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IS FEED AND FODDER SHORTAGE A MAJOR IMPEDIMENT TO ACCELERATED LIVESTOCK DEVELOPMENT IN BHUTAN?

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Abstract

Accelerated livestock production in Bhutan is constrained by perceived unavailability of feed/fodder both in quality and quantity. Consequently the domestic livestock are underfed and are less productive. To understand its detrimental effect, a study was conducted in major Agro-Climatic Zone (ACZ) of Bhutan. Availability and contribution of different feed and fodder resource to diet of domestic livestock was assessed to generate information on the extent of feed and fodder shortage at the different ACZ and explore availability of different feeding options to optimize production.

Study covered eight out of 20 districts in Bhutan. Within each dzongkhags 16 representative *geog* (sub-district) in three ACZ was selected and, ten households per geog were chosen for interview. Primary data is collected adopting Feed and Fodder Assessment Tools recommended by International Livestock Research Institute.

Results indicated that to supplement conventional fodder resources, farmers across ACZ cultivated improved fodder crops with average acreage of 2.14 acres per household. Some excess summer fodder was conserved as hay and silage. Besides, 79% of available crop residues are conserved to feed animals during lean season. Conserved fodder/straw contributed 25% while fodder trees supplied about 29% of fodder required during winter. Remaining fodder needs was met via forages collected from forests, gruel made out of grains and a little of concentrate feed purchased.

Study concluded that fodder shortage is localized and is not uniform across ACZ. In higher elevations, fodder shortage is acute due to longer winter which hampered animal production. However, the farmers in mid and low altitude did not face severe fodder/feed storage because of shorter winter and other feeding alternatives available. The study recommended that proper planning of fodder resource utilization in different ACZ, vigorous promotion of available technologies, nutrient enrichment of crop residues, research on frost resistant fodder varieties, and utilization of breweries waste can bring fodder shortage to near zero.

Keywords: ACZ , Bhutan, fodder shortage , livestock production Introduction

Introduction

Livestock is an integral part of the Bhutanese farming system with every rural household owning a few livestock of one type or other. Over 77% of households own cattle (DoL 2010). But only about three percent of cattle owners own improved temperate pasture and over two percent of cattle owners own improved sub-tropical pasture (NFFDP, 2008). The other important fodder resources contributing to the fodder requirement are grazing on forest and fallow land, fodder collection from forest and fringes, fodder trees and crop residues. Of these, forest grazing and natural grassland contribute over 44% of the total fodder requirement (Roder, 1990).

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Some of the pertaining issues that hinders livestock production is inadequate availability of feed and fodder both in quality and quantity. Further, overgrazing and deterioration of grazing resources limits fodder availability for ruminants (Roder, 2002). Lack of knowhow on the use and formulation of local feed are other limiting factors (Wangchuk & Dorji, 2009). Consequently the domestic livestock are often underfed, and therefore are less productive. There is a need for high year round supply of quality fodder and nutritious feed to optimize livestock production and get value from improved livestock breeds.

Owing to the apparent problem that has detrimental effect on livestock productivity, a nationwide study was conducted to understand root causes of the problem and devise measures to exploit harness existing opportunities to ensure year round availability of feed and fodder. The specific objectives were to assess availability and contribution of feed/ fodder resources to diet of the livestock in major Agro Climatic Zone (ACZ) and understand the extent, cause and effect of feed/fodder shortage and explore availability of different agro-industrial by-product as livestock feed supplement.

Study location

Study covered eight out of 20 Dzongkhags(districts) in Bhutan. Within each dzongkhags 16 representative geog (sub-district) were purposively selected based dominant livestock farming system that covers dairy, egg and chicken, pig/pork at all agro-ecological zones (low, mid and high altitude) (Table 1).

Table 1: Study location description

Agro Climatic Zone	Districts selected	Sub-district selected	Farming System
High Altitude(temperate and alpine zone) (>1800 *m asl)*	Bumthang	Chumi and Chokor Chokor	Dryland, pastoral based system
Mid altitude (dry and humid subtropical zone) (600-1800 *m asl*)	Samdrup Jongkhar	Orong Deothang	Dryland, maize based system
	Tashigang	Kanglung Samkhar	
	Chukha	Darla	
	Punakha	Talo	
		Kabji	Wetland rice based system
	Tsirang	Kikhorthang Tsholingkhor	
Low altitude (wet wubtropical zone(150-600 *m asl*)	Chukha	Samphelling	Dryland, maize based system
	Sarpang	Dekiling Sangpangkha	Wetland, rice based system
	Samtse	Ugentse Samtse	

Data collection methods

Primary data is collected from each region, adopting Feed and Fodder Assessment Tools-a Participatory Rural Appraisal Method recommended by International Livestock Research Institute (ILRI) to understand the problems/ issues in livestock farming and assess feed and fodder situation in selected *dzongkhags/geogs*. Within the *geogs*, nine households (three each from each category poor/average/rich) were selected for interview. Categorization of interviewee was determined by their land holdings (< 3 acre with few livestock- low income group, 3-6 acres with moderate number of livestock- average or medium income group and >6 acres land with good quality livestock- higher income group). The feed and fodder availability in selected households was assessed through site visits, focused group discussion(Fig 1) and individual farmers interviews using tools such as problem ranking, seasonal calendar and semi-structured questionnaires prescribed by ILRI.The answers obtained is validated with key informants- village elderly (t*shogpa*) .The secondary date is collected through review of published documents related to feed and fodder research done in Bhutan

Figure 1 Focus group discussion, Punakha

Data Analysis

Quantitative variables were entered in spread sheet and analyzed using software SPSS 14. Qualitative data acquired through semi structured interview, answers in many cases that fall into patterns with the same answer appearing frequently were coded and entered in spreadsheet. The frequency of each answer was sorted, counted manually and, when appropriate, converted into percentage.

Qualitative data acquired through discussion with herders were summarized and described

Results and discussions

Farming system

Farmers in high altitude (1800 to 2800 *m asl*) cultivate sweet and bitter buckwheat, wheat, barley and maize. The dairy farmers also cultivate oats for seed production and tuber crops such as turnips and radish for feeding the animals during winter. In the mid altitude (1200-1800 masl), the main cereal crops grown are maize, followed by rice, soya bean and mustard. In the low altitude (below 1200 masl), the major cereals cultivated are rice, maize and millet. In the warmer areas farmers also practice double cropping of maize in a year. These cereals left behind the valuable crop residues which could be fed to the livestock. Winter cereals cultivated includes wheat, barley and

buckwheat. Cattle were reared across all ecological zones followed by poultry while pigs were reared only in some few remote pockets owing to religious reasons

Herd size of improved cattle

Farmers in the high altitude reared more number of improved cattle than the farmers in the lower elevations. This could be attributed to the availability of other opportunities in the mid and low altitude. For instance, farmers in the lower altitude reared poultry owing to higher potentials for the trade. The average improved herd size is 7, 4 and 5 for high, mid and low altitude respectively.

Many farmers (72 %) across all agro-ecological zones are interested to increase the herd size of productive animals and move into semi-commercial mode (5-15 cows). Some farmers were even interested to go into commercial farming rearing up to 30 productive cows. However, marginal farmers (with little or no land and money) were restricted by limited resources despite their interest in expanding the farm. On the other hand, some farmers with larger herds wanted to decrease the herd size due to labor shortage.

Livestock management system

Majority of the farmers in mid altitude of Trashigang, Tsirang and Punakha (72%) and low altitude Samdrup Jongkhar (58 %) stall fed their cattle while the practice of day time grazing and night time stalling was common in the high altitude (41%). Open grazing and seasonal migration was practiced mostly for local cattle and buffaloes. The higher percent of farmers stall feeding in mid altitude could be because this area is mostly crop intensive area and letting animals loose destroys crops. The other probable reason could be the awareness among farmers who live in mid altitude the environmental benefits of rearing livestock in confinements.

Fodder production

Farmers across all AEZ cultivate improved pasture and fodder. Fodder under orchard and propagation of sub-tropical grass mixture is common in low and mid altitudes. Improved fodder species like Napier, Guatemala and fodder trees that were planted along the difficult terrains served as good fodder while they also helped stabilize the soil(Fig 3). Broom grass (*Amliso*) was extensively cultivated by the farmers in mid altitude of Tsirang and Chukha due to its multiple uses which could be adopted by the farmers in other areas. Some farmers dedicated their second maize crops solely for fodder. In the higher elevations, farmers cultivated temperate mixture (Cocksfoot, Italian rye and White clover) for summer and turnips, radish and oats for winter and spring feeding.

Figure 2: Fodder production Whooling Samdrup Jongkharystem

Acreage of pasture varied with Average improved pasture owned by the farmers was 2.14 acres especially among the dairy groups with range from 0.52 to 5.4 acres (Table 2).Farmers with small landholdings, and a variety of agricultural practices, have always been constrained by availability of land. Similar finding have been reported from hills where limited land with low fertility potential is leading to socio-economic consequences (FAO, 1993).A slightly higher acreage of pasture at Samdrup Jongkhar is due to wider uptake of pasture development and dairy farming activities by the area farmers

Table 2. Acreage of improved pasture in sampled households.

ACZ	Improved pasture (acres, mean)	Standard Deviation	Broom grass (acres, mean)	Standard Deviation
Mid altitude (Tsirang, Punakha, Trashigang)	0.52	0.05	1.29	0.47
High Altitude Bumthang	2.95	0.92		
Low altitude S/Jongkhar	5.40	2.7		

Fodder conservation and fodder trees

In high altitude temperate areas, excess fodder was conserved for winter in form of hay and straw while silage making was not popular due to religious reasons, inadequate infrastructure support such as silo pits. Available fodder conserved included grass hay and buckwheat straw wherever they are cultivated. Willow trees have been adequately grown but are largely underutilized due to lack of adequate awareness on the technology. In mid and lower elevations, the farmers conserved paddy straw, maize husks and millet straw. In dairy intensive areas farmers treat maize stover with urea and molasses resulting to minimal wastage which alleviated winter fodder shortage at large.

The fodder trees contributed about 29% of fodder requirement while 25 % of fodder requirement was met from conserved fodder. Some farmers also collected available fodder from the forests during the lean season

Crop residue utilization

In high attitude areas about 50% of sweet buckwheat straw had been used for feeding livestock in winter. Other crop residues such as wheat, barley and oat straw were not even harvested from the field resulting to wastage. Further buckwheat straws were also not properly stored which were stacked on tree tops and temporary platforms exposed to weathering, leaching of nutrients and fungal infestations. In mid altitude, about 91 % of the available rice straw were used to feed livestock as bulk fiber along with tree fodder and were supplemented with cooked gruels of rice bran and flour. However, only about 65% of the crop residues were being fed to the animals in the low altitude which could be attributed to the availability of other fodder resources such as tree fodder and fodder plantations. This could also be due to inadequate support on the enrichment technologies. The overall average utilization of the crop residues is about 79 % (Fig 3).

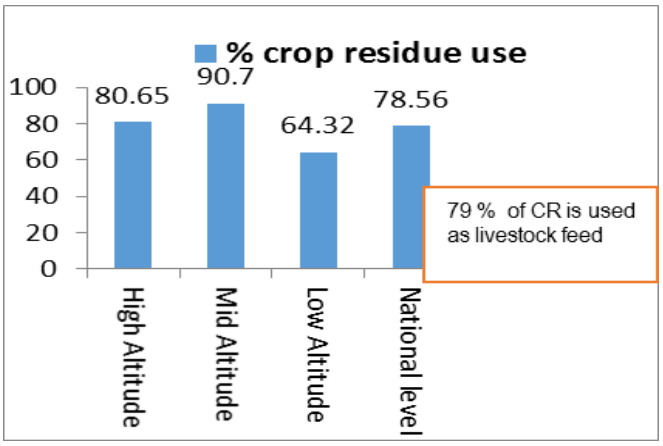

Figure 3 Crop residue use

Maize stover is not used beyond 50 % in maize based systems reportedly probably due to its coarseness and poor palatability. However, urea and molasses treated maize stover was more palatable and used extensively by the dairy groups in Trashigang. The finding is in line with use of crop residue s in other countries of Asia. For example, in Thailand, it was reported that 75% of the rice straw from rain fed upland farms and 82% in the lowland farms is collected by farmers for use as feed (Wanapat, 1990). In Bangladesh, Saadullah et al. (1991) found that 47% of rice straw is used as animal feed. However ILRI projected crop residue utilization between 20-50% (ILRI, 2013). Thus crop residue remains a substantial part of the daily ration of the livestock in mixed farming system.

Availability of agro industrial byproducts

A substantial quantities (> 60 MT) of wet brewers grains (semi-liquid) is founsd to be produced from Army Welfare Project(AWP), Gelephu daily while 24 MT of the same was produced by Brewery Unit at Pasakha bi-monthly. Farmers around Gelephu however are not able to utilize these byproducts although AWP, Gelephu allowed them to take them for free owing to transportation and storage problems while 90 % of the brewery waste from Pasakha was exported to India. Hence, the AWP, Gelephu had installed a drying plant adjacent to the brewery plant and produces about 8 MT of Dry Distillers Grains Solubles (DDGS) which was exported to India. This indicates that there was a great potential to tap these resources for feeding the animals and operating a feed mill within Bhutan Though exact percentage of use in Bhutan is not known, feeding of DDGS upto 40% of the diet to growing dairy heifers achieve excellent growth rateand dairy cow 20 percent of the diet can be replaced without decreasing dry matter intake, milk production, and percentage milk fat and protein (Abdelqader, *et al.* 2006)

Fodder shortage scenario

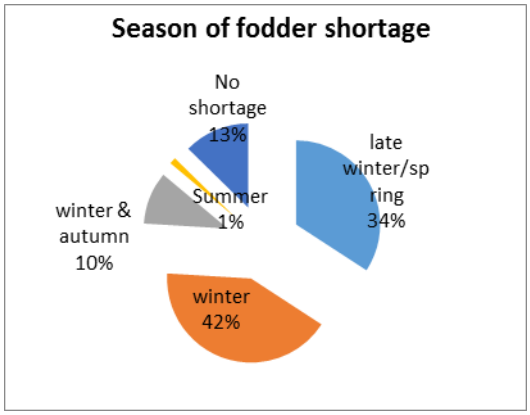

Figure 4 : Fodder shortage scenario in different season

The secondary data indicated that adequate fodder resources were available in the country. However, some cases of fodder shortage had been reported which were localized and regionalized. This could be attributed to under utilization of the available fodder resources. In higher elevations fodder shortage was experienced during late winter and early spring (mid February to mid April) since the conserved fodder and crop residues got exhausted due to long winter season (Fig 4). However, the farmers in mid and low altitude did not face acute shortage of fodder since they cultivated oats which provided them three cuts (harvests) in spring while they also cultivated other fodder crops such as winter maize, broom grass and had ample fodder trees and crop residues. The farmers in low elevations stated that the subtropical pasture and fodder remained green till the end of December while new regeneration of grass began by April. This indicated very short lean period which was easily supplemented by crop residues and fodder trees during from January to March. However, the availability of fodder largely depended on careful planning and management of the available fodder resources.

Feed milling, availability, affordability and quality

Karma feed produced at Phuntsholing Bhutan is extensively used by all farmers. Feed is reported to be available with all most all the feed agents. However, Majority (98%) of the farmers reported that ever rising price has drastically cut the profit margin to bare minimal level, not even enough to sustain the business thereby threatening the mere existence of on-going livestock enterprises. Farther the distance from feed mill in Phuntsholing higher is the transportation cost and resultant price. Thus far off *dzongkhags* are reportedly hard hit.

Among seven mini feed mills (of < 1MT capacity /hr) supplied across Bhutan only one mill at Tashigang is functional. Others, for want of spare parts, break down of motor and lack of feed ingredient had made it non functional. But the functional one also suffers serious problem in maintaining product quality, the feed is often not mixed properly and seems to be with lots of lumps and solid materials. Poor monitoring of production process, not following standard guidelines provided on use of ingredient are the main cause of quality deterioration. Thus as suggested by ILRI (2013) and as is true in other countries investing in feed manufacturing process needs to consider quality control regulatory framework.

Production performances during winter

In the high altitude areas milk production during winter is estimated to reduce by about 50% to what can be produced during summer. Farmers attributed this to cold weather condition, damage to fodder by frost, snow covering the grazing ground which resulted to fodder shortage. In mid and lower elevations too, milk production is reported to decrease during winter but production upset is marginal. Further body condition score is recorded to be below 2.5 (scale 0-5) for most of the animals during winter.

Conclusion and recommendations

Fodder shortage is not so acute in mid hills and lower subtropical belt because of existing feeding alternatives owing to mild weather condition. But in high altitude area, fodder shortage is more pronounced and is having a deleterious effect on livestock production.

Across all ACZ proper planning of fodder resource utilization is non-existent and fodder conservation technologies is unheard by in some areas. Farmers' inadequate knowledge on effective use of available feeding resource warrants a greater attention and advocacy on various technologies and feeding options available during different seasons of the year.

Lack of knowhow on fodder production, feed formulation and feed milling are drawback that hinders concentrate feed availability and affordability to smallholder farmers

Therefore, to bring-down fodder shortage to near zero the study recommends:.

- Vigorous promotion of all available technologies, conservation and nutrient enrichment of crop residues is way forward to overcome fodder shortage
- Breweries waste though is a cheap source nutrition for livestock, potential of hese resources for feeding the animals and use of DDGs as good protein sources for feed mill within Bhutan remained to be tapped
- To address issue of compound feed, a greater awareness on formulation of local feed resource and make optimal use of existing feed mills and installation of additional feedmills of higher capcity but with better quality materials
- Research has to immediately focus on frost resistant winter fodder varieties, improving yields of available fodder species and provide alternatives to farmers.

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