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DRY MATTER CONTENT OF FODDER RESOURCES UTILIZED BY DAIRY FARMERS' GROUPS IN WEST-CENTRAL BHUTAN

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ABSTRACT: The study objective was to evaluate nutrient and Dry Matter (DM) content of available fodder resources utilized by Dairy Farmers' Groups (DFG) in the west-central region. Two DFGs were randomly selected from each district in the region. Samples of available fodders were collected from DFGs. The available fodder resources, including local grasses, improved pasture and the fodder trees were listed. The samples were collected in early spring during the month of March and April in 2017 when fodder plants were flushing and tender. Hundred and ten fodder samples were collected and dried in the laboratory for DM analysis. Secondary data were collected from farmers. The results indicated that farmers used maximum of 41.61% fodder trees as source of fodder to feed their dairy cattle. The mean DM content of available fodder differed significantly. The maximum DM content of 27.68% was in tree fodders and minimum DM content of 19.60% in improved pasture. Overall, the Dry Matter Intake (DMI) of dairy cattle was 8.46 kg, which indicated that the requirement is within the range required by a dairy cow in the region, taking into consideration the average live weight of cattle as 300 kg. The findings of this study on the available fodder resources and the DMI of dairy cattle in the west-central region revealed that there are adequate fodder resources available to meet the DM requirement of dairy cattle.

Keywords: Dry matter; fodder resources; fodder tree; local fodder; improved pasture.

1. INTRODUCTION

The year-round availability of fodder is important to sustain dairy development. Dry matter (DM) is an important component, which determines the chemical composition and nutritive value of feeds and fodder. Livestock, particularly the dairy cattle, needs to consume certain amount of DM in a day. On an average, about 10-11 kg DM day^{-1} is required by a cow to maintain health and production. Dry Matter Intake (DMI) is affected by both animal and feed factors. Body size, milk production, and stage of lactation or gestation are the major animal factors. During peak, the daily DMI of high-producing cows may increase up to 5% of body weight, and even higher in extremely high-producing cows. The typical peak DMI values are in the range of 3.5%–4% of body weight (Herdt 2016). The reliable estimates of forage DM content can help managers to achieve the objectives of forage conservation, livestock feeding and pasture allocation.

DM content in fodder plants increases with maturity. DM is an indicator of the amount of nutrients that are available in particular feed. The knowledge on DM in feed helps to understand the amount of DM an animal can obtain from the feedstuff. It also helps to determine the amount of concentrate feed that is required as supplement.

However, in Bhutan, the nutritional requirements of dairy cattle for optimum production are less emphasized, particularly the nutritional content and quality improvement of available fodder resources. Therefore, a brief study was conducted with the Dairy Farmers Groups (DFGs) in the west-central region on available local fodder resources and the amount of DM fed to the dairy cattle. The objectives were to assess the DM content of available fodder resources and recommend feeding regime for effective dairy production.

2. MATERIALS AND METHOD

2.1 Study sites and sample collection

The districts and study sites of west-central region are presented in Figure 1. The west-central region has 30 functional DFGs. Among them, two DFGs were randomly selected from each district. Samples of available fodder were collected from these two DFGs. The DFG members were asked to list down the available fodder resources that included local grasses, improved pasture and fodder trees. Most of the available fodder species that reappeared within and among DFGs were excluded. The average daily intake of fresh fodder by cattle was collected by interviewing farmers through recall method. The amount of local fodder consumed by the cattle was estimated based on the amount of time spent while grazing during the day.

The samples were collected in early spring during March and April in 2017 when fodder plants were flushing and tender. The plants were identified using books and published articles. A minimum of 10 random samples of fodder preferred by farmers were collected from each DFG. The grass samples were cleaned and cut into appropriate sizes and its fresh weight was measured. The procedure of Upreti and Shrestha (2006) for fodder tree sampling was followed. Samples were collected from all four sides of mid canopy and tree top. Upon collection of fresh samples, the leaves were cleaned to remove any visible surface contaminants and then weighed. The fresh samples weighing 200 to 500g were collected from each fodder species. A total of 110 fresh fodder samples (68.32%) were collected from five districts. The weight of fresh samples was recorded in the field, using a digital weighing balance. The samples were dried in hot air oven to determine DM content. The number of samples collected from each district is presented in Figure 2. The highest number of

Figure 1: Study sites.

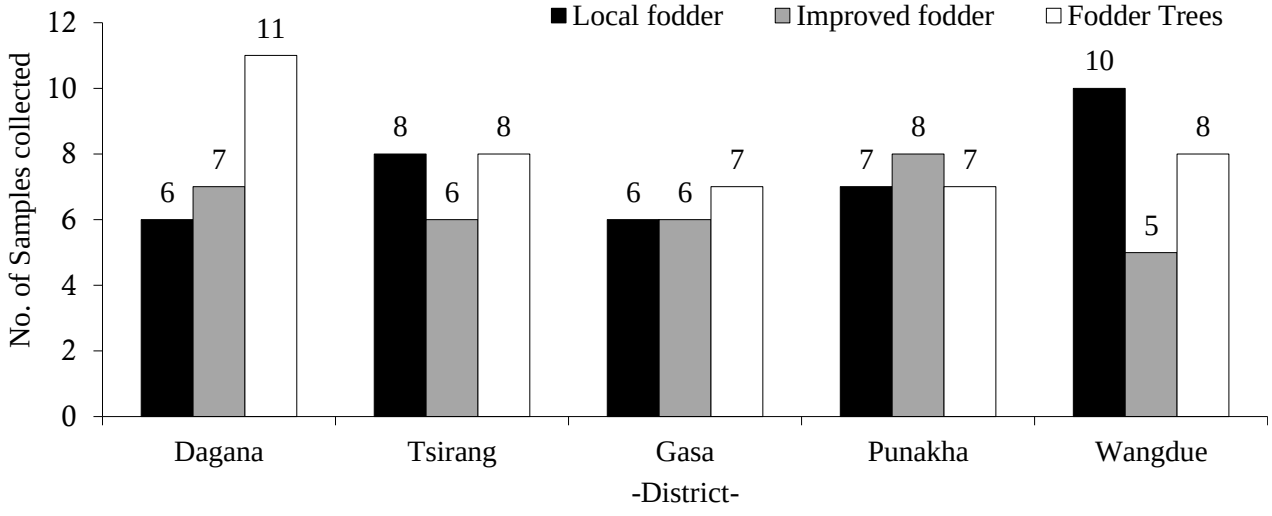

Figure 2: Total number of samples collected from study districts.

samples was collected from Dagana and the lowest was collected from Gasa (Figure 2). The samples were oven dried in paper bags at about 105ºC for 24 hours. The weights of dried samples were measured to determine the DM content of fodder species. The results were entered in Microsoft Excel and analyzed with SPSS version 16.

3. RESULTS AND DISCUSSION

3.1 Available fodder resources

Generally, there were around 161 fodder species available and used by DFG members for feeding dairy cattle in the region (Table 1). The fodder resources available were mainly local fodder, improved pasture and tree fodder. Tsirang district had a maximum number of 47 types of fodder resources. The least was in Gasa district with 17 types of resources. Among the available fodder resources, fodder tree was utilized more (41.61%), followed by local fodder (37.89%) and improved pasture (20.50%) (Table 1).

Table 1: Number of available fodder resources in five districts in west-central region.

District	Number of fodder resources			
	Local fodder	Improved fodder	Fodder Trees	Total
Dagana	10	6	20	46
Tsirang	18	8	21	47
Gasa	6	4	7	17
Punakha	10	9	9	28
Wangdue	17	6	10	33

3.2 Common fodders available in the region

In fodder tree category, the common fodder tree species were *Ficus roxburghii, Ficus cunia, Bauhinia purpurea, Ficus lacor, Grewia tiliaefolia, Ficus nemoralis* and *Ficus benjamina L.* In improved fodder category, the common species were *Brachiaria ruziziensis, Setaria sphacelata, Pennisetum purpureum, Tripsacum laxum, Pennisetum clandestinum, Trifolium repens* and *Avena sativa.* Similarly, in local fodder category, the common species were *Thysanolaena maxima, Cynodon dactylon, Setaria pallidesesca, Persicaria nepalensis, Bidens pilosa* and *Galinsoga parviflora.*

3.3 Dry Matter analysis

The dried sample weights of three different types of available fodders are presented in Table 2. There was a significant difference ($p \leq 0.05$) among fodder categories in dry sample weight. The highest dry sample weight was found in fodder tree (90.99g), followed by improved pasture (69.58g) and lowest in local fodder (68.18g). Fodder tree had the highest dry sample weight. The highest dry sample weight in fodder tree could be attributed to leaf stalks and branches in the sample.

The DM content varied significantly ($p \leq 0.001$) among different types of fodder. In general, the feeding of mixture of all three types of available fodder could provide 22.82% DM to the dairy cattle in the region. Among the types of fodder available, fodder tree contributes maximum DM of 27.68% and improved pasture contributes minimum DM of 19.60% (Table 3). Local fodder and improved pasture were moderately low in DM content as compared to tree fodder. This could be attributed to the stage of fodder growth since the fodder samples were collected during the vegetative stage. Therefore, it is important to consider this fact while formulating feeding regimes and diet for dairy cattle.

3.4 DM Requirement and Intake

The mean DMIs of DFGs are presented in Table 3. The mean DMI was 8.46 kg per animal. The highest DMI was in Goserling DFG, Tsirang and the average DMI was 9.35 kg. The lowest was in Damji/Khatoe, Gasa with mean DMI of 7.78 kg. The average DMI required by each DFG in the region was 7.5 – 9 kg, considering the standard live body weight of 300 kg for Bhutanese cattle (Samdrup et al. 2010; Wangchuk et al. 2017).

The DMI requirement of adult cattle feeding on average quality pasture is 2.5–3% of body weight (http://pir.sa.gov.au). The DMI of this study is within the range and it is meeting the requirement of dairy cows. However, the DM content varies across different seasons.

4. CONCLUSION

There is a need for similar studies for different seasons and stages of fodder growth to derive complete conclusion of DM content of available fodder resources in the region. There is also a need for analysis of other nutrient contents such as crude protein, neutral detergent fiber and energy. Adequate laboratory facilities are needed at regional level beside the facility at the National Research and Development Center for Animal Nutrition. In order to balance DMI of dairy cattle round the year, the DFG members are recommended to practice fodder conservation (hay and silage) during fodder abundance season and use them during the fodder deficit period. Considering that the fodder trees provide maximum DM, it is important to encourage farmers to plant more fodder trees.

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Table 2: Average DM content of different types of available fodder across DFGs in west-central region.

District	DFG	Fodder Type	No. of samples	Mean DM%	SD	CV%
Dagana	Zingchela, Tsangkha	Local Fodder	4	15.76	4.10	26.04
		Improved Pasture	3	17.74	1.87	10.57
		Fodder Tree	6	29.57	8.20	27.73
	Tashiding	Local Fodder	2	15.22	3.94	25.88
		Improved Pasture	4	19.60	5.35	27.32
		Fodder Tree	5	25.22	5.61	22.25
Tsirang	Goserling	Local Fodder	6	27.52	12.23	44.45
		Improved Pasture	2	22.28	0.59	2.65
		Fodder Tree	3	27.42	5.69	20.75
	Patshaling	Local Fodder	2	12.04	3.91	32.47
		Improved Pasture	4	17.02	3.34	19.62
		Fodder Tree	5	25.36	3.84	15.16
Gasa	Damji/Khatoe	Local Fodder	2	9.69	3.09	31.88
		Improved Pasture	4	17.20	4.98	28.93
		Fodder Tree	3	29.03	10.18	35.08
	Yamina/Khailo	Local Fodder	4	13.04	3.97	30.45
		Improved Pasture	2	17.17	10.09	58.76
		Fodder Tree	4	24.89	6.41	25.76
Punakha	Kabjisa	Local Fodder	4	23.32	8.99	38.55
		Improved Pasture	5	20.28	6.02	29.69
		Fodder Tree	2	22.45	3.74	16.67
	Toepaisa	Local Fodder	3	12.72	5.78	45.46
		Improved Pasture	3	23.96	3.58	14.94
		Fodder Tree	5	20.09	5.99	29.82
Wangdue	Busa, Sephu	Local Fodder	5	22.86	13.51	59.12
		Improved Pasture	3	18.44	4.99	27.06
		Fodder Tree	3	46.51	15.65	33.64
	Bajo, Tsedtsho	Local Fodder	5	29.67	26.48	89.24
		Improved Pasture	2	25.69	7.06	27.46
		Fodder Tree	5	30.16	6.87	22.79

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Table 3: DMI of DFGs in study districts.

Dry Matter Intake of DFGs						
District	Name of DFG	Fodder Type	Mean DM%	Average daily feeding (kg)	DMI (kg)	Total
Dagana	Zingchela, Tsangkha	Local Fodder	15.76	20	3.15	8.47
		Improved Pasture	17.74	5	0.89	
		Fodder Tree	29.57	15	4.44	
	Tashiding	Local Fodder	15.22	25	3.81	8.96
		Improved Pasture	19.60	7	1.37	
		Fodder Tree	25.22	15	3.78	
Tsirang	Goserling	Local Fodder	27.52	15	4.13	9.35
		Improved Pasture	22.28	5	1.11	
		Fodder Tree	27.42	15	4.11	
	Patshaling	Local Fodder	12.04	20	2.41	8.33
		Improved Pasture	17.02	5	0.85	
		Fodder Tree	25.36	20	5.07	
Gasa	Damji/Khatoe	Local Fodder	9.69	6	0.58	7.78
		Improved Pasture	17.20	25	4.30	
		Fodder Tree	29.03	10	2.90	
	Yamina/Khailo	Local Fodder	13.04	20	2.61	8.44
		Improved Pasture	17.17	5	0.86	
		Fodder Tree	24.89	20	4.98	
Punakha	Kabjisa	Local Fodder	23.32	20	4.66	9.05
		Improved Pasture	20.28	5	1.01	
		Fodder Tree	22.45	15	3.37	
	Toepaisa	Local Fodder	12.72	25	3.18	8.40
		Improved Pasture	23.96	5	1.20	
		Fodder Tree	20.09	20	4.02	
Wangdue	Busa, Sephu	Local Fodder	22.86	15	3.43	8.52
		Improved Pasture	18.44	15	2.77	
		Fodder Tree	46.51	5	2.33	
	Bajo (Tsedtsho)	Local Fodder	29.67	20	5.93	8.73
		Improved Pasture	25.69	5	1.28	
		Fodder Tree	30.16	5	1.51	
	Mean					8.46
	Std. Deviation					0.67