- Partnerships between researchers, civil society organisations and extension have built local organisational skills and knowledge and helped reach large numbers of farmers. It is highly cost effective to mobilise existing partnerships (e.g. UGADEN *, networks developed through SCALE) as a vehicle for efficient scaling up.
- Dissemination through farmer groups, instead of to individual farmers, economised on extension resources and ensured greater farmer-to-farmer information exchange and dissemination.
- In Uganda, institutionalising project activities into local government development plans has helped to mobilise communities and to create a sense of ownership among beneficiaries. The devolution of governance to the village level has allowed decentralised Government structures at the sub-county level to allocate resources directly, including nurseries, demonstration plots and co-funding.
- Partner organisations giving livestock to farmers require them to plant fodder shrubs as a precondition. Heifer International and several other NGOs in the region operate schemes to provide improved dairy animals (cows or goats) to communities. They work exclusively through groups, which are also ideal entry points for fodder shrub promotion. The approach is essentially a loan scheme in which a group is made the guarantor of its members. Improved animals are given to a few members of the group, who then have to pass on the first female offspring to other members in the group. This approach is known as ‘passing on the gift’. The organisation operating the scheme usually requires farmers to have planted sufficient fodder to feed the animal before they can receive it, creating an instant demand for fodder shrubs. Partnerships with organisations using this approach have been very helpful in promotion and adoption of the technology itself (Output 1); and the extension approaches developed by the project (Output 2) have, equally, ensured that these partners have been able to deliver accurate and up-to-date extension messages.

* Uganda Agroforestry Development Network

[6] Franzel, S. Wambugu, C., Stewart, J., Cordero, J., and Sande, B.D. 2005. Fodder shrubs for improving incomes of dairy farmers in the East African highlands. In: O’Mara, F.P., Wilkins, R.J., and Mannetje, L.XX International Grassland Congress: Offered papers. Wageningen Academic Publishers. Wageningen, The Netherlands.

Current Promotion

D. Current promotion/uptake pathways

*16. **Where** is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion **(max 200 words).***

Fodder shrubs are being widely promoted in all four target countries, by a wide range of stakeholders. During 2005, ICRAF undertook a study [7] to estimate the total numbers of farmers planting fodder shrubs in the region. Estimated numbers of smallholder farmers planting in each of the four countries (figures updated as of 2006) are shown in Table 1. Data were also collected on the number and types of different organisations promoting fodder shrubs (Table 2).

[7] Franzel, S., Mawanda, F. & Aike, G. (2005). Estimating numbers of farmers planting fodder shrubs in East Africa. *The Prunus Tribune* **4**: 16-17. World Agroforestry Centre, Nairobi, Kenya.

Table 1. Estimates of numbers of farmers planting fodder shrubs in each country, 2006.

Country	No. of farmers planting according to our records	Rough estimate of additional farmers planting	TOTAL
Kenya	32,000	16,000	48,000
Uganda	23,000	10,000	33,000
Tanzania	5,500	3,000	8,500
Rwanda	6,800	4,500	11,300
TOTAL	67,300	33,500	100,800

Table 2: Number of organisations promoting fodder shrubs in each country, 2006.

	Uganda[1]	Kenya[1]	Rwanda[2]	Tanzania[3]	Total
Government	7	16	15	5	43
International. NGOs	15	10	21	1	47
National NGOs	8	13	17	5	43
Community-based org.	40	16	11	2	69
Private sector	10	5	2	2	19
Unknown	0	0	3	0	3
Total	80	60	69	15	224

1. The numbers include organizations buying fodder shrub seed from the national tree seed centres and with staff promoting fodder shrubs among farmers. Uganda data is for organisations buying seed from 1994 to 2005.
2. Organisations buying seed from the National Tree Seed Centre, 2000-2004, plus 13 other organisations known to be promoting fodder shrubs.
3. Organisations in the Arusha-Moshi-Kilimanjaro-Tanga areas promoting fodder shrubs

*17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. **(max 200 words)**.*

There are three main constraints limiting adoption:

1. Availability of planting material. We encourage farmers to leave some trees unpruned, for seed production, and this will gradually increase the amount of seed locally available. However, in areas where the use of shrubs is being introduced, external seed sources are needed. A study of the calliandra seed market [8] under R6549 showed that most production of calliandra seed for sale in Kenya is in Western Province, while the greatest shortages are in Central Province. The development of a functioning market has been hampered by the tendency of extension providers to give seed to farmers for free. A second problem relating to the seed market in Kenya is that current phytosanitary laws require seed dealers to be licensed, and this is too expensive for local agricultural input stockists or dairy societies to become involved in the sale of tree seed. In practice, the regulations are not enforced with regard to seed vendors in the informal sector (e.g. seed associations), but seriously inhibit uptake by the formal sector (e.g. shops and input stockists).

[8] Technoserve (2003). *Calliandra calothyrsus:* sustainable planting material distribution and marketing systems. Technoserve and World Agroforestry Centre, Nairobi, Kenya. Unpublished report. 63 pp.

2. Lack of knowledge about how to establish nurseries and plant and manage fodder shrubs. While the technology requires little labour and almost no land or capital, it is fairly “knowledge intensive” and does require skills that most extension staff and farmers do not have.

3. In some areas, poor access to milk markets limits the adoption of fodder shrubs. This is usually related to road access, but may also reflect local preferences, e.g. in northern Tanzania there is very little local market for milk, and it has to be sent to Dar-es-Salaam for sale. Even if a market is accessible, prices may be so low that the profitability of the dairy enterprise becomes marginal and there is no incentive to increase milk production.

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues ***(max 200 words).***

With regard to seed, our efforts to facilitate the emergence of private seed vendors in central Kenya have succeeded, showing that a sustainable supply and distribution of seed focusing on the private sector is feasible. This model needs to be replicated in other areas where uptake of fodder shrubs is high. At the national policy level in Kenya there is a need to relax the licensing requirements for local seed stockists. This will help give many more farmers access to planting material. There is also a need to discourage projects from producing seed and distributing it freely, because this serves a disincentive to private sector seed producers and vendors.

More effort is needed to build the capacity of trainers and farmers in establishing and managing fodder shrubs. The model promoted in this project, in which a single “dissemination facilitator” provided technical backstopping to many organizations in an area, was effective for promoting fodder shrubs.

Milk marketing constraints need to be addressed at the national level, both by increasing access to markets through improvements to roads, and by policies aimed at increasing local demand, encouraging export markets and value addition through processing.

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people?

(max 300 words).

The experience of R6549 was that the key to cost-effective scaling up was to focus our efforts on a range of different types of stakeholders who would themselves reach a large number of other people, giving a multiplier effect. This central concept could be applied at different levels, from extension providers to groups to individual farmers. By organising training workshops for extension partners working with smallholder dairy systems, a single dissemination facilitator can raise the profile of fodder shrubs on the development agendas of a wide range of stakeholder organisations, and provide accurate and appropriate information for them to incorporate in their own extension messages.

At the farmer level, working with common interest groups is clearly more efficient than targeting individual farmers. More importantly, it gives access, by definition, to motivated and/or innovative individuals who are more likely to pass the message on to others. Given the shortage of resources available for conventional agricultural extension in Africa, particularly in national government systems, spontaneous farmer-to-farmer dissemination is a vital part of the scaling up process. A study in central Kenya under R6549 found that about half of farmers receiving inputs (seed, information) from extension providers disseminated planting material to other farmers, and, on average, each passed on planting material to six other farmers. Moreover, a very few “master farmer disseminators” were actually responsible for most of the farmer-to-farmer dissemination taking place. A follow-up R6549 study characterised these master disseminators and proposed that future dissemination efforts focus on identifying them and supporting their promotion efforts.

In addition to effective targeting of dissemination activities, an enabling policy environment is crucial to successful promotion of fodder shrubs in East Africa. Our experience in Uganda, where governmental structures are highly decentralised, has been that advocacy at the local (district and sub-county) level has been very effective in mobilising support for fodder shrub promotion.

More recently, our experience with the SCALE approach (see (9)) highlights the effectiveness of civil society campaigns as complements to more conventional extension programs. Religious leaders, the media (radio, TV, the press), private input suppliers, local government administrators, and dairy companies each have a critical role to play in sensitizing and training farmers about new practices such as fodder shrubs. The SCALE approach brings these various actors together into a unitary planning process, enhancing the synergy of their individual efforts.

Impacts On Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

Several different kinds of impact studies were conducted. Farmer workshops were conducted in central Kenya, southern and southwestern Uganda at which farmers specified the kinds of impacts they were experiencing from growing fodder shrubs [4]. Formal household surveys were also conducted in the same three areas in which respondents specified impacts from fodder shrubs [4] [5]. The costs and returns of growing and feeding calliandra to dairy cows was assessed in four areas: central Kenya [5], western Kenya [9] and southern and south-western Uganda [4] Koech *et al*. (2005) [9] provide a summary of cost-benefit analyses at four sites, two in Uganda and two in Rwanda. However, impact can only be assessed once fodder shrubs have been adopted and used for some time, because it takes two years from planting for them to reach their full production potential. These analyses therefore focused on farmers who had been using fodder shrubs for several years (i.e. since before the start of the scaling-up phase of R6549).

[9] Koech, Mawanda, and Franzel, 2005. The profitability of using fodder shrubs to feed dairy cows in Kenya and Uganda. In: Franzel, S. The adoption and impact of fodder shrubs in East Africa. External Program and Management Review. ICRAF, Nairobi.

Concurrently, during Phase 2 of R6549, fodder shrub uptake arising directly from the project's activities was regularly monitored in all six project areas: see (21). The potential impact directly attributable to R6549 can be estimated by applying the results of the impact studies to this data.

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) ***(max. 500 words):***

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*

The increase in milk production is typically around 1-2 litres/day for a crossbred dairy cow being supplemented with fodder shrubs at the recommended rate of 25% of the diet. This increase is realised within 1-2 weeks of starting to feed fodder shrubs. This increase is large enough to be clearly perceptible to farmers, and this has greatly contributed to the high levels of adoption of the technology. Increased milk production contributes, firstly, to the household's ***financial*** livelihood assets. The economic impact assessments under R6549 found that farmers with 500 fodder shrubs could realise the profits shown in Table 3. In general, it is slightly more profitable to use fodder shrubs as a substitute for commercial concentrates (thereby saving on the purchase cost of these) than to use them simply as additional supplementation to the previous diet.

Location	Increase in income ($US per year)	
	Substitution strategy	Supplementation strategy
Embu, Kenya, 2003	101	62
Kisumu, Kenya, 2004	122	115
Makono, Uganda, 2003	112	93
Kabale, Uganda, 2003	102	72
Mean	109	85
Overall mean=97		

Table 3: Annual increases in income for farmers with 500 fodder shrubs, at different locations and using different strategies

The increase in milk production translates into ***human*** as well as financial assets. Milk consumption in the home increases, particularly for children, with clear health benefits. The extra income is often used for school fees, another human livelihood asset, and for ***physical*** assets such as improved water supply, sanitation or housing.

In addition to their primary role of leaf production, fodder shrubs can have an important role in soil conservation, particularly in contour planting on steep slopes, and in this way contribute to the farmer's ***natural*** assets.

The extension approach which we have used, with its emphasis on group approaches, contributes to farmers' ***social*** assets through development of wider and more effective networks of social interactions. Social capital can also be acquired through the status associated with a successful farm enterprise, and through becoming a disseminator of knowledge and planting material to other farmers.

- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*

The principal beneficiaries have been the **moderate poor.** By definition, some land is needed to grow fodder shrubs, and most adopters also have one dairy cow or a few dairy goats (though some keep only rabbits or chickens, or have no animals but grow fodder to sell to other livestock keepers). In all the project areas there are significant numbers of female- and child-headed households, owing to the high incidence of HIV/AIDS and malaria. We do not have data on participation of children. As stated in (10) above, at the project sites where gender data is available (Western Kenya, Central Kenya and Uganda Lakeshore), the proportion of women planting fodder shrubs was 54%, 43% and 57% respectively..

- *Indicate the number of people who have realised a positive impact on their livelihood;*

The number of farmers who planted fodder shrubs during the implementation of R6549, and whose activities are directly attributable to the project outputs at each of the six project sites, is summarised in Table 4.

	No. of farmers planting	No. of shrubs planted	Average no. of shrubs/farmer
Western Kenya	1802	183800	102
Central Kenya	2100	200000 (est.)	100 (est.)
South-west Uganda	585	185629	317
Uganda Lakeshore	1856	22800	12*
Rwanda	300	90300	301
Tanzania	742	100400	135
TOTAL	**7385**	**c. 780,000**	**135**...

Table 4: Fodder shrub planting directly attributable to R6549

* This figure is a considerable underestimate: it does not include plants raised from seed, which at this site was the main method used.

... Excluding unrepresentative data from Uganda Lakeshore

The mean profitability of about $US100/year calculated from the economic impact assessment data assumed 500 fodder shrubs per farmer. The data on planting in Table 4 shows a mean of only 135 plants per farmer, but this is to be expected as we worked in areas with relatively little previous exposure to fodder shrubs, so uptake and adoption are still at an early stage. Nonetheless, the planting already in place translates to a mean profit of around $US25/farmer: a total of $US180,000/year across all the participating farmers.

- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

An increase of 1-2 litres of milk per day represents about 10-20% additional production.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? ***(max 300 words)***

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

Fodder shrubs contribute direct environment benefits in addition to their primary role of fodder production. As they are deep-rooting woody perennials, their roots have an important role in soil conservation. When managed for fodder in hedges planted across the contour of slopes, they can significantly reduce soil erosion. Moreover, most of the main fodder species are leguminous, and transfer nitrogen fixed from the atmosphere to the soil.

Fodder cultivation can also reduce pressure on natural vegetation, and help to sustain biodiversity, by reducing the need to collect wild material from the 'bush'.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? ***(max 100 words)***

Shrubs are generally deeper-rooting than annual crops so there is little below-ground competition with most species. Mulberry, however, can compete adversely with crops so care is needed in choosing where to plant this species.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? ***(max 200 words)***

There are two ways in which fodder shrubs can act as a buffer to the effects of climate change. Both relate to the

increasingly erratic and unpredictable rainfall patterns now being experienced in East Africa.

- As droughts become more frequent, fodder shrubs offer a coping mechanism by providing green foliage after shallower-rooting herbaceous plants have died. This is true particularly of the species adapted to semi-arid conditions (see (7)).
- At the other extreme, hedgerows of shrubs planted on sloping land protect against soil erosion during flood events.

Annex

Adoption Maps

Click below to view the related document ....

PF_FRP43_Annex.pdf
