More trees, more milk, more money

Shortage of fodder places a major constraint on livestock enterprises in the tropics, particularly during the dry season. This gap can be filled by leguminous trees and shrubs, which provide year-round, protein-rich animal fodder. The World Agroforestry Centre has successfully introduced improved fodder trees to small-scale farms in several parts of Africa. When they grow the trees, farmers can save both money and time, since they have less need to buy in feed or walk long distances herding cattle or collecting fodder. Fodder shrubs also provide fuel-wood, fencing stakes, and bee food, as well as improving soil fertility and controlling erosion. The technology has been particularly well accepted in East Africa, where is has been adopted by more than 200,000 smallholder dairy farmers. Most have gained significant benefits in terms of increased milk production and income as a result.

Key facts and figures

- By 2006, 224 organizations were counted across Kenya, Rwanda, northern Tanzania and Uganda promoting fodder shrubs, and some 205,000 farmers had successfully planted fodder shrubs on their farms.
- Trials demonstrated that a farmer with 500 fodder shrubs (enough to feed one dairy cow) could increase net income by US$62 to $115 per cow per year, beginning in the second year after planting.
- Net benefits accruing to adopters of fodder shrubs in Kenya alone between 1993 and 2008 were estimated at between US$19.7 million and $29.6 million.
Background

Rising incomes and growing urban populations in East Africa (particularly Kenya) are creating an ever-greater demand for milk. A large proportion of the current demand is met by smallholder dairy farmers, who typically own between one and three cows on farms of 0.5–1.5 hectares. The cows are usually stall-fed and it is often the job of the women to cut and carry fodder for them. Although milk production rose during the 1990s at a rate of 4.1% per year in Kenya and 2.6% in Uganda (Ngigi, 2004), productivity remains very low due mainly to the scarcity of feed resources.

To address this constraint, the World Agroforestry Centre began working in the early 1990s with the Kenya Agricultural Research Institute (KARI) and the Kenya Forestry Research Institute to test and introduce leguminous fodder trees (particularly Calliandra and Leucaena spp) to the dairy farmers of the East African highlands. The research (based at Embu in Kenya) built on an International Livestock Research Institute (ILRI)-KARI initiative to introduce fodder shrubs to Kenya’s coastal region. The objective was to improve the quantity and quality of feed resources and raise incomes for the several million small-scale dairy farmers in the highlands.

However, little was known about how management affected shrub growth and sustainability in a highland agro-ecological zone, how different proportions of fodder shrubs in the diet affected milk yield from the dairy cattle breeds found there, how the shrubs could best be grown on the small farms of the region, and how best to multiply seed and establish shrubs on farms. Place et al. (2009) describes the research undertaken and the dissemination processes that unfolded, as well as providing an analysis of the adoption and impact of the technology. This Brief provides a summary of the full report.

Adoption of fodder shrubs

The uptake of fodder shrubs has been substantial. By 2006, about 10 years after dissemination began in earnest, 224 organizations were counted across Kenya, Rwanda, northern Tanzania, and Uganda promoting fodder shrubs, and some 205,000 farmers had successfully planted fodder shrubs on their farms (Table 1). While most farmers planted fewer than the 500 shrubs needed to feed a single dairy cow throughout the year, many continued to plant incrementally, expanding the area of trees on their farms over successive years.

Farmers were keen to introduce the technology because it is relatively low-cost and easy to use, effective in raising milk yields, and can replace expensive dairy-feed concentrates. However, researchers found that the farmers needed some technical training, for example on where to plant, how to prune, and how to grow new trees from seed. The spread of the technology has thus been facilitated greatly by other projects, non-governmental organizations (NGOs), and extension staff through group training; as well as by farmers disseminating seed and seedlings to other farmers on their own initiative. The focus on identifying and training farmer innovators has contributed a large number of additional adopters. The experience yielded five main lessons for successful dissemination (see box).

About half of the farmers planting the shrubs were women and several major dissemination efforts have purposefully targeted them. Women have benefited particularly from having greater feed resources available on the farm, since they lack cash for buying high-protein concentrates and can use their time more profitably if they do not have to collect fodder from far afield. However, women often have little control over the income from dairy or other farming activities in which they participate, and focus group discussions revealed that continued efforts to reduce gender inequalities will be necessary.

### Table 1. Number of farmers planting fodder shrubs (1995–2005)

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of organizations promoting fodder shrubs</th>
<th>Project records of number of farmers planting</th>
<th>Rough estimate of additional farmers planting</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>60</td>
<td>51,645</td>
<td>30,000</td>
<td>81,645</td>
</tr>
<tr>
<td>Uganda</td>
<td>80</td>
<td>77,369</td>
<td>5,000</td>
<td>82,369</td>
</tr>
<tr>
<td>N. Tanzania</td>
<td>15</td>
<td>17,519</td>
<td>10,000</td>
<td>27,519</td>
</tr>
<tr>
<td>Rwanda</td>
<td>69</td>
<td>9,590</td>
<td>4,400</td>
<td>13,990</td>
</tr>
<tr>
<td>Total</td>
<td>224</td>
<td>156,123</td>
<td>49,400</td>
<td>205,523</td>
</tr>
</tbody>
</table>

1 Calculated from random sample surveys and reports from participating organizations, mostly during 2004–2005

2 Conservative estimate from areas not included in surveys
Impacts on milk production and income

Farmers use fodder shrubs in two ways. Firstly, as a substitute for expensive high-protein feeds such as purchased dairy meal, in which case the objective is to reduce costs; and secondly as a supplement to their existing feeds, when the objective is to increase milk production. On-farm controlled feeding trials indicated that feeding 1 kg dry equivalent of fodder shrubs increased milk production by 0.6–0.8 kg per day. The trials demonstrated that a farmer with 500 fodder shrubs (enough to feed a dairy cow at the rate of 6 kg fresh leaves, equivalent to 2 kg of dried leaves per day per year) could increase net income by US$62 to $115 per cow per year, beginning in the second year after planting. The range in estimates is largely a function of milk prices, which vary considerably across the highlands.

A more recent study found that farmers actually use a number of different feeding strategies, so the researchers attempted to isolate the shrub impacts from those of other feeds using econometric analysis. They found that 6 kg of fresh shrubs had a mean impact of an additional 0.7 kg of milk per day, controlling for other feeds. Farmers in the study sites fed fodder shrubs for between 70 and 119 days (median and mean) and the effect on the average annual household income was calculated to be about US$35 net of costs. Using a range of values for the impact per household per year, it was estimated that the net benefits accruing to adopters of fodder shrubs in Kenya between 1993 and 2008 was between US$19.7 million and $29.6 million.

Conclusions

The results of the several studies confirm that fodder shrubs have a significant impact on milk production. While on-farm feeding trials have found that 1 kg of calliandra increases milk production by 0.6–0.8 kg, a survey of farmers’ perceptions in Kenya found the effect to be about half as large after controlling for the effects of breeds, season, and other feeds. Whether the effect is the lower or higher estimate, the overall impact of the shrubs in terms of additional net income from milk is large, at US$19.7 million to $29.6 million in Kenya alone over the past 15 years.

To achieve these benefits, the World Agroforestry Centre invested an estimated US$4.7 million in fodder shrub research and scaling up between 1988 and 2007. This figure includes all staff and operating costs in the East African field sites and some backstopping support from headquarters. Much of this was funded by restricted grants, with unrestricted funds as a supplement, notably for staff time. The figure underestimates the total amount devoted to fodder shrub research in the region, as national partners also allocated funds, as did ILRI. Nevertheless, it is clear that the World Agroforestry Centre has played an important role in developing fodder shrubs as a viable technology in East Africa and catalyzing its scaling up, with significant benefits accruing to smallholders.

Critical elements for successful dissemination

- Large NGO promoters were important to extend the reach of the technology. Some organizations were promoting agroforestry while others promoted dairy production.
- Civil society campaigns created awareness and led to demand from farmers for training as well as bringing stakeholders together to plan and align their efforts.
- Supporting seed vendors with training and linking them to buyers was necessary to overcome the constraint of seed availability.
- Dissemination facilitators increased the effectiveness of the extension providers by supporting them with training, information, and access to seed; facilitators were usually employed through donor-financed projects.
- Farmer-to-farmer dissemination played a critical role in disseminating seed and information.

Additional studies are recommended to improve understanding of the use and impact of fodder shrubs in the region, especially in Rwanda, Tanzania, and Uganda. The technology has been disseminated only recently, so farmers are still learning how to use the fodder shrubs in combination with other feeds. Following up on how impacts through farmer-to-farmer dissemination may differ from those of dissemination by specialized facilitators or projects is important for advising future dissemination efforts. The
issue of how women have benefitted from the technology is not fully settled, and qualitative research undertaken in this study indicated that a quantitative follow-up study would be valuable. Finally, several previous studies have identified additional benefits from fodder shrubs worth investigating. These include the feeding of shrubs to other animals such as dairy goats, rabbits, and chickens; as well as the marketing of fodder shrubs and leaf meal produced from the shrubs as enterprises in themselves.

References


Key research partners
Key research partners, in addition to those mentioned above, included the Ugandan National Agricultural Research Organisation, the Rwanda Agricultural Research Institute, Selian Agricultural Research Institute of Tanzania, the Natural Resources Institute (UK), and the Oxford Forestry Institute (UK). The main investors included the Swedish International Development Cooperation Agency, the Systemwide Livestock Programme, the UK Department for International Development, and the United States Agency for International Development.