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Availability and requirement of feed and fodder in different districts of Karnataka

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Fodder and feed resources in the country are dwindling. The demand for forages however is increasing due to rearing of crossbred animals. Sustenance of livestock corresponds with fodder availability. In today's scenario, systematic planning of fodder and feed resources is required to ensure the survival of not only animals but also the livelihood of the vast majority of small and marginal livestock owners. Karnataka needs to pursue a systematic fodder planning strategy because it is the country's second most drought-affected state. Planning exercise demands factual information. The present study brings out insights into the availability of fodder as dry matter to the livestock for Karnataka, keeping district as the smallest unit.

Study area: Study was conducted in Karnataka by considering its districts as units.

Sources of data: Study sourced both primary and secondary data. District-wise land use classification data and crop production data of 24 crops for four years, viz. 2015–16, 2016–17, 2017–18, and 2018–19 was obtained from Directorate of Economics and Statistics, Government of India [AUTHOR: PROVIDE REFERENCE]. Secondary data on livestock numbers as per 20th livestock census was collected from the Department of Animal Husbandry and Dairying, Government of India [PROVIDE REFERENCE] and converted into Adult Cattle Units as recommended by Ramachandra *et al.* (2007) as outlined in Table 1.

Computing availability of dry matter: Crop production data was converted into quantity of straws/stovers (crop residue), grains, husk and bran by using harvest indices and extraction rates as suggested by Anandan and Sampath (2012) with slight modification wherein instead of uniform harvest indices for all pulses (1.7) specific harvest indices for tur (1.8), gram (1.2) and soybean (1.2) were used (Biradar and Kumar 2013). Using harvest indices, dry matter for each crop was obtained. For instance, for every 100 tonnes of wheat grain produced, it was converted into 100 tonnes of wheat straw (100 multiplied by the harvest index of 1.0), 2 tonnes of wheat grains available for feeding (100 multiplied by the extraction rate of 0.02) and 8 tonnes of wheat bran (100 multiplied by 0.08). The dry matter content for all-crop residues, grains, cakes, bran/husk was considered as 90% except for sugarcane tops. For sugarcane tops, 25% dry matter was considered, as it is high in moisture. Dry matter available from all the crops were added and expressed in Million Metric Tonnes (MMT).

Table 1. Adult cattle units

Species	Age	Conversion factor
Buffalos	>2.5 years	1.14
	1.0-2.5 years	0.50
	<1.0 years	0.17
Cattles (cow + bullocks)	>2.5 years	1.00
	1.0-2.5 years	0.34
	<1.0 years	0.11
Sheep/goat	1.0 years	0.10
	<1.0 years	0.03

Green fodder yields for seven land use types mentioned under land use classifications were computed by following the procedure suggested by Ramachandra *et al.* (2007). It was assumed that the average dry matter content of green fodder obtained from all land use classifications is 25%. So total dry matter availability from crops and land use classifications was worked out using the formula:

$$DM\ availability\ MMT) = DMc + DMluc$$

where, DMc, Dry matter from crops and DMluc, Dry matter from land use classification.

Computing requirement of dry matter: Dry matter requirements of ruminants (cattle, buffalo, sheep and goats) were calculated on the basis of a standard adult cattle unit (ACU) of 350 kg body weight, utilizing the conversion factors for livestock species and age class (Ramachandra *et al.* 2007). It was assumed that dry matter requirement

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of an Adult Cattle Unit is 2% of body weight (350 kg) that comes to 7 kg dry matter/day/ACU which is equivalent to 2.555 tonnes/year/ACU. Using this, total dry matter requirement (DMr) of livestock for each district of Karnataka was calculated as:

$$DMr\ (t/y) = TotalACU \times 2.555$$

where, DMr, total dry matter requirement (tonnes/year).

Per cent DM availability was worked out to understand to what extent the state/district had excess/deficit DM using the formula:

$$\text{Per cent DM availability} = \frac{\text{DM available}}{\text{DM required}} \times 100$$

Categorization of districts: Difference between dry matter availability and requirement was calculated and converted into percentage for each district. Based on per cent dry matter availability, districts were classified into five groups: surplus (>100%), adequate (80-100% DM availability), moderately adequate (60–79% DM availability), deficient (40–59% DM availability) and severely deficient (< 40% DM availability) districts.

Contribution of different sources to DM availability: Sources of dry matter were crop residues (Crop production data), greens (land use classification data) and concentrates (crop production data). These sources were further divided as sub-sources coarse straw, fine straw, leguminous straw, sugarcane tops for crop residues; gross cropped area, fallows, forests, pastures and others for greens and; grains, brans and chuni, oil cakes for concentrates. Percentage contribution of each source and sub-source towards total dry matter availability was calculated to understand which source is contributing highest to the total dry matter.

Classification of districts in Karnataka based on extent of estimated DM availability to the livestock: Out of 30 districts of Karnataka, 6 districts belonged to surplus DM available category. Four districts belonged to adequate, 3 districts belonged to moderately adequate DM available categories and 5 districts belonged to deficient category. Twelve districts belonged to severely deficient DM category with the DM availability of less than 40% (Table 2). The mean DM availability for the state was 68.61±54.41% indicating the deficiency to the extent of 31.39%. Singh *et al.* 1997 reported that there was a substantial gap of demand and supply of dry matter of about 31% in India.

Table 2. Classification of districts as per estimated DM availability

Category	Criteria	No. of districts	Percentage of districts
Surplus	>100 % DM availability	6	20.68
Adequate	80-100 % DM availability	4	13.79
Moderately adequate	60–79% DM	3	10.34
Deficient	40–59% DM availability	5	17.24
Severely deficient	< 40% DM availability	12	41.37
Total		30	100
Mean DM availability	-	68.61%	-
SD		54.41	

Distribution of districts based on the estimated availability of DM: Results pertaining to district-wise DM availability is presented in Fig. 1. Bagalkot, Belagavi, Vijayapur, Kalaburagi, Bidar and Haveri districts belonged to surplus DM available category. The mean percentage of DM available for this category was 158.44%. Bagalkot has more area under irrigation due to Upper Krishna and Tungabhadra irrigation projects, as a result higher cropping intensity prevails in this district. Also, Sugarcane is grown widely in this district and sugarcane tops are fed to livestock (Rathva *et al.* 2020), which could be the reason for having surplus DM. Davangere, Bellary, Mandya and Raichur districts belonged to adequate DM available category. Dharwad, Koppal and Chikkamagaluru districts belonged to moderately adequate DM available category. Gadag, Yadgir, Chamarajanagar, Mysuru and Kodagu belonged to deficient DM available category. The mean percentage of DM availability in these districts was only half the requirement (50.86%). Chikballapur, Chitradurga, Hassan, Shivamogga, Uttara Kannada, Bengaluru rural, Tumakuru, Ramanagara, Kolar, Udupi, Dhakshina Kannada and Bengaluru urban were the districts having percentage dry matter availability of less than 40% and thus belonged to severely deficient category. Anandan *et al.* (2005) also reported that the potential dry matter availability for the Malnad region was hardly sufficient to meet the dry matter requirement. Deficient and severely deficient districts were the most vulnerable districts.

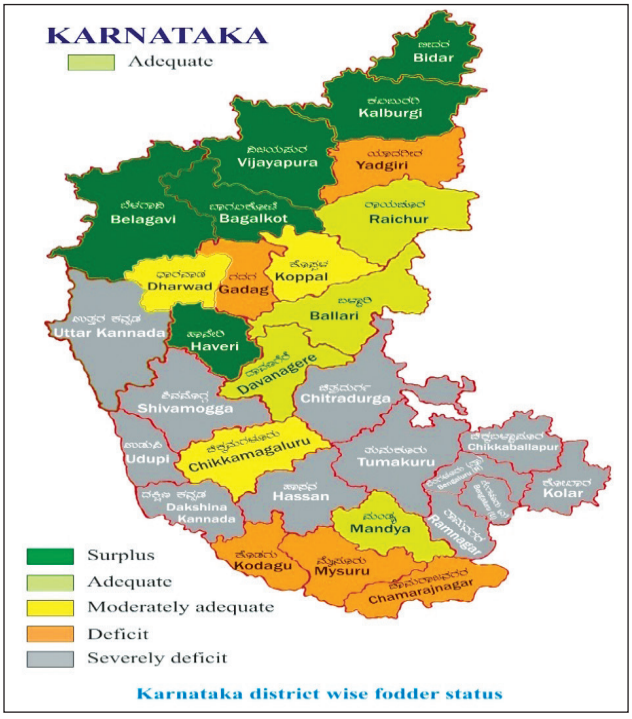

Fig. 1. District-wise estimated DM availability.

Table 3. Percentage contribution of different sources towards total estimated DM availability in different categories of districts

Source	Surplus >100% DM	Adequate DM availability 80%	>Moderately Adequate DM availability 60%-79%	Deficient DM availability 40%-59%	Severely deficient DM availability <40%	State
Crop residue						
Coarse straw	14.79	25.37	27.30	15.57	21.33	18.60
Fine straw	1.59	18.58	14.28	15.13	17.16	9.17
Leguminous straw	14.85	6.58	7.36	10.03	2.89	10.44
Sugarcane tops	49.84	21.20	8.58	12.16	4.44	30.80
Total crop residues	81.07	71.72	57.52	52.90	45.82	69.01
Greens						
Gross cropped area	13.88	18.97	26.01	28.89	22.79	18.53
Fallows	0.59	1.36	1.25	1.81	2.95	1.29
Forests	0.98	1.91	4.54	7.61	11.88	3.94
Pasture	0.75	1.94	5.98	4.51	12.31	3.73
Others*	0.12	0.58	0.51	0.62	1.77	0.56
Total greens	16.32	24.76	38.29	43.44	51.69	28.05
Concentrates						
Grains	0.49	1.11	1.08	0.75	1.05	0.76
Brans and chuni	0.41	1.13	0.72	0.96	0.42	0.60
Oil cakes	1.70	1.28	2.40	1.96	1.02	1.59
Total concentrate	2.61	3.52	4.19	3.67	2.49	2.94

*, Culturable waste and miscellaneous.

Contribution of different sources to the total DM availability: Contribution of crop residue to the total dry matter availability in the state was 69.01% (Table 3). Its contribution was highest (81.07%) in surplus districts and lowest in severely deficient districts (45.82%). Gross cropped area contributed nearly 29% to the total dry matter availability in deficient districts. This was followed by 26.01% in moderately adequate districts, 22.79% in severely deficient districts, 18.97% in adequate districts and 13.88% in surplus districts. Contribution of total greens from all sources was more in severely deficient districts than surplus districts. Its contribution to the state DM was 28.05%. Among the concentrates, oil cakes contributed more among all the categories.

As the contribution of coarse straw (Sorghum, Bajra and maize) decreased, the contribution of fine straw (Rice, wheat, Ragi and small millets) increased in some of the districts. However, the proportion of increase was not in correspondence with decrease between coarse and fine straw (Yadav *et al.* 2017 and Reddy *et al*. 2018). In high rainfall districts of Udupi and Dakshina kannada, contribution of coarse straw was almost negligible which is due to cropping pattern followed in these districts (Fig. 2A). Gulbarga district got more legume straw (47.74%), being the pulse bowl of Karnataka (Fig. 2B). Neighboring districts of Gulbarga like Bidar (14.85%), Yadgir (10.03%), Bijapur (14.85%) and Raichur (6.58%) also showed good quantity of leguminous straw. Contribution of leguminous straw was almost negligible in the districts like Kodagu (10.03%), Shimogga (2.89%), Dakshina Kannada (2.89%), Uttara Kannada (2.89%), Hasan (2.89%) and Mandya (6.58%). Protein rich legume straws contribution was 10.44% to the total dry matter availability of the state.

It can be concluded that the average availability of DM in state is not encouraging. Even at village level, the situation is almost same. Six districts of the state were surplus in DM by almost 50%. This is an opportunity for the policy makers to ensure that this surplus DM is collected and distributed in those districts which are experiencing DM deficiency. Composition of leguminous straw in total DM as was found by the study is less. It is demanded to take steps for enhancing the availability of top feeds to the livestock, so that livestock husbandry becomes more remunerative to the farmers.

SUMMARY

Agriculture and livestock sectors are crucial for economic and social equity in rural areas. Livestock sector growth and fodder availability are directly related. Enhancing profitability of livestock husbandry can only be possible by ensuring adequate fodder to the livestock. A study was therefore conducted to know the feed and fodder availability and requirement at various districts of Karnataka. Secondary data of land use classification, crop production (2015 to 2019) and livestock census were used to derive dry matter (DM) availability and requirement for each district. Primary data was collected to understand the village level situation. Results indicated that state has an average of only 68.61±54.41% dry matter availability. Out of 30 districts, six districts belonged to surplus (>100%) and 12 districts belonged to severely deficient DM category with the DM availability of less than 40%. Crop residues contributed highest (69.01%) to the total DM. Contribution of total greens from all sources was found to be more in severely deficient districts. Bagalkot district had

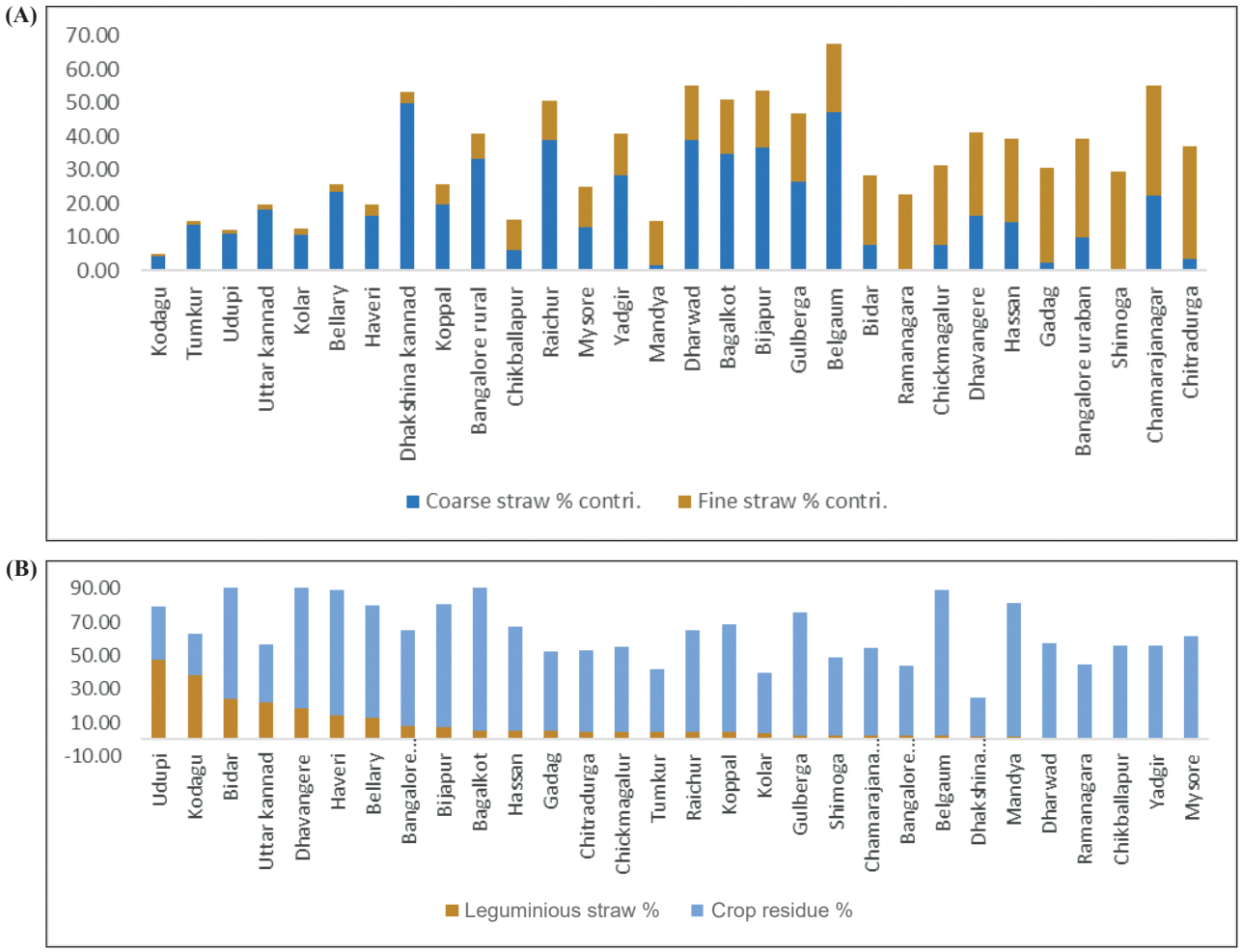

Fig. 2. (A) Percentage contribution of coarse straw and fine straw in different districts of Karnataka; (B) Percentage dry matter availability from legume straw to the total crop residue across different districts of Karnataka.

highest and Bengaluru urban had lowest DM availability. These findings are pivotal for developing fodder plan for Karnataka.

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