Chapter Four
Extension

Extension recommendations

Many documents have provided recommendations for extension activities in Bhutan. Many of these recommendations have been repeated again and again, yet many have never been implemented on a large scale. The recommendations based on research activities have been discussed in Chapter 3. The most important documents providing extension recommendations are listed in Table 61.

Table 61: Major extension recommendations for fodder

Recommendations	Year	Reference
A package of practices for temperate regions including recommended species, and establishment and fodder conservation techniques	1978	AHD undated
Recommended fodder species and methods for temperate and subtropical regions	1981	Roder 1981a
Lecture notes on recommended species, establishment methods, grassland management, and arable fodders	1982	Roder 1982c
Economic winter feed production through standing hay	1978 1983	Logan 1978 Roder 1983d
Recommended fodder tree species	1982 1987	Roder 1982b; AHD 1987a
Package of practices for selected fodder tree species	1980s	AHD undated
Urea treatment of straw	1987	AHD 1987b
Fodder species for subtropical areas	1987	AHD 1987a
Fertiliser recommendations for subtropical regions	1990	Gibson et al. 1990

Extension network

Modest extension activities aimed at increasing fodder production or fodder quality started in the late 1960s and early 1970s. These early activities were sporadic and generally related to projects that were limited in time and space. Most of the development centres initiated in the late 1960s such as Samtse, Lingmethang, Gogona, and Bondey government farms at some stage promoted fodder species (Maurer 1985; Roder 1988b; Roder et al. 1997b; Wangdi

1979). Although these activities may have had little direct impact they provided important experience for later programmes.

The Bhutanese Government's Animal Husbandry Department began to build up a network of extension centres in the 1970s. These centres were placed at geog level and were generally staffed by technicians with basic veterinary training to provide health care and to supervise crossbreeding activities. Extension workers for fodder development, also known as pasture assistants, were trained from 1978 onwards and placed in these extension centres. Some of these fodder specialists were placed at the geog level whilst others were attached to the dzongkhag headquarters.

The responsibility for all livestock-related extension activities was entrusted to extension workers at the geog level after the reorganisation of the training programme, which followed the inception of the Natural Resource Training Institute and the reorganisation of the Ministry of Agriculture in 1995. Their responsibilities covered health, general livestock management, and fodder resource development aspects. The training of extension workers and field activities remains strongly biased towards animal health.

As mentioned above, fodder development, especially extension, was also an important component of the two large livestock development projects, the HLDP (1986-1993) and the HAADP (1987-92), as well as of the earlier Rural Development Project Bumthang (1974 to 1985).

Extension programmes

Herbaceous species in temperate regions

The earliest documented and sustained extension activities focusing on fodder development started in Bumthang dzongkhag in 1978 (Roder 1980; 1983b). Seed was sold at a nominal rate of Nu 2.0 per kg (approximately 10% of the production cost) and phosphate fertiliser was provided free of cost. The following practices were recommended.

- Species and seed rate (kg ha^{-1}): white clover 4 kg, Italian ryegrass 8 kg, cocksfoot 4 kg, and tall fescue 4 kg
- Inoculation: clover seed was inoculated and coated with gum arabic and rock phosphate prior to distribution or broadcasting.
- Establishment: the preferred method of establishment recommended was under-sowing into sweet buckwheat. Transplanting of white clover without cultivation was also recommended.
- Management: both grazing and cut and carry systems were recommended; scythes were introduced and distributed at subsidised rates.
- Preservation: winter feed preservation through hay or silage making was recommended; simple pit silo systems were introduced.

This package of practices became the model for the nationwide extension programmes promoted by the Department of Animal Husbandry (AHD) in the Fifth, Sixth, Seventh, and Eighth five-year plans, with the first countrywide activities initiated in 1978 (RGOB 1997). This recommended package has changed little over the years, with only three main adaptations:

- when more cocksfoot and tall fescue seed became available it became possible to replace some of the Italian ryegrass seed with these species;
- seeds were distributed free of charge from 1983 onwards; and
- fertiliser subsidies were discontinued in 1996.

Early activities in Bumthang dzongkhag profited from the following special circumstances not present in other dzongkhags (Roder 1980; 1983b).

- The promotion of fodder species coincided with a rapid rise in potato cultivation and the introduction of bullock-drawn implements for potato planting, weeding, and earthing-up. In the initial phases of the programme it was farmers who grew potatoes who were most interested in producing fodder and making silage because of the need to feed the draught animals during the latter part of the dry winter season.
- The Rural Development Project, Bumthang, which spearheaded the promotion programme, was responsible for both agriculture and animal husbandry development programmes in the dzongkhag.
- Intensive fodder development activities carried out in two government farms located in Bumthang dzongkhag (the Rural Development Project and the Sheep and Yak project, Dechenplerithang) served as inspiring examples.

In spite of these favourable circumstances, progress in the initial years was slow (Figure 51). An early assessment of nationwide activities highlighted the following problems (Roder 1981a):

- extreme variations in climate and other environmental conditions;
- unfavourable rules and regulations regarding grazing lands;
- low motivation of farmers as cultivating fodder was a new concept and there were no examples;
- high phosphate inputs were required;
- expensive inputs (seeds) were given to the farmers free or at a nominal cost, thus farmers were not motivated to optimise coverage and establishment success; and
- inoculation failures due to poor quality inoculum.

The progress of fodder development activities in Bumthang dzongkhag was reviewed in 1986 (Helvetas 1986). From 1981 to 1985 an average of 0.25 ha was sown to white clover and grass by participating farmers in the dzongkhag. At the end of this four-year period only 61%

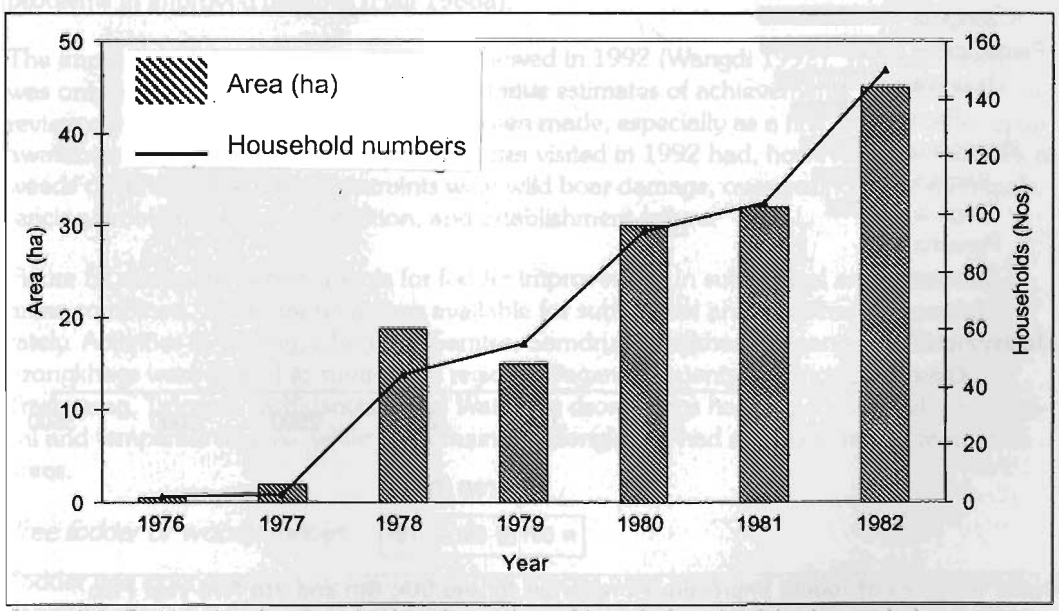

Figure 51: Fodder development in Bumthang dzongkhag during the 4th plan period

of the sown area was still present as improved grassland. Most of the failures occurred in the first 12 months after seed broadcasting due to (Helvetas 1986)

- over-grazing;
- lack of interest due to free inputs and the target-driven programme;
- failure to follow fertiliser recommendations; and
- insufficient support and follow up provided by project staff and government extension staff.

Despite the slow pace of improvement in Bumthang dzongkhag, the results were still far superior to those in other areas. By the end of the 7th Five Year Plan period (1997), fodder improvement activities were reported to have been carried out over an area of more than 2,800 ha (Figure 52). No other dzongkhag has achieved comparable results to Bumthang. This lead is even more impressive when it is considered that Bumthang ranks only eighteenth for the number of rural households and eighth for the number of cattle and yak. The other regions that have achieved the best results are those with similar conditions to Bumthang, especially areas in Wangdue and Trongsa dzongkhags.

Gyamtsho (1992) reviewed the progress of HAADP. He focused largely on the implementation of a land allotment scheme. No quantitative data were provided on the achievements of the fodder development programme, and the author felt that HAADP's activities had only had a minor effect on livestock nutrition.

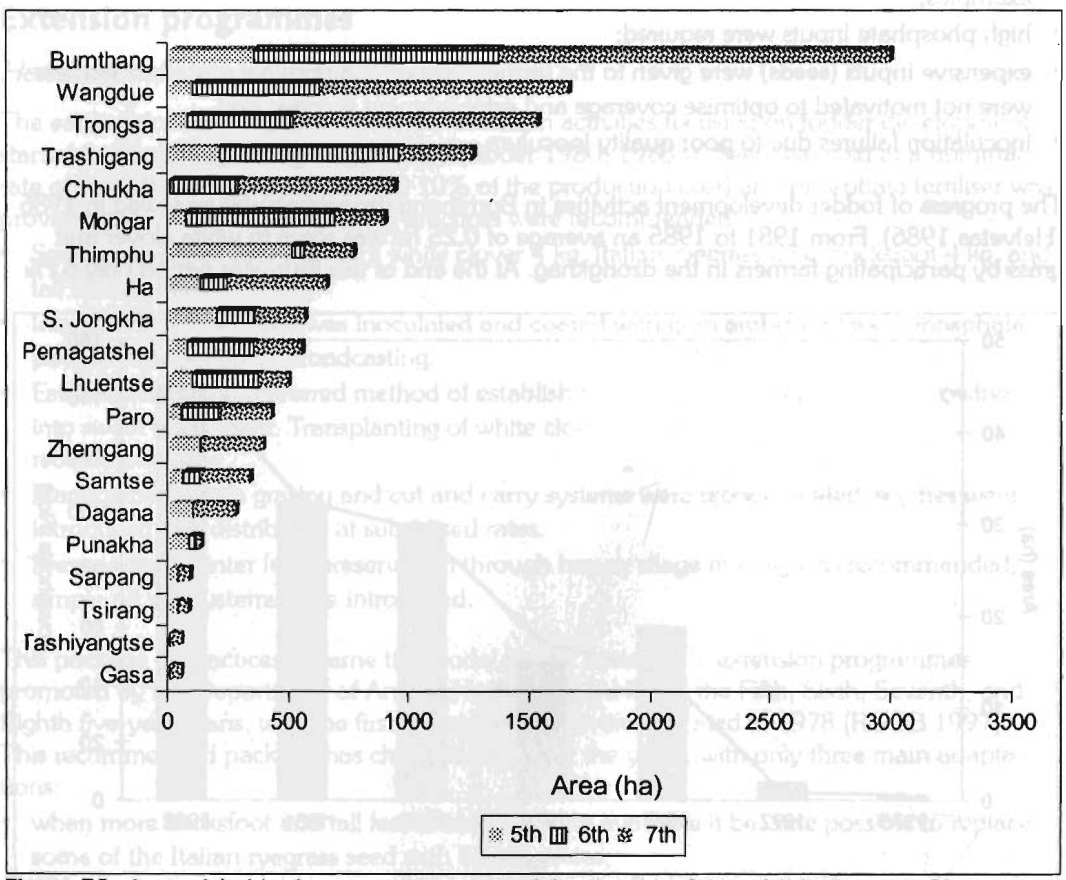

Figure 52: Area of fodder improvement reported for the 5th, 6th and 7th Five-year Plan periods

Herbaceous species in subtropical regions

Due to a lack of seed and suitable methodologies, the extension activities in subtropical regions have been less successful. The recommended species have changed with every plan period (Table 62).

Table 62: Species recommended for subtropical areas during the 5th to 7th Five Year Plan Periods

Plan period	Species recommended	
Fifth Plan[1] (1982-87)	Kikuyu grass	Pennisetum clandestinum
	Guinea grass	Panicum maximum
	Setaria	Setaria sphacelata
	Rhodes grass	Chloris gayana
	Napier grass	Pennisetum purpureum
	Silverleaf desmodium	Desmodium uncinatum
	Glycine	Neonotonia wightii
	Stylo	Stylosanthes guianensis
Sixth plan[2] (1987-92)	Signal grass	Brachiaria decumbens
	Molasses grass	Melinis minutiflora
	Guinea grass	Panicum maximum
	Setaria	Setaria sphacelata
	Centro	Centrosema pubescens
	Silverleaf desmodium	Desmodium uncinatum
	Greenleaf desmodium	Desmodium intortum
	Siratro	Macroptilium atropurpureum
	Glycine	Neonotonia wightii
	Stylo	Stylosanthes guianensis
Seventh plan (1992-97)	Ruzi grass	Brachiaria ruziziensis
	Molasses	Melinis minutiflora
	Greenleaf desmodium	Desmodium intortum

[1]Roder 1982c; [2]AHD 1987a

Fodder extension activities in Chhukha and Samtse dzongkhags are referred to in Hall (1988a; 1989), in Mongar dzongkhag in Rumball (1988a; 1989), and in Pemagatshel dzongkhag in Gibson (1988b; 1989b) and Roder (1988a). Some of the issues discussed in these papers are: the appropriateness of extension recommendations and targets (Gibson 1988b), the results of extension activities (Hall 1988a; Rumball 1988a), input supply problems (Gibson 1989b), and management problems in improved pastures (Hall 1988a).

The impact of the HLDP activities were reviewed in 1992 (Wangdi 1992). The assessment was only qualitative and lacked any quantitative estimates of achievements and impact. The review concluded that good progress had been made, especially as a first step, in creating an awareness for fodder development. Many sites visited in 1992 had, however, reverted back to weeds or shrubs. The main constraints were wild boar damage, overgrazing by wild animals, fencing problems, weed competition, and establishment failure.

Figure 52 shows the achievements for fodder improvement in subtropical and temperate areas combined. There are no figures available for subtropical and temperate areas separately. Activities in Tsirang, Chhukha, Samtse, Samdrup Jongkhar, Sarpang, and Pemagatshel dzongkhags were limited to subtropical regions. Dagana, Lhuentse, Mongar, Zhemgang, Trashigang, Trongsa, Tashiyangtse, and Wangdue dzongkhags had activities in both subtropical and temperate regions, while the remaining dzongkhags had activities only in temperate areas.

Tree fodder or woody species

Fodder tree extension activities with local tree species were launched in 1982 (Roder 1982b). Farmers were advised to plant *Artocarpus lakoocha, Bauhinia variegata, Bauhinia purpurea,*

Litsea polyantha, Ficus roxburghii, Ficus nemoralis, Brassaiopsis hainla, Saurauia nepaulensis, Prunus cerasoides, and *Salix babylonica* ((Roder 1982b). During the Fifth Plan period the farmers were paid Nu 0.5 for each fodder tree they planted.

The only exotic fodder tree species recommended and distributed to farmers were *Leucaena leucocephala* and black locust (*Robinia pseudoacacia*) (Roder 1982b; 1984; 1989). Farmers were, however, reluctant to accept these exotic species (Roder 1984). Psyllid infestation of *Leucaena leucocephala* was observed at various locations (Gibson 1989b). Fewer species were recommended in the Sixth Plan (AHD 1987a), they were limited to *Artocarpus lakoocha, Bauhinia variegata, Bauhinia purpurea, Ficus roxburghii, Ficus cunia, Ficus lakoor, and Celtis australis.* The farmers' interest in tree fodders was highest in those regions where tree fodders were traditionally used such as Samdrup Jongkhar, Trashigang, Mongar, and Samtse dzongkhags (Figure 53). The achievements from the tree fodder extension activities were reviewed in a survey carried out in a number of dzongkhags in 1996 (Tshering et al. 1997a).

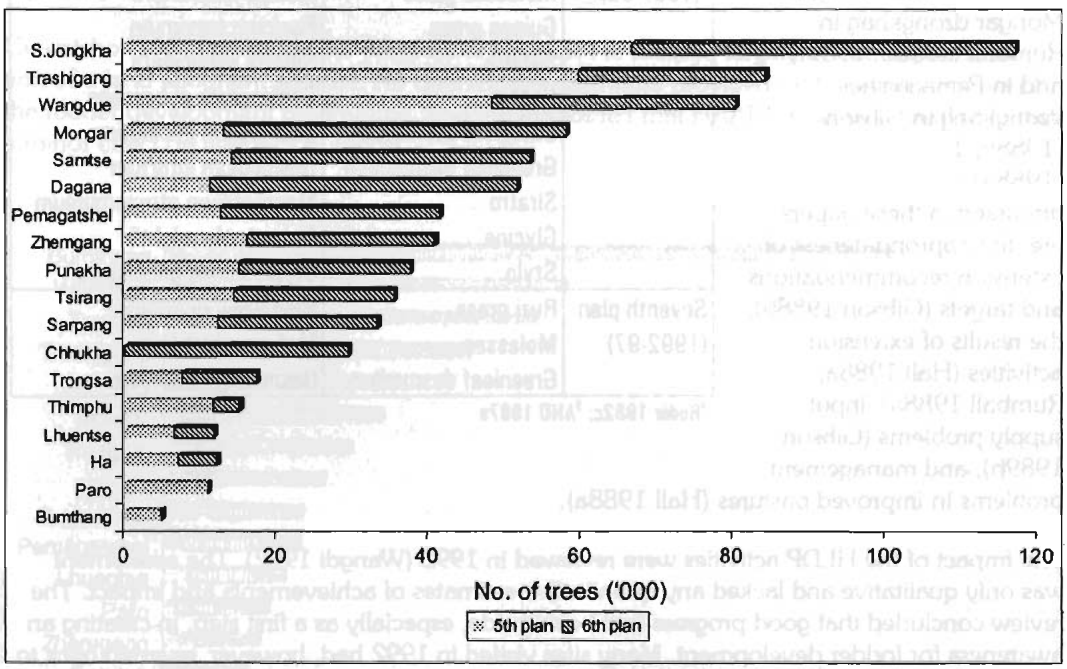

Figure 53: Number of fodder trees planted during 5th and 6th Five-year Plan period

In the survey of 1996, most of the farmers' fodder trees were found to originate from saplings collected from the forest or from trees raised by the farmers themselves (Table 63). Only in Wangdue dzongkhag did the majority come from official sources.

Paddy straw treatment and urea molasses blocks

Urea treatment of paddy straw was an important component of the extension programme during the Sixth and part of the Seventh Plan. Farmers were trained in the methods of treatment and provided with free urea. An extension booklet was issued in 1987 (AHD 1987b). The advantages of urea treatment were said to include

- higher palatability and intake by livestock;
- better digestibility;

- higher N intake (from the urea); and
- fewer liver fluke infestations in livestock.

The response of farmers to this method of paddy treatment was documented for Paro in 1986 (van Wageningen 1985; 1986). In 1996 a survey was carried out to evaluate the experience of past extension activities with paddy straw treatment (RNR-RC Jakar 1997a). Information was collected at the household level in six dzongkhags using a formal questionnaire. The two geogs with the most intensive activities in straw treatment in each dzongkhag were selected, and all households in 20-50% of the villages in these geogs included in the survey. The results are summarised in Table 64.

Table 63: Source of planting material

Dzongkhag	Source of planting material (% of households)[1]		
	Wild[2]	AHD[3]	Self-seeded
Punakha	39	38	27
Wangdue	37	69	24
Trongsa	100	0	0
Chhukha	89	24	27
Zhemgang	91	1	9
Lhuentse	95	10	0
Mongar	83	17	0

[1]The total is greater than 100 because some households had saplings from two sources (AHD and wild); [2]mostly collected from the forest; [3]Animal Husbandry Department
Source: Tshering et al. 1997b

The major findings were that

- liver fluke was considered a problem by the majority of households;
- almost all households fed paddy straw to their livestock during the dry season;
- many of the respondents had tried the urea treatment method but all of them had discontinued its use;
- a large percentage of households reported reduced intake by livestock fed with treated straw; and
- the increased labour requirements and the cost of the urea were felt to be disadvantages.

Following the poor response to the paddy straw treatment programme, the use of urea molasses block was recommended. Bajracharya (1992) provides some discussion of these activities. The method was tested on cattle, yak, and sheep at village level in five dzongkhags with 91 contact farmers. Increased milk production was reported in some cases but, although promising, this programme was not continued.

Table 64: Summary of paddy straw treatment survey findings in two selected geogs of each dzongkhag

Dzongkhag	Sample (no.)	Cattle (no./HH)	Liver fluke problems (%)	Feeding straw (%)	Tried treated straw (%)	Straw intake reduced when straw treated (%)
Punakha	86	6.7	35	88	23	15
Wangdue	120	12.6	60	89	76	61
Trongsa	29	9	52	100	72	40
Thimphu	76	6.3	78	95	46	32
Paro	102	2.3	93	100	51	17
Chhukha	109	7.2	34	89	32	23

Source: Roder 1998b

Impact of extension activities

It is difficult to assess the overall impact of the fodder development extension activities, although some of the survey data can be used to quantify or to estimate changes that have occurred (Table 65). Clearly other factors will have been involved in addition to direct extension like peer group example and information, changing needs, and introduction of improved livestock, but to some extent at least the changes are likely to be the direct result of the government's fodder development activities. Effects were noticed not only on the area of improved pasture and the quantity and quality of available fodder, but also on

Table 65: Changes in fodder and livestock production in Bhutan partially due to RGOB's fodder development activities[1]

Component of the system	At national level (%)	Selected pockets in temperate regions (%)
Dry matter production increase	1-2	10
Fodder quality increase during summer	5	50
Fodder quality increase during winter	20	200
Milk production increase	100	500
Cattle migration (reduction)	15	60

[1] Estimates by the author

- the seasonal availability of fodder (winter fodder);
- animal production;
- cattle migration ;
- the productivity of field and horticultural crops and labour requirements for their production; and
- soil conservation.

Achievements reported and area covered

All fodder development activities have been strongly target oriented and only limited attempts have been made to assess their impact. The only quantitative data available are from detailed follow-up activities carried out in Bumthang dzongkhag during the 1980s (Helvetas 1986) and from a later survey carried out in selected dzongkhags (Roder 1998b).

Herbaceous fodder and pasture development

During the initial years the reported results of fodder development activities were relatively good in Bumthang where a 61% success rate was reported for the Fifth Plan period. In other dzongkhags, especially in eastern Bhutan, the impact was much less. One observer reported that fodder development activities in the east of Bhutan only started with the Sixth Plan (Wangdi 1992). This is in strong contrast to the officially reported achievement of 600 ha of pasture improvement reported for the Fifth Plan.

According to the achievements reported during the 5th, 6th, and 7th Plan periods (1981-1997), the area established under improved pasture by individual households was relatively high, especially for Bumthang, Trongsa, and Wangdue dzongkhags (Figure 52). However, the coverage reported in the 1997 survey (Roder 1998b) was substantially below the levels previously reported (Tables 66 and 67). In this survey, Bumthang dzongkhag – thought of as the most advanced in fodder resource development – showed only 10% of the reported area

remaining under improved fodder. This disappointingly low proportion of improved pasture remaining is probably due to the following:

- a high proportion of the large areas covered during the 5th and 6th Plan periods (Figure 52, Table 66) have reverted back to other land uses (Roder 1998b);
- earlier fodder development activities were driven by demand for subsidised fertiliser rather than the desire to improve fodder; and
- over-reporting of achievements.

In the 1997 survey, Sephu and Phubjikha (both Wangdue dzongkhag), Chumey (Bumthang dzongkhag), Tangsibi (Trongsa dzongkhag), and Trong (Zhemgang dzongkhag) geogs had the highest area of improved pasture per household (Table 67). These geogs also had more than half an acre (0.2 ha) improved pasture available per milking cow.

Fodder tree development

In 1997, the number of fodder trees present per household and their source was compared with the number distributed per household in the course of extension activities from 1982 to

Table 66: 1997 survey results of existing acreage of improved pasture compared to values reported in RGOB official reports

Dzongkhag	Reported achievement 1982-97 (ha)		Existing improved pasture observed in 1997 as % of reported[1]
	Total	Area per HH	
Paro	411	0.16	36
Wangdue	1,645	0.57	39
Trongsa	1,519	0.85	45
Zhemgang	378	0.16	70
Bumthang	2,980	1.98	10

[1] In the blocks surveyed
Source: Roder 1998b

Table 67: Area of improved pasture per household in various geogs

Dzongkhag	Geog	Households with improved pasture (% of total HH)	Pasture area per household with improved pasture (ha/HH with pasture)	Pasture area for all households (ha/total HH)	Area per milking cow (ha)
Paro	Dopjari	67	0.24	0.17	0.08
	Narja	54	0.16	0.08	0.04
Wangdue	Phubjikha	88	0.65	0.56	0.25
	Sephu	93	0.73	0.67	0.35
Trongsa	Tangsibi	75	0.69	0.51	0.22
	Drakten	35	0.28	0.11	0.08
Zhemgang	Nangkhor	40	0.20	0.07	0.04
	Trong	48	0.81	0.39	0.25
Bumthang	Tang	72	0.40	0.30	0.17
	Chumey	74	0.81	0.59	0.26

Source: Roder 1998b

1996 (Table 68). The survival of fodder trees distributed under the extension programme was estimated to be less than 20% in all dzongkhags except Chhukha. Since the survival rate calculation was based on the average rather than the actual number of trees distributed per household, the actual survival rates may well be lower. The high survival rate reported for Chhukha may be due to the relative low proportion of fodder trees originating from government sources. Chhukha reported the highest tree numbers per household, while the numbers distributed were low.

Dry matter production

Between 1982 and 1997 the following achievements were reported:

- 13,760 ha of pasture established;
- 735,819 fodder trees planted; and
- extensive uptake - more than 50% of rice-growing households in some dzongkhags - of paddy straw treatment.

Table 68: Impact of extension activities on fodder trees available and tree survival

Dzongkhag	No. of trees per HH			Survival (%)
	Distributed from 1982-96	Trees present in 1997		
		Total	From AHD	
Punakha	18	5.3	1.9	11
Wangdue	29	6	3.2	11
Trongsa	12	12	<0.5	<5
Chhukha	9	53	9.0	100
Zhemgang	22	17	<0.5	<5
Lhuentse	5	8.1	0.8	16
Mongar	12	11.8	2	17

Source: Roder 1998b

However, at the national level the impact of fodder development activities on the total dry matter production has been limited. Assuming a success rate of 10% for trees planted and 20% for the pasture improvement activities, and an additional dry matter yield of 1.5t per acre for improved pasture and 30 kg per tree, then 10,200t additional dry matter has been produced as a result of pasture development activities and 2,200t from trees. With an intake of 8 kg per day this amount is equal to the annual feed requirements of 4,250 animals or about 1-2% of the total population of large ruminants.

Although the impact at the national level seems small, a strong impact on the dry matter production is visible in areas that have benefited from a high concentration of fodder development activities such as Sephu and Phubjikha in Wangdue dzongkhag, Tangsibi in Trongsa dzongkhag, and Tang and Chumey in Bumthang dzongkhag (Table 67). Households in these geogs have between 0.16 and 0.35 ha of improved pasture per milking cow (Table 67) and a large proportion of them consider improved pasture as an important fodder resource during the summer season (Table 69).

Seasonal fodder availability - winter fodder

Tree fodder species are almost exclusively used for winter fodder. Herbaceous fodder species contribute substantially towards improved winter fodder quality and quantity. Hay is especially important at higher elevations and between 40 and 78% of respondents in Tang, Chumey, Phubjikha, and Sephu considered hay, mostly made from improved pasture, as one of their main winter fodder resources (Figures 54, 55, Table 69).

The traditional winter fodders such as hay from native grasses, paddy straw, buckwheat straw, the grazing of native pasture, and tree fodder leaves are all poor quality livestock feeds. Most of them are insufficient to even maintain the body weight of large ruminants. Therefore, even small improvements in the quality of winter fodder will have substantial impacts on infertility problems, mortality, and production over the entire season.

Table 69: Importance of improved grassland for grazing and making hay

Dzongkhag	Geog	Important fodder source (%)[1]		
		Improved pasture		Hay
		Summer	Winter	Winter
Paro	Dopjari	49	0	67
	Narja	12	1	0
Wangdue	Sephu	23	4	60
	Phubjikha	61	5	67
Trongsa	Tangsibi	72	26	18
	Drakten	15	15	0
Zhemgang	Trong	20	10	0
	Nangkhor	5	0	0
Bumthang	Tang	7	49	48
	Chumey	30	30	78

[1] Percentage of households ranking improved pasture or hay as the most (first rank) or second-most important fodder resource
Source: Roder 1998b

Nutritional quality and animal production

The impact of tree fodder and of subtropical herbaceous fodder species on the nutritional quality of the diet of Bhutan's livestock has probably been negligible. In temperate regions, however, the introduction of white clover has resulted in a substantial increase in the fodder quality in both the wet and dry seasons.

White clover has spread over large areas of permanent grazing land. Because of its excellent nutritional qualities (high palatability, high protein content, and low crude fibre), small additions of white clover to the native grassland vegetation substantially increase the fodder quality. It is largely through this improvement that the milk potential of crossbred animals can be realised (Table 70) and this has been the main impact of fodder development on animal production.

Figure 54: White clover grass cut with sickle in cut and carry system

There is no reliable data on increases in milk production. It is, however, estimated that the milk production potential of white clover based grassland and hay is between two and five times more than that of grassland or hay without white clover. The combined effect of increased yield and improved quality could therefore have resulted in between four and ten-fold increases in milk production (Figure 56).

Figure 55: Cutting white clover/grass with scythe, for hay making

Table 70: Milk production potential of selected fodder sources

Fodder type	Potential milk production (kg/animal)
Local pasture with white clover	15.0
Hay from white clover/grass mixtures	14.0
Local pasture: summer	8.0
Hay from local pasture	2.0
Local pasture: winter	< 0.5

Source: authors of review, estimates based on fodder analysis data shown in Table 36

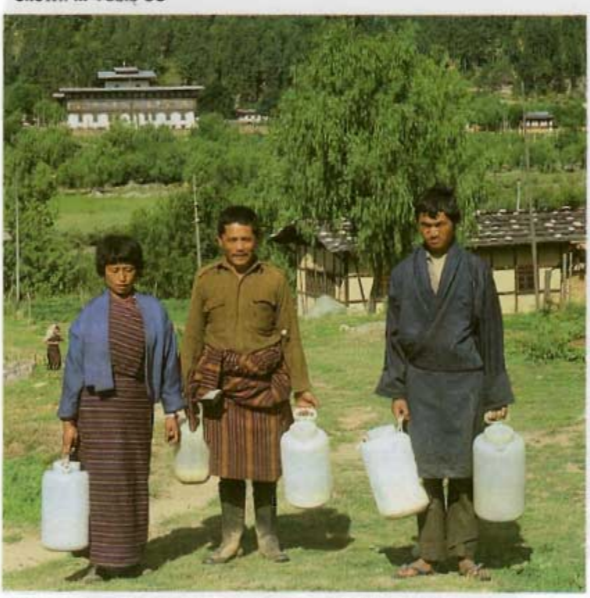

Figure 56: Farmers delivering milk to the milk processing plant in Bumthang

The primary reason cited by local farmers for additional fodder resource development was the expected increase in milk production. Several of the other reasons cited "plans to bring in cross-bred animals", "fodder needed for improved cattle", and "increases in cattle numbers" are also related to milk production (Figure 57). The high emphasis on milk production is also evident from the response to the question "what animals are the primary users of improved fodder" (Roder 1998b, Figure 58).

Improved forage production over the years has to some degree contributed to improvements in the livestock sector. Although no quantitative data are available, it is unquestionable that the increased availability of livestock products have made an important contribution to human nutrition in Bhutan. In addition, the sale of milk products is an important source of cash for many households (Table 71).

The number of yak and cattle doubled from around 165,000 in 1976 to 335,000 in 1995 (LUPP 1995), and it can be assumed that this also led to a 100% increase in feed requirements. The increased requirement has largely been met from traditional fodder resources but the combined effects of increased dry matter production, better seasonal availability of forage, and improved nutritional qualities of the forage have contributed substantially to making this tremendous increase in livestock numbers possible.

Impact on traditional cattle migration

The traditional system of bringing cattle down to lower elevations during the cold, dry winter has many disadvantages, in particular that it spreads livestock diseases, limits the production potential of livestock, and limits the options for field crops and horticultural

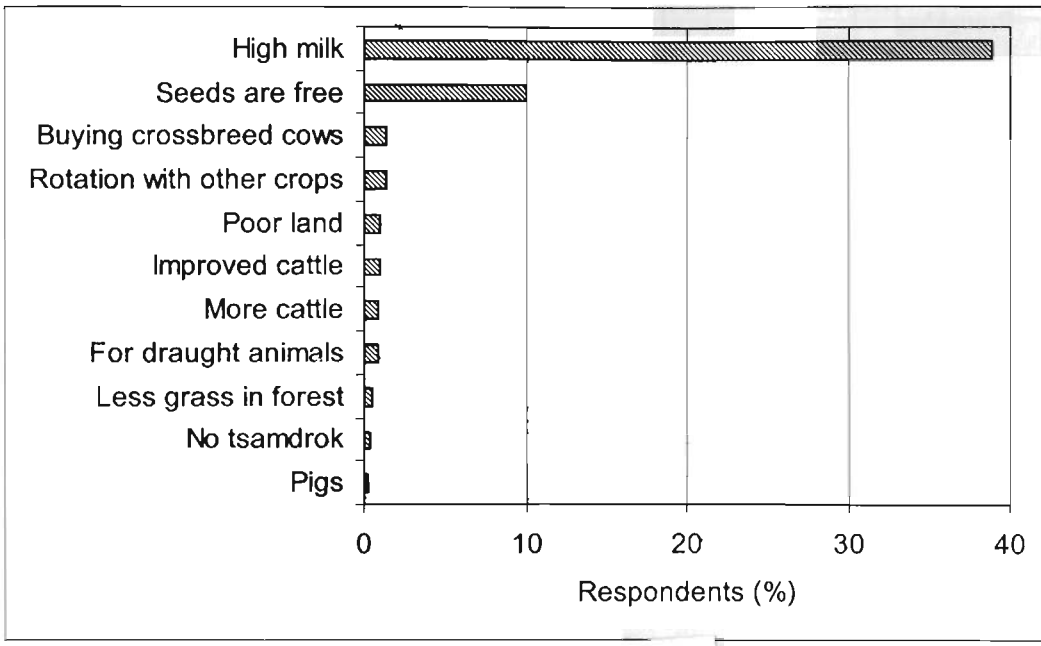

Figure 57: Reasons cited for planting more improved fodder

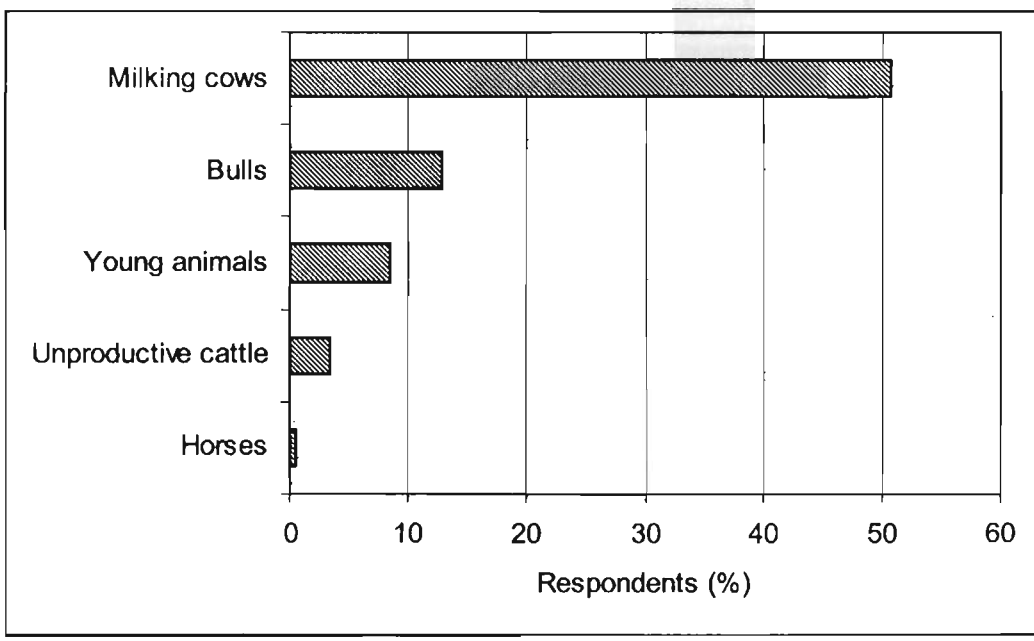

Figure 58: Use of improved fodder

Table 71: Households selling milk products and estimated income

Dzongkhag	Geog	Households		
		Selling milk products (%)	Income from milk products (Nu/year)[1]	HHs earning > Nu 10,000 per year (%)[1]
Paro	Dopjari	63	6,054	46
	Narja	41	4,165	31
Wangdue	Sephu	75	5,084	26
	Phubjikha	51	2,787	7
Trongsa	Tangsibi	80	4,875	18
	Drakten	32	1,575	5
Zhemgang	Trong	42	2,311	8
	Nangkhor	21	1,096	3
Bumthang	Tang	33	810	3
	Chumey	21	737	1

[1]Average of all households; 40 Nu approx. US$ 1; 10,000 Nu approx US$ 250

production in lower areas. Changes in these migration patterns are, however, only possible if alternative sources of feed can be found for the critical periods. The fodder development activities in the temperate regions have contributed substantially towards reducing cattle migration.

Bourgeois-Luethi (1998) has reviewed the impact of crossbreeding activities on cattle migration. Various references discuss the extent of migration but quantitative information on changes in migration is scant. A survey carried out in 1983 reported a 19% reduction in migration (Muller-Jaag 1984).

Impact on soil conservation

A large proportion of the improved pasture established in Bumthang, Mongar, Wangdue, and Ha dzongkhags was seeded into buckwheat crops in pangshing production systems. In the traditional pangshing systems, the plant cover after the buckwheat harvest remains very poor for up to five years. Establishing white clover based fodder mixtures combined with the application of P fertiliser has greatly improved plant cover and soil conservation. Furthermore, several of the legume and grass species introduced have been recommended for soil conservation.

Gender impacts

Farming activities are generally carried out jointly with all family members contributing. Some crop production activities do have strong gender divisions, however (Table 72, Figure 59) (RNR-RC Jakar 1998b). Ploughing is a job carried out largely by men whilst women do most of the manure carrying and rice weeding. Gender differences were less marked in Zhemgang and Trongsa than in Paro and Wangdue (Table 73). Except for Zhemgang, this study found that livestock-related jobs are more likely to be carried out by women, especially milking and milk processing. The gender differences are less pronounced for new activities associated with fodder resource development such as cutting and carrying grass. The higher proportion of women in most activities is partly the result of a gender imbalance in the available work force. Men are more likely to leave the farms looking for temporary or long-term off-farm employment.

Lipper (1989) found that in Chhukha and Samtse dzongkhags, cheese and butter making was more likely to be carried out by women, while milking and fodder gathering were carried out by both men and women.

Table 72: Gender labour division for work related to livestock production					
	Ratio of female/male for a particular activity				
Type of activity	Paro	Wangdue	Trongsa	Zhemgang	Bumthang
Milking cows	4.4/1	13/1	1.9/1	1/1.2	3.9/1
Herding cattle	1/1	3.2/1	1.2/1	1/2	1.1/1
Cutting grass	2.3/1	6.3/1	1.9/1	1/1.8	1/1.4
Carrying grass	2.3/1	6.2/1	2/1	1/1.8	1/1.4
Feeding cattle	3.6/1	11/1	2.1/1	1.1/1	1.7/1
Decide on planting grass	1/1.7	1/1.7	1.2/1	1.1/1	1.4/1
Butter making	3.3/1	7.8/1	1.7/1	1/1.2	4/1
Cheese making	5.7/1	11/1	1.8/1	1/1.2	4/1
Selling butter/cheese	4/1	4.2/1	1.7/1	1.3/1	1.3/1
Carrying manure	13/1	19/1	4.2/1	1.3/1	1.2/1
Ploughing	1/25	1/20	1/10	1/25	1/20
Weeding rice	12/1	-	1/1.3	2.2/1	-
Weeding maize	12/1	-	1/1.8	1.7/1	2.4/1

Source: Unpublished survey data, RNR-RC Jakar

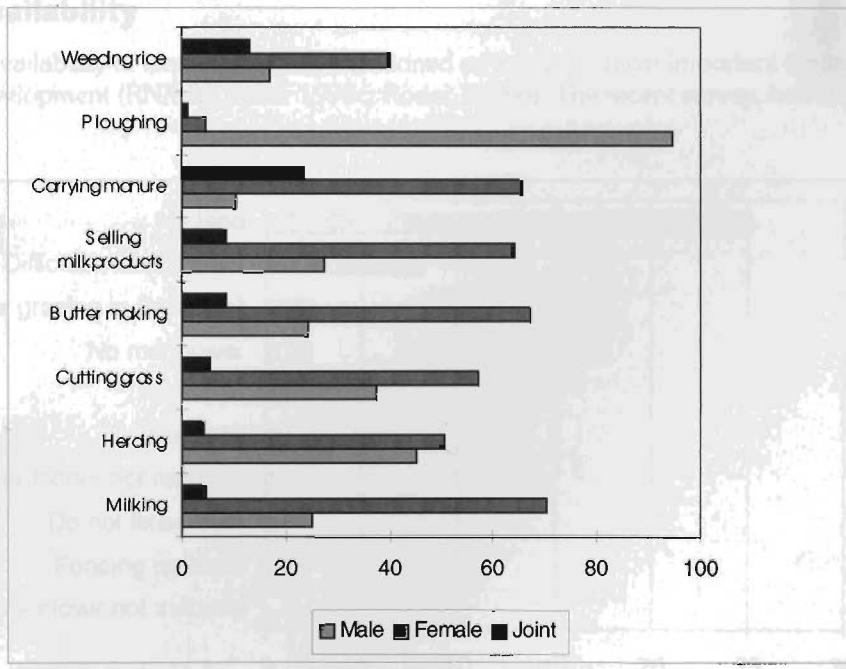

Figure 59: Gender-wise execution of selected activities

Table 73: Investigations into whether shortage of land is the real reason for lack of interest in fodder development

Dzongkhag	Geog	Land[1] (ha/HH)	% Respondents claiming land constraint	Milking cows/HH	HHs with milking cows	HHs selling cheese
Trongsa	Drakten	1.13	55	1.3	66	32
Bumthang	Tang	2.06	44	1.7	84	33
Trongsa	Tangsibi	1.46	38	2.3	86	70
Bumthang	Chumey	2.14	29	2.3	78	19
Paro	Dopshari	1.94	25	2.2	86	63
Paro	Narja	2.02	21	2.1	95	40
Zhemgang	Nangkhor	2.35	16	1.9	64	20
Wangdue	Sephu	0.57	13	1.9	77	74
Zhemgang	Trong	2.27	5	1.6	60	42
Wangdue	Phubjikha	1.01	5	2.2	89	50

[1] Kamshing, pangshing, and tsheri combined; HH = household

Source: Roder 1998b