Farmer experiences in the production and utilisation of fodder trees in Zimbabwe: constraints and opportunities for increased adoption

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Abstract

Availability of adequate good quality fodder is a major constraint to animal production in Zimbabwe, especially in the smallholder dairy sector. Strategies to alleviate this problem have included the use of commercial protein sources, and herbaceous and tree legumes as supplements to crop residues and native pasture, the resources that form the major feed base. During the 1994–95 cropping season, the International Centre for Research in Agroforestry (ICRAF) in Zimbabwe introduced leguminous fodder trees to smallholder dairy farmers in the Chikwaka Communal Area of Zimbabwe. Subsequently, studies were carried out to determine the level of integration of fodder trees into feeding systems in this farming sector and to identify the opportunities for and constraints to the use of this feed resource. Formal and informal surveys were conducted to examine farmers’ views on the agronomic, nutritional and economic performance of the tree-based fodder bank technology. Five years after the introductory plantings, the number of farmers with fodder trees on their farms had increased more than 15-fold. In addition, farmers had generally increased the number and types of fodder trees on their farms. Nevertheless, farmers faced constraints in the production and utilisation of the fodder trees; the major problem was uncontrolled browsing from other farmers’ animals. Moreover, poor agronomic performance was reported for some species and farmers lacked information on ration formulation using the fodder trees. Farmers’ strategies to cope with some of the problems and activities undertaken within the ICRAF project and by its partners to facilitate adoption are highlighted in this paper.

Introduction

The productivity of livestock in Zimbabwe and other tropical countries is constrained by the lack of adequate good quality fodder, especially during the dry season. Native pasture and crop residues, the major feed resources in the smallholder livestock production systems in Zimbabwe, have insufficient nutritional value to support acceptable levels of livestock production. The most limiting nutrient is protein, and it is necessary to feed protein supplements to all classes of livestock to reduce losses in productivity. In the smallholder dairy sector, protein supplements are required throughout the year. Studies assessing the performance of cows in smallholder dairy schemes concluded that shortages of both protein- and energy-rich feeds were major constraints to the productivity of animals in this sector (Dube 1995; Mupeta 1995). While farmers successfully grow grasses [napier grass (Pennisetum purpureum), Bana, Cynodon spp., Chloris gayana] and ensile maize as sources of energy, they still buy protein concentrates to meet the protein requirements of their cows. The use of purchased concentrates adversely affects profitability of the dairy enterprise. The Zimbabwe Government, through the Dairy Development Programme (DDP), encourages farmers to grow protein banks of both herbaceous and tree legumes on their farms. Herbaceous legumes like Macroptilium atropurpureum, Stylosanthes guianensis and Chamaecrista rotundifolia have been grown with limited success; however, these
legumes have not been productive and have failed to persist under the low levels of management that exist on smallholder farms.

During the 1994–95 cropping season, through the ICRAF project in Zimbabwe, tree forage legumes were introduced to farmers in the Chikwaka Dairy Scheme following requests from both extension staff and farmers. Initially, 6 farmers were involved and planted the trees in conjunction with researchers. In subsequent years, farmers were supplied with seed and seedlings but were given no assistance with planting. Despite this, the number of farmers planting fodder trees increased. Two surveys and a farmer feedback workshop were undertaken to obtain data on the performance of the tree legumes and to determine the level of integration of this feed resource in the livestock feeding systems in Chikwaka.

The specific objectives were to:

a. Determine the numbers of farmers planting trees and the species planted, and identify farmers’ problems in the establishment, management and feeding of the fodder trees;
b. Explore the reasons for adoption of particular feed technologies, including tree legumes, by farmers in the Chikwaka Dairy Scheme; and
c. Enable farmers to share information amongst themselves and with other stakeholders (research and extension staff) with regard to the production and utilisation of tree legumes as fodder.

Materials and methods

Site characteristics

Farmers involved in the 2 household surveys and the feedback workshop were members of the Chikwaka Dairy Association, Chikwaka Communal Area. Chikwaka Communal Area lies about 50 km north of the capital city, Harare, in agro-ecological region II, a zone with an average annual rainfall of 800–1000 mm. The rain falls from October to April, while the rest of the year is dry. Mean temperatures range from 5°C in June–July to 35°C in October, with ground frost occurring each year (Burgers et al. 1997). The soils are mainly granite-derived sands of low fertility.

The population density of Chikwaka is about 33 persons/km², slightly above the national average of 29/km² for communal areas in the same agro-ecological zone (Moyo 2001). The average household size is about 5.5 persons and each household has an average of 4.6 ha of arable land. There is significant migration to Harare by the adult population in search of employment (Burgers et al. 1997).

The farming system in Chikwaka is mixed crop-livestock and the major crop is maize. Other crops grown include groundnuts, sunflower, cotton and tobacco. In addition, farmers grow vegetables, mainly during the dry season. The livestock kept are cattle (both beef and dairy), poultry and goats; about 59% of all farmers own cattle (Burgers et al. 1997). Beef cattle are grazed in communal grazing areas while dairy cattle are grazed near homesteads and have access to planted grass pastures. Forages like bana and napier grass are harvested and fed to dairy animals but not to beef cattle. In addition, dairy animals are fed crop residues, purchased concentrates and maize grain.

Chikwaka Dairy Association

The Chikwaka Dairy Association was formed in 1984 and had 170 members at the beginning of the second household survey in 1999. Membership of this association is voluntary, although members pay a relatively high joining fee and pay annual subscription fees. With the assistance of the DDP, a milk collection centre has been established where farmers can sell their milk. The farmer most remote from the milk collection centre is about 25 km away. Before they can produce milk for sale at the centre, farmers are required to have planted pastures and have a specified milking shed. Farmers can obtain protein and mineral supplements and medicines on credit from the centre. A Liaison Officer at the centre provides technical advice on dairy farming to the members of the association. Farmers can also obtain technical advice from the regular extension staff in the area.

Survey methods

Two household surveys were carried out; one in February 1998 and the other in September–December 1999, and details of the processes are presented in Ayuk et al. (1998) and Moyo (2001), respectively. In the 1998 survey, 58 farmers belonging to the Chikwaka Dairy Association,
who were known to have planted fodder trees, were interviewed using a questionnaire. The survey was conducted at the end of the planting season in early 1998 and the farmers were asked about their previous planting and management of the trees, and feeding of tree fodder.

The second survey involved 118 households of whom 80 were using tree fodder to feed their dairy animals. A random utility model was used to assess the determinants of choices made by farmers on what feeding technology to use (Moyo 2001). The feeding technologies were: use of both trees and concentrates; use of concentrates alone; use of tree fodder alone; and use of neither concentrates nor tree fodder.

**Farmer feedback workshop**

Farmers who had experience of feeding tree fodder on their farms were divided into 3 classes based on the performance of their dairy enterprise, namely: above average, average and below average. Two farmers from each of the 3 classes presented their experiences with the dairy enterprise, with emphasis on performance of the fodder bank technology and profitability of the dairy enterprise. The farmers’ presentations were used to stimulate debate amongst farmers and between farmers and researchers.

**Results and discussion**

The number of farmers using fodder trees increased from 6 in 1994–95 to a peak of 108 in the 1997–98 season (see Table 1). Most of the farmers with fodder trees had obtained germplasm (seed and seedlings) mainly through the ICRAF project. The farmers initially received seedlings of *Acacia angustissima, Calliandra calothyrsus, Cajanus cajan* and *Leucaena leucocephala*. However, by the time the second household survey was conducted in 1998, farmers were planting a total of 8 species (see Table 2). The increase in number of species planted does not reflect a change in demand by the farmers but rather an effort by the ICRAF project team to diversify the genetic base of fodder trees available to farmers. Most farmers were unable to say which species they preferred, as they lacked sufficient experience.

The expansion of fodder tree plantings at least once after the initial introduction was taken as an indicator of adoption. About 72% of farmers expanded their fodder tree plots, largely using their own resources.

**Tree establishment practices and niches chosen by farmers**

Most farmers planted the trees in areas reserved for forage production. Some planted them as pure stands while others intercropped with food (sunflower, beans) and other fodder crops (*Desmodium uncinatum*, *Macroptilium atropurpureum* and *Stylosanthes guianensis*). The farmers who intercropped emphasised the need to allow the trees to establish before the other crops were planted. All farmers attempted to improve the soil at planting; most commonly, kraal manure, single superphosphate fertiliser and compost were used. The

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of farmers planting (n = 58)</th>
<th>% of farmers planting</th>
<th>No. of total plantings</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Leucaena leucocephala</em></td>
<td>51</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td><em>Acacia angustissima</em></td>
<td>45</td>
<td>78</td>
<td>54</td>
</tr>
<tr>
<td><em>Leucaena diversifolia</em></td>
<td>28</td>
<td>48</td>
<td>31</td>
</tr>
<tr>
<td><em>Leucaena pallida</em></td>
<td>25</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td><em>Calliandra calothyrsus</em></td>
<td>13</td>
<td>22</td>
<td>14</td>
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<tr>
<td><em>Cajanus cajan</em></td>
<td>7</td>
<td>12</td>
<td>8</td>
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<tr>
<td><em>Sesbania sesban</em></td>
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<td>10</td>
<td>6</td>
</tr>
<tr>
<td><em>Leucaena esculenta</em></td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

1Percentages do not sum to 100 because most farmers planted more than one species.

2A planting was defined as a stand of fodder trees that a farmer planted in a particular year.
farmers weeded the plots in the first year and harvesting began in the year following establishment.

Agronomic performance

Survival rates from the first plantings ranged from 0–75% (mean = 42%). Farmers attributed these low survival rates to termite attack and poor soil fertility. A local formulation, made of paraffin and extracts of leaves from *Tagetes minuta*, was used by some farmers to control the termites. Survival rates from subsequent plantings were higher (80–100%; mean = 75%); farmers attributed these increased survival rates to improved management of the trees as they gained experience.

Feeding management

The farmers began to harvest their fodder trees during the second year after planting. Leaves were used in both dry and wet seasons, and were fed in both dry and fresh states. Normally, the farmers fed dry leaves as dry leaves could be mixed with maize meal to make a supplement. Results of the 1999 household survey showed that, of those farmers using tree fodder, the majority (84%) chose to feed the leaves in combination with purchased protein concentrates. A few farmers (4 out of 58 interviewed in 1998) had ensiled tree leaves mixed with maize.

The farmers reported that milk became more creamy and ‘tasty’ when tree fodder was used to feed the cows. Although economic analysis of the tree-based fodder bank technology was not undertaken, farmers indicated that the use of trees increased their profit margins.

Factors determining the choice of tree legumes as a feed for dairy cows

Significant determinants of choice were identified using the Random Utility Model. Larger scale and higher productivity of the dairy enterprise, area already planted to forage tree legumes and experience in growing the fodder trees were shown to increase the probability of farmers using both tree fodder and purchased concentrates (Moyo 2001). The probability of using tree legumes decreased with an increase in the contribution of crops to farm cash income.

Factors facilitating the integration of fodder trees in dairy feeding systems in Chikwaka Communal Area

Several factors were identified as important in influencing dairy farmers in Chikwaka Communal Area to plant and utilise tree legumes as fodder. Key factors were: production of a marketable product, easy access to markets and relatively high costs of alternative feeds. The cash income motivation and the relatively short distances (less than 25 km) that farmers travel to sell their milk have contributed to the success of the dairy sector in Chikwaka. These, combined with the high cost of alternative protein supplements, have encouraged farmers to use fodder trees. Other factors promoting adoption were:

- Effective extension and dissemination strategies. Farmers in the dairy scheme had access to technical information concerning trees from staff of several organisations including ICRAF, the Forestry Commission, a local
non-government organisation, DDP and Agricultural Technical and Extension Services (AGRITEX, the government’s national extension service), all of whom were residing in the area. Farmers were thus able to receive technical information on trees as well as other aspects of their dairy enterprise;

- Training and information sharing. The organisations involved facilitated the training of both extension staff working in the area and some farmers in various aspects of tree establishment, management and feeding. This was complemented by annual field days and farmer exchange visits;

- Development of local-level seed supply systems. Initially, organisations supplied tree seedlings, but this was gradually stopped as farmers were trained in seed collection and propagation. Farmers were encouraged to leave some of their trees for seed production and some farmers reported that they gave or sold seed to their neighbours. Many farmers established individual nurseries; and

- Multiple products from the trees. Some farmers reported that, after stripping the leaves, the stems were used as fuelwood, for poles and fencing, and as stakes for tomatoes.

A number of important challenges remain:

- Information is needed on the profitability of fodder trees and their use in rations. Optimum levels of tree foliage to be incorporated into dairy rations at the farm level are not yet known. The optimum ratios for maize and browse in mixed silage need to be determined.

- A greater range of species should be identified, including suitable indigenous species.

- The practice is information-intensive and is unlikely to expand into new areas without facilitation, especially the training of farmers in those areas in establishment, management and utilisation of fodder trees. Farmer exchange tours would greatly assist so that farmers in areas without fodder trees could see for themselves how the practice works.

- New strategies are needed to protect fodder trees from stray livestock. While live fences may play a role, farmers suggested that local leaders should review the by-laws governing the movement of livestock during the dry season, when most of the uncontrolled browsing occurs.

- More work is needed to confirm the value of farmers’ methods of controlling pests and incorporating tree leaves into rations. Facilitators can help farmers to exchange information on these innovations and researchers should confirm their effectiveness.

References


