

# Fodder shrubs for improving incomes of dairy farmers in the east African highlands

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## Dairying is a key farm enterprise

Dairying is an important economic enterprise in the coffee zone of central Kenya, where farm sizes average 1–2 ha and about 80% of the farmers own one or more dairy cows or goats. In 1997 dairy farming accounted for 30% of the value of output on smallholder dairy farms in central Kenya. This proportion has most likely increased in recent years with the decline in the coffee industry. Smallholder dairying is also a rapidly growing enterprise in western Kenya and in the highlands of neighbouring countries such as Tanzania, Uganda and Rwanda. Dairying provides the household with cash and improved nutrition, as well as manure for improving crop production.

In central Kenya, dairy farmers practise zero-grazing, growing napier grass (*Pennisetum purpureum*) on small plots to feed their confined animals. Farmers keep a portion of milk for their families and the rest is sold, providing much-needed income for everything else from staples like sugar, flour and rice to medicine, clothing and school fees. Unfortunately, the acute protein shortage in the feed ration of cows reduces milk production and forces many farmers to spend some of that precious income on commercial dairy meal supplements.

## Researchers and farmers develop fodder shrub options

In the early 1990s on-farm trials were started in Embu District by the National Agroforestry Research Project, a collaborative project implemented by the Kenya Agricultural Research Institute Regional Research Centre, Embu (KARI-Embu), the Kenya Forestry Research Institute (KEFRI) and the World Agroforestry Centre (ICRAF). Among the indigenous and exotic species tested, farmers and researchers identified *Calliandra calothyrsus*, a leguminous fodder shrub originating from Central America, as the most promising species that could be grown on farms and used to substitute for commercial dairy meal.

Because of the limited size of farms in the highlands of central Kenya, researchers and farmers have focused on integrating calliandra into the existing cropping system rather than planting the shrub in pure-stand fodder banks. On-farm trials confirmed that calliandra could be planted between upperstorey shrubs on farm boundaries, in hedges around homesteads, on contour bunds and in lines in napier grass. On-farm feeding trials have confirmed the effectiveness of calliandra as both a supplement to the basal diet and as a substitute for dairy meal. One kilogram of dry calliandra has the same amount of digestible protein as about 1 kg of dairy meal. On fresh weight basis, 3 kg of calliandra is equivalent to about 1 kg of dairy meal, and the effects of calliandra and dairy meal were found to be additive, suggesting that the two feeds are nutritionally interchangeable. Project research results indicate that a farmer would need about 500 shrubs to feed a cow throughout the year at a rate of 2 kg dry matter (6 kg fresh material)

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a day. In fact, a typical farm of 1.5 ha can easily find space for 500 shrubs along internal and external field boundaries, along contour bunds, or around the homestead (Paterson et al. 1998; Roothaert et al. 2001).

Fodder shrubs are also appropriate for dairy goats, a rapidly growing enterprise in central Kenya that is especially suited to poor households. A household needs about 100 fodder shrubs to supplement the base feed of a dairy goat throughout the year.

Researchers and farmers are seeking to diversify fodder sources by testing other fodder shrubs and herbaceous legumes. In Kenya extension staff have recently begun disseminating *Leucaena trichandra*, an exotic shrub species, *Morus alba* (mulberry), a naturalised shrub, and *Desmodium intortum*, a herbaceous legume. At KARI-Embu researchers are testing indigenous fodder species but none has so far proved suitable for cultivating under intensive management on farms.

### Farmer management and innovations

Farmers usually produce seedlings of calliandra and leucaena in group nurseries and transplant them onto their own individual farms. The shrubs grow rapidly and by the end of the first year are ready to be pruned for feeding to livestock. Most farmers grow the trees in hedges, cutting them at a height of about 1 m and trimming several shrubs per day to obtain leaves for their livestock. Keeping the shrubs at a height of 1 m or lower ensures that they do not shade adjacent crops. Calliandra and leucaena leaves may be fed fresh or dried and stored. Mulberry is planted using cuttings.

Farmer experimentation in the early 1990s was helpful in identifying the niches on farms where farmers could successfully plant fodder shrubs. For example, farmers demonstrated that calliandra could be successfully grown between *Grevillea robusta* trees along boundaries and intercropped between rows of napier grass. In one case feedback on a farmer innovation has resulted in a change in extension recommendations. Farmers in Kandara Division, Maragua District, conducted experiments on soaking of calliandra seeds before planting and found that seeds soaked for 48–60 hours had higher germination rates than those soaked for the recommended 24 hours. Researchers at KARI-Embu confirmed the farmers' findings, and extension staff now recommend the longer soaking time.

### Benefits for farm households

Planting fodder shrubs does not involve any cash costs. Rather, it allows farmers to substitute small amounts of land and labour for cash that would otherwise be needed for purchasing dairy meal. Farmers value the fodder shrubs as a supplement to their basal feeds or as a partial substitute for commercial dairy meal, which they find to be expensive and of unreliable quality. The shrubs are also useful for conserving the soil, supplying firewood and providing bee forage needed for honey production. Some farmers are also earning money from selling seeds. When used as a supplement, fodder leaves may also improve animal health and reduce the calving interval. On the negative side fodder shrubs may slightly reduce the yields of adjacent crops. However, if trimming of the shrubs is timely, as is the case in nearly all farms, then this effect is negligible.

Between 1996 and 1998 farmers in central Kenya planting about 500 calliandra shrubs earned an additional US\$130 per year from their dairy enterprises beginning in the sec-

ond year after planting. The benefits were the result of either increased milk production or savings from reduced dairy meal purchases. On average each household has about 1.7 cows, so the potential increase in earnings per household is about US\$220, or about 10% of household income. There are about 625,000 smallholder dairy farmers in Kenya. Therefore, the potential benefits from adopting calliandra or similar fodder shrub species in Kenya's smallholder dairy sector amount to about US\$137 million per year.

### **Scaling up the benefits to reach more farmers**

During 1999–2001 KARI, ICRAF and the International Livestock Research Institute (ILRI) collaborated in a project supported by the Systemwide Livestock Programme (SLP) of the Consultative Group on International Agricultural Research (CGIAR) to scale up the use of fodder shrubs in central Kenya. A project extension facilitator, working with a range of government and NGO partners, assisted 180 farmers' groups comprising 3200 farmers across 7 districts to establish nurseries and plant fodder shrubs. The approach proved to be very effective in facilitating the spread of the practice. By 2002 each farmer had an average of 340 shrubs and each had given information and planting material (seeds or seedlings) to an average of six other farmers (Wambugu et al. 2001).

Sixty percent of the participating farmers in central Kenya were women. However, surveys showed that female-headed households planted fewer fodder shrubs than male-headed households and the shrubs had lower survival rates, probably because of labour shortage.

A project financed by the Forestry Research Programme of DFID (UK Department for International Development) and implemented by the Oxford Forestry Institute and ICRAF is helping a range of partner organisations to increase the adoption of fodder shrubs in five countries: Kenya, Uganda, Rwanda, Tanzania and Ethiopia. By early 2003 about 22,000 farmers were planting fodder shrubs in Kenya and several thousand in the other countries. Facilitators are helping to train the extension staff of a range of different organisations, including government institutions, NGOs, churches, community-based organisations, farmers' groups and private sector firms. The project is also helping to facilitate the development of private seed producers and dealers and to help link them to areas where seed demand is high.

### **Research on the dissemination process**

Both the projects financed by SLP and DFID have included important research activities to understand and promote the adoption and dissemination of fodder shrubs. Franzel et al. (2002) assessed the variables associated with the adoption of fodder shrubs. The importance of the dairy enterprise in the household was strongly associated with adoption. Place et al. (2002) reported on methodological issues in assessing group performance and factors associated with performance. Technoserve and ICRAF staff examined the chain of stakeholders involved in producing, marketing and distributing fodder tree seed, and prospects for enhancing the role of farmers and private traders in seed production and marketing. Another recent study assessed the factors associated with farmer-to-farmer dissemination, that is, who in a community extends planting material and information about fodder shrubs to other farmers. Over half of the farmers had disseminated the practice to others. Disseminating to others was positively associated with numbers of fodder shrubs on the farm, numbers of farmers growing fodder shrubs in the district and

visits from extension. Variables not associated with dissemination to others included wealth level, gender, age, level of education and whether a farmer had a nursery.

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