

Fodder Shrubs for Increasing the Incomes of (Peri)urban Livestock Owners

In Kenya, there are about 650,000 smallholder dairy farmers and most are near cities and towns, where milk demand is high and marketing costs are relatively low. Milk is highly perishable, which is a primary reason why it is produced in and around urban areas.



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Sixty percent of participating farmers in central Kenya were women

Dairying is an important economic enterprise in urban and periurban areas of East Africa. Approximately 80% of dairy animals in central Kenya are kept in confined systems. The importance of the dairy enterprise in smallholder farms has increased in recent years due to liberalisation in the dairy sub-sector in Kenya, which has resulted in redistribution and an increase of the overall social and economic benefits of market-oriented smallholder dairying (Omoro et al., 1999). In 1997, the dairy sector accounted for 30% of the value of output of smallholder dairy farmers in central Kenya; this proportion has likely increased in recent years with the decline of the coffee industry. Smallholder dairying is also a rapidly growing enterprise in periurban areas of western Kenya and in the highlands of neighbouring countries, such as Tanzania, Uganda, and Rwanda. Dairy production provides the household with cash and improved nutrition, as well as manure for improving crop production.

The farms in urban and periurban areas are small, making the feeding of the dairy animals a major constraint. Most dairy farmers practice zero-grazing, growing napier grass (*Pennisetum purpureum*) on small plots and feeding it to their confined animals. Farmers keep a portion of milk to feed their families and the rest is sold, providing much-needed income for everything from staples like sugar, flour and rice to medicine, clothing and school fees.

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The main feed source for dairy cows is napier grass supplemented during the dry season with crop residues. Research conducted in Embu area by Murithi in 1998 found that 45% of the farmers buy commercial dairy meal (which is composed mainly of maize bran, wheat bran, cotton seed cake, soybean meal, and fish meal and is nominally 16% crude protein) to supplement their cows' diet. However, farmers often complain that the price of dairy meal is high and that they lack the cash to buy it, and that it is difficult for them to transport dairy meal from the market to the homestead. Many also have doubts about its nutritive value, because of scandals in Kenya concerning fraudulent maize seed and agrochemicals sold to farmers (Franzel et al., 2004).

Unfortunately, acute protein shortages reduce milk production and force many farmers to spend some of their precious income on commercial dairy meal supplements. Fast-growing shrubs and herbaceous legumes have the potential to alleviate the farmers' feed problems. Fodder from these shrubs is rich in protein and, unlike the grass species, the shrub leaves maintain their levels of protein even during the dry season.

FODDER SHRUB OPTIONS

In the early 1990s, on-farm trials started in Embu District by the National Agroforestry Research Project, a collaborative project implemented by the Kenya Agricultural Research Institute, Regional Research Centre, Embu, the Kenya Forestry Research Institute, and the World Agroforestry Centre. Among the indigenous and exotic species tested,

farmers and researchers first identified *Calliandra calothyrsus*, a leguminous fodder shrub originating in Central America, as the most promising species that could be grown on farms and used as a substitute for commercial dairy meal. Other species later introduced and evaluated by farmers include *Leucaena trichandra*, *Morus alba* (mulberry), *Chamaecytisus palmensis* (tree lucerne) and a herbaceous legume, *Desmodium intortum*.

Due to the limited size of farms, researchers and farmers have focused on integrating the fodder shrubs into the existing cropping system, rather than planting them in pure-stand fodder banks. On-farm trials confirmed that the fodder shrubs could be planted between upper-storey 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 fodder shrubs both as a supplement to the basal diet and as a substitute for dairy meal. For example 1 kg of dry calliandra was found to have roughly the same amount of digestible protein as about 1 kg of dairy meal. On a fresh weight basis, 3 kg of calliandra gives similar results in milk production as 1 kg of dairy meal. The effects of calliandra and dairy meal were found to be additive, suggesting that the two feeds are nutritionally interchangeable. Project research indicates that a farmer would need about 500 shrubs to feed one cow throughout the year at a rate of 2 kg dry matter (6 kg fresh material) a day (Roothaert et al., 2001). The average smallholder dairy

farmer in central Kenya has 1.7 cows and those with fodder shrubs have about 340 (Wambugu et al., 2001). In fact, a typical periurban farm of 0.4 ha and one cow could easily find space for 500 shrubs along internal and external field boundaries, along contour bunds, or around the homestead. Researchers and farmers are seeking to diversify fodder sources, by testing other fodder shrubs and herbaceous legumes. In the East African region the extension staff have recently begun disseminating *Leucaena trichandra*, an exotic shrub species, *Morus alba* (mulberry, a naturalised shrub), and *Desmodium intortum*, a herbaceous legume.

FARMER MANAGEMENT AND INNOVATIONS

Periurban farmers usually produce seedlings of calliandra and trichandra in group nurseries and transplant them onto their own individual farms. Others purchase the seedlings from commercial nursery operators or manage their own on-farm nurseries. 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 metre and trimming several shrubs per day in order to provide leaves for their livestock. Keeping the shrubs at a height of 1 metre or lower ensures that they do not shade the adjacent crops. Calliandra and trichandra leaves may be fed fresh or dried and stored. Mulberry is planted using cuttings.

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, for supplying firewood and for providing bee forage needed for honey production. Some farmers earn money from the sale of seed. Calliandra is also appreciated as an ornamental, an important characteristic for urban and periurban farmers. 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 the shrubs are trimmed in a timely fashion, as they are on nearly all farms, then this effect is negligible.

In 2001, farmers in central Kenya with about 500 calliandra shrubs earned an additional \$US 98 to \$US 124 per year from their dairy enterprises by growing calliandra, beginning in the second year after planting. The benefits were the result of either increasing their milk production or in savings from reducing their purchases of dairy meal. The potential benefits if 20% of Kenya's smallholder farmers adopted calliandra or similar fodder shrub species in Kenya's smallholder dairy sector would amount to about US \$ 104-132 million per year. These estimates depend in part on increasing milk demand, which is expected to be strong because of increases in population and incomes. Omore et al. (1999) projected that milk demand would increase by 58% to 73% between 1998 and 2010.

SCALING UP THE BENEFITS TO REACH MORE FARMERS

During 1999-2001, KARI, ICRAF, and the International Livestock Research Institute collaborated in a project of the Systemwide Livestock Programme (SLP) of the 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 farmer groups comprising 3200 farmers across 7 districts to establish nurseries and plant fodder shrubs. The approach proved to be very effective for 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). Most of these farmers could be termed urban or periurban, as their proximity to cities and towns provides markets for their milk.

Sixty percent of participating farmers in central Kenya were women. However, surveys showed that female-headed households planted fewer fodder shrubs than male farmers and had lower survival rates, probably because of labour shortages. A project financed by the Forestry Research Program of DFID (UK

Farmer experimentation has been helpful in providing new innovations that have spread to other farmers. In one case, feedback on a farmer innovation has resulted in a change in extension recommendations. Farmers in Kandara Division, Maragua District, Kenya, conducted experiments on soaking calliandra seeds before planting and found that seeds soaked for 48 to 60 hours in water at room temperature had higher germination rates than those soaked for the recommended 24 hours in hot water. Researchers confirmed the farmers' findings and extension staff now recommend the longer soaking time. This has also an added advantage since farmers sometimes kill the seeds by accidentally boiling them.

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. Facilitators are helping to train the extension staff of a range of different organisations, including government, NGOs, churches, community-based organisations, farmer groups and private sector firms. The project is also helping to link seed production with demand. Seeds are available in certain rural localities, such as western Kenya and south-western Uganda but demand is highest in periurban areas around cities, such as Nairobi, Kampala, and Kigali, where the dairy sector is rapidly increasing. The project is helping to facilitate the development of private seed producers and dealers, and to help link them to periurban areas where seed demand is highest. The SLP- and DFID-financed projects are providing important lessons about how to scale up the adoption of fodder shrubs. We are confident that sharing these lessons will help increase the contributions that agroforestry makes to improving urban and rural livelihoods.

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