

## ASSESSMENT OF LIVESTOCK FEED AND FODDER RESOURCES IN CENTRAL ZONE OF PUNJAB

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### SUMMARY

This paper estimates the feed and fodder resources in Ludhiana district using primary data from 90 farmers spread over standard land holding categories. By referring to the standard values, *i.e.* a requirement of 4.02 kg of dry matter, most of the farmers of each farm size category attained the overall adequate status in the rainy season (83.3%), followed by the winter season (63.3%), and summer season (44.4%), which means that almost half of the sampled farmers (56% to be exact) had insufficient dry matter availability from green fodder during the summer season. The roughage to concentrate ratio observed for all the three seasons has been recorded as, summer (68.9:31.1), rainy (79.3:20.7) and winter (72.1: 27.9) against the standard normative requirement of 67:33. Overall 94.7 per cent of large, 88.5 per cent of medium and 73.1 per cent of the small farmers had adequate total dry matter intake on their farms. It can be concluded that Punjab state is lucky to have relatively enough dry matter availability on an overall basis, which may be related to a greater degree of awareness about the relevance of feed and fodder in enhancing livestock output. However, the nutritionally insufficient dry matter intake from green fodder during lean seasons in the majority of farms points to the need to sensitize farmers about better land resource management and appropriate fodder crop selection to provide year-round availability of green fodder.

**Key words:** Availability, adequacy, dry matter, green fodder, requirement

The livestock sector also known as animal agriculture sector employs at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world (Thornton, 2010). Despite the importance of livestock, our livestock output has been exceedingly low. Because most animals in developing countries belong to a class that is typically characterized by lower productivity levels, global gains can be generated by large numbers of producers catching up through the application of good feeding and management practices rather than pushing the frontier for a few high producers using high-tech approaches (Makkar and Ankers, 2014).

Availability of feed in quantity as well as quality is one of the most limiting factors to improve livestock productivity (Birtal and Jha, 2005). Livestock sector relies heavily on the sources of feed and fodder to maintain its economic feasibility as feed and fodder, constituting about 65-70 percent of the livestock rearing cost, are said to be responsible for improving the productivity by 70 per cent and only 30 per cent improvement comes through genetic research. It is well acknowledged that increasing livestock production is a prerequisite for achieving overall agricultural

expansion. The security of animal feed and fodder is just as critical as human food security (Meena *et al.*, 2018).

Assessment of feed and fodder resources for any particular region is a pre-requisite for planning towards improvement of livestock sector. Although several attempts (Hajra and Rekib, 1991; Singh and Mujumdar, 1992; Jain *et al.*, 1996; Ramachandra *et al.*, 2007; Dixit and Birtal, 2010, Thirunavukkarasu *et al.*, 2011) have been made to estimate feed and fodder availability in the country for livestock, however no systematic efforts have been made in Punjab state. Therefore, this study was undertaken to assess the demand and supply of different feed stuffs in the state.

### MATERIALS AND METHODS

The present study is based on the primary data. Four stage random sampling technique was used for the selection of ultimate sampling units. One district was randomly selected out of top five ranking districts in first stage, two blocks from each district, two villages from each block, thus selection of a total of 90 farmers spread over standard land holding categories.

In order to reasonably infer the results, the varied dairy animals were transformed into standard animal units, synonymously known as Adult Cattle Units (ACU's) as per (Ramachandra *et al.*, 2007).

Feed resources were categorized as green forages, crop residues and concentrates (grains, grain by products and oil seed cakes). Livestock feed and fodder availability was estimated on DM basis from roughages (green fodder and dry fodder) and concentrates. The dry matter content of different fodder crops cultivated by the respondent farmers is according to Feedipedia.com. The feed and fodder requirement were calculated on the basis of standard adult cattle unit (ACU) of 350 kg body weight by assuming DM intake of 7.5 kg /day/ACU (Dixit and BIRTHAL, 2010). The total DM requirement of each ACU was calculated, considering that requirements were met by a ration containing 1/3 of concentrate and 2/3 of roughages, out of roughage portion, dry fodder comprised 1/5 and green fodder 4/5 to draw the conclusions. The fodder availability has been enumerated for the three different seasons as follows.

Summer season : 120 days (March, April, May, June)

Rainy season : 90 days (July, August, September)

Winter season : 150 days (October, November, December, January, February)

The One-way Analysis of Variance was carried out to test the significance of the seasonal differences with respect to selected variables (Snedecor and Cochran, 1994).

## RESULTS AND DISCUSSIONS

Adequate supply of quality feed and fodders is critical for enhancing the productivity of dairy animals. The feed and fodder resources are gradually decreasing throughout India owing to many factors like shrinkage of common property resources and shift towards the cultivation of commercial crops etc (Biradar and Kumar, 2013). In this scenario, quantification of existing feed resources is necessary for the development of efficient feeding strategies and judicious utilization of available feed resources (Raju *et al.*, 2017).

### Livestock Population

The livestock population at the selected farm households has been presented in (Table 1). The

average size of herd was the highest for the medium farms (8.11) followed by large (7.85) and small farms (5.39). The average livestock population (in terms of ACUs) irrespective of the farm size has been recorded at 5.29, the corresponding number being 3.86 for small farms, 5.73 for medium farms and 5.92 for large farm size category. On an average, there were 2.63 in milk buffalo ACUs per farm, the highest were recorded at 3.00 for large farms, followed by 2.76 for medium and 1.97 for small farm category. The total buffalo ACUs were to the order of 4.09, 4.04 and 2.43 on large, medium and small farm size category respectively. The average number of young buffalo stock per farm has been recorded at 1.88, 1.63 and 1.23 for medium, large and small farms size categories, respectively which indicated an encouraging trend for the future livestock population.

The rearing of indigenous or local cows has been recorded for only small farmers. On an average there were only 0.19 in milk local cows on small farms and young stock has been conspicuous by its absence in all the farm size categories. The number of crossbred cattle was found to be higher than the local cows in all farm size categories who preferred to keep them due to comparatively higher yield indicating an increased awareness about productive performance of crossbred cattle. The number of in milk crossbred cattle was 1.34 in case of large farms, 1.27 in case of medium farms and 0.88 in case of small farms. The crossbred young stock has been found to be the highest on small farms *i.e.* 0.46 per farm followed by medium (0.42) and large farms (0.37). The total ACU's of crossbred cattle were calculated to be 1.51 on large and medium farms and 1.13 on small farms, the overall average being 1.40. It was clear that in the study area, number of buffaloes was much higher than number of crossbred and local cows. However, young stock population of crossbred cattle indicated a positive trend but still it was comparatively lower than that observed in the case of buffalo. The reason might be the preference of people for buffalo milk over the cow milk in Punjab.

### Green fodder

Fodder, being a major and cheap source of protein, plays an important role in reaping the economies in livestock production and particularly so in case of milk. Fodder crops are inherently rich in dietary fiber, energy and crucial nutrients. It is well known that cereal fodder crops are energy rich and

TABLE 1  
Livestock population of the selected farms

Particulars	Small (n <sub>1</sub> =26)		Medium (n <sub>2</sub> =26)		Large (n <sub>3</sub> =38)		Overall (N=90)					
	HS*		HS		HS		HS					
	Abs	Av	Abs	Av	Abs	Av	Abs	Av				
<b>Buffalo</b>												
In Milk	45	1.73	1.97	63	2.42	2.76	100	2.63	3.00	208	2.31	2.63
Dry	3	0.12	0.13	10	0.38	0.44	11	0.29	0.33	24	0.27	0.30
Heifer	6	0.23	0.12	27	1.04	0.52	37	0.97	0.49	70	0.78	0.39
Young Stock	32	1.23	0.21	49	1.88	0.32	62	1.63	0.28	143	1.59	0.27
Total	86	3.31	2.43	149	5.73	4.04	210	5.53	4.09	445	4.94	3.60
<b>Local Cattle</b>												
In Milk	5	0.19	0.19	-	-	-	-	-	-	5	0.06	0.06
Dry	-	-	-	-	-	-	-	-	-	-	-	-
Heifer	2	0.08	0.03	-	-	-	1.00	0.03	0.01	3	0.03	0.01
Young Stock	1	0.04	0.004	-	-	-	-	-	-	1	0.01	-
Total	8	0.31	0.22	-	-	-	1	0.03	0.01	9	0.10	0.07
<b>Crossbred Cattle</b>												
In Milk	23	0.88	0.88	33	1.27	1.27	51	1.34	1.34	107	1.19	1.19
Dry	3	0.12	0.12	1	0.04	0.04	2	0.05	0.05	6	0.07	0.07
Heifer	6	0.23	0.08	12	0.46	0.16	8	0.21	0.07	26	0.29	0.10
Young Stock	12	0.46	0.05	11	0.42	0.05	14	0.37	0.04	37	0.41	0.05
Total	44	1.69	1.13	57	2.19	1.51	75	1.97	1.51	176	1.96	1.40
Draft Animal	2	0.08	0.08	5	0.19	0.19	12	0.32	0.32	19	0.21	0.21
Grand Total	140	5.39	3.86	211	8.11	5.73	298	7.85	5.92	649	7.21	5.29

\*HS: Herd size, Abs: Absolute number. Av: Average herd size.

leguminous fodders are protein rich. Apart from that the green fodder crops help in economizing the cost of milk production by providing less expensive source of nutrients in sharp contrast to concentrates and thereby paving the way for sustained profitability (Singh and Kataria, 2017).

### Season wise availability vis-a-vis requirement

In order to capture the effect of seasonal variations in fodder availability, a season wise analysis was proposed to be conducted. The pertinent information related to this aspect has been presented in (Table 2). The perusal of the information presented therein highlights that the availability (on fresh basis) of green fodder on small farms was significantly higher ( $p < 0.05$ ) in rainy season (36.2 kg/ACU/d) in comparison to both winter (29.6 kg/ACU/d) and summer (29.3 kg/ACU/d), which were statistically at par. In case of medium farms, the availability in rainy season (31.2 kg/ACU/d) has been recorded as statistically at par ( $p < 0.05$ ) with that in winter season (28.9 kg/ACU/d) notwithstanding the absolute difference of more than 2 kg/ACU/d. The fodder

TABLE 2  
Season-wise per animal availability of green fodder at the selected farm households

Particular	Availability of green fodder/animal (kg/ACU/d)			
	Summer	Rainy	Winter	Overall
	<b>Fresh basis</b>			
Small (n <sub>1</sub> =26)	29.3 <sup>b</sup>	36.2 <sup>a</sup>	29.6 <sup>a</sup>	31.2
Medium (n <sub>2</sub> =26)	26.0 <sup>b</sup>	31.2 <sup>a</sup>	28.9 <sup>ab</sup>	28.5
Large (n <sub>3</sub> =38)	30.2 <sup>b</sup>	38.9 <sup>a</sup>	36.3 <sup>a</sup>	34.9
Overall (N=90)	28.7 <sup>b</sup>	35.9 <sup>a</sup>	32.2 <sup>ab</sup>	32.0
	<b>DM basis</b>			
Small (n <sub>1</sub> =26)	4.3 <sup>b</sup>	7.6 <sup>a</sup>	4.6 <sup>b</sup>	5.2
Medium (n <sub>2</sub> =26)	3.9 <sup>b</sup>	6.6 <sup>a</sup>	4.7 <sup>b</sup>	4.9
Large (n <sub>3</sub> =38)	4.5 <sup>c</sup>	8.4 <sup>a</sup>	6.2 <sup>b</sup>	6.1
Overall (N=90)	4.2 <sup>c</sup>	7.6 <sup>a</sup>	5.3 <sup>b</sup>	5.5

<sup>abc</sup>Figures with different superscripts in a row differ significantly ( $p < 0.05$ ).

availability in all the three seasons was the highest in case of large farms in comparison to their counterparts with smaller holdings. At the overall level, irrespective of the size of holding, the availability of green fodder in rainy and winter season was statistically at par

( $p < 0.05$ ) and significantly higher ( $p < 0.05$ ) than that in the summer season.

Green fodder availability on the basis of dry matter also exhibited the same pattern as far as the absolute values are concerned. The green fodder availability on dry matter basis was significantly lower ( $p < 0.05$ ) in summer season in comparison to rainy season in all the three land holding categories. The dry matter availability (kg/ACU/d) has been estimated to be maximum at 7.6 kg in rainy season, and significantly higher ( $p < 0.05$ ) than that in winter (5.3 kg) and summer season (4.2 kg). The overall dry matter availability was 5.5 kg/ACU/d. The maximum dry matter availability of 6.1 kg was observed on large farms followed by small (5.2 kg/ACU/d) and medium farms (4.9 kg/ACU/d). The critical examination of second panel of (Table 2) brings forth that in case of all the seasons and all the land holding categories (except for availability of 3.9 kg in case of medium farmers in summer season) has been way above the reference value of 4.02 kg/ACU/d, hence connoting adequacy.

#### Green fodder adequacy status (on DM basis)

In order to overcome the flaw of inferring the results on the basis of averages, an effort has been made to make a comparison of green fodder availability with reference values with respect to each farm separately in different seasons. The results obtained there from have been presented in (Table 3). By referring to the standard values i.e., requirement of 4.02 kg of dry matter, it was enumerated that 42.3 per cent of the sampled small farms had adequate green fodder intake in summer seasons, 69.2 per cent in rainy season and 50 per cent were having nutritionally

adequate dry matter intake in winter season on small farms. In summer season, only 30.8 per cent of the medium farms were having nutritionally adequate dry matter intake while this proportion is 84.6 per cent in rainy season and 57.7 percent in winter season. In case of large farmers, 55.3 per cent in summer, 92.1 per cent in rainy and 76.3 per cent in winter were having the nutritionally adequate green fodder. It was also evident from the table that most of the farmers of each farm size category attained the overall adequate status in rainy season (83.3 %) followed by that of winter season (63.3%) and summer season (44.4 %) which means on the individual basis, almost more than half of the sampled farmers (56 % to be more precise) were having inadequate dry matter availability during summer season.

#### Month-wise availability vis-a-vis requirement

An attempt has been made to estimate the month-wise green fodder availability and the results have been presented in (Table 4). The perusal of the table highlights that the green fodder availability was the highest in the months of January and February in case of all the land holding categories. It can be attributed to availability of multi-cut berseem fodder crop during this period, which gives its best during these months and attains the high yield which leads to glut like situation in these months and adequate supply is there till April. After this i.e. in May, the availability of green fodder starts declining and hence in the current situation reached at its minimum of 19.1 kg/ACU/d during the month of June. The supply of green fodder again increased from 33.5 kg/ACU/d during July to 41.1 kg/ACU/d during September and reached at its minimum of 19 kg/ACU/d during the month of

TABLE 3  
Season-wise distribution of sampled farms on the basis of green fodder adequacy\* status

Particulars		Summer		Rainy		Winter		Overall	
		F	%	F	%	F	%	F	%
Small ( $n_1=26$ )	Adequate	11	42.3	18	69.2	13	50.0	26	100.0
	Inadequate	15	57.7	8	30.8	13	50.0	0	0.0
Medium ( $n_2=26$ )	Adequate	8	30.8	22	84.6	15	57.7	26	100.0
	Inadequate	18	69.2	4	15.4	11	42.3	0	0.0
Large ( $n_3=38$ )	Adequate	21	55.3	35	92.1	29	76.3	38	100.0
	Inadequate	17	44.7	3	7.9	9	23.7	0	0.0
Overall ( $N=90$ )	Adequate	40	44.4	75	83.3	57	63.3	90	100.0
	Inadequate	50	55.6	15	16.7	33	36.7	0	0.0

\*on the DM basis kg/ACU/d.

October. The months of June and October were the months, when farmers were having shortfall of green fodder in general and some of them have to take recourse to dry fodder and homemade feed only. The trend has been more or less the same for all the land holding categories, with large availability in all the months being higher than their counterparts with small holdings.

In case of month-wise daily availability of green fodder (kg/ACU) on the basis of dry matter, the overall scenario depicts that maximum dry matter of 9.6 kg was available in the month of September in comparison to 7.2 in the month of January and February when fodder on the fresh basis happens to be at its maximum. The reason could be the higher DM content of maize (23.3 %) fodder available in September and comparatively lower DM content of berseem (12.5 %) available in the month of January.

### Feed (Dry fodder and concentrates) and Fodder Availability

#### Dry fodder

Wheat straw was given as dry fodder to the animals in the study area. Straw is a poor quality dry roughage. Straw is given to the ruminants as fillers because straw hardly has any feeding value. It is highly deficient in minerals, vitamins, proteins. Even the carbohydrate present is of poor quality and provide between 40 to 50 per cent in digestible energy. It is barely sufficient to yield adequate energy to meet their maintenance/needs.

#### Concentrates

Concentrates are feeds that contain a high density of nutrients, usually low in crude fiber content

(less than 18 % of dry matter) and high in Concentrates may be high in energy, referred to as energy concentrates, such as cereals and milling by-products, or high in protein, with over 20 per cent crude protein, referred to as protein concentrates. Concentrates may be fed in raw or milled forms as individual feeds (grains, oil meals and cakes etc.) or may be blended or formulated into balanced rations for particular production purposes (compound feeds).

A wise admixture of roughage and concentrates is very important to enhance the productive performance of animals.

In view of the observations reported by many of the researchers (GOI, 1976; Singh and Majumdar, 1992; Ramachandra et al, 2007) that the supply of feed and fodder has always remained short of normative requirement, the present study had been envisaged the feed and fodder intake at per ACU level. The table that follows gives a season wise account of feed and fodder intake. It can be observed that the overall roughage (green and dry fodder) intake per ACU per day during summer, rainy and winter was 6.8, 8.7 and 7.9 kg respectively while the overall concentrate intake was 3.1 kg in summer, 2.3 kg in rainy and 3.1 kg in winter season in comparison to standard reference value of 5.03 kg for roughages and 2.47 kg for concentrates. The roughage to concentrate ratio observed for all the three seasons has been recorded as, summer (68.9:31.1), rainy (79.3:20.7) and winter (72.1: 27.9). The consumption of concentrates in rainy season has been found to be less than the normative quantity of 2.47 kg in case of small (2.2 kg) and large (2.1 kg) farms presumably because of the notion of abundance of green fodder in rainy season. It can be concluded that due to more availability of green fodder, farmers prefer to use more

TABLE 4  
Month-wise green fodder availability on the selected farms

Particular	Month-wise green fodder availability (kg/ACU/d)											
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
	<b>Fresh basis</b>											
Small (n <sub>1</sub> =26)	33.9	33.5	41.1	18.6	13.5	20.4	47.8	47.8	39.2	29.9	29.5	18.6
Medium (n <sub>2</sub> =26)	30.2	29.8	33.6	15.2	11.0	21.4	48.4	48.4	34.6	27.4	23.5	18.3
Large (n <sub>3</sub> =38)	35.4	35.0	46.2	21.9	17.5	28.1	56.9	56.9	41.1	33.7	25.9	20.1
Overall (N=90)	33.5	33.1	41.1	19.0	14.5	23.9	51.8	51.8	38.7	30.8	26.2	19.1
	<b>DM basis</b>											
Small (n <sub>1</sub> =26)	6.7	6.6	9.5	4.5	3.3	2.8	6.2	6.2	4.9	3.7	4.7	3.7
Medium (n <sub>2</sub> =26)	6.0	5.9	7.8	3.7	2.7	3.4	6.8	6.8	4.3	3.4	4.0	3.7
Large (n <sub>3</sub> =38)	7.0	7.0	11.0	5.5	4.5	4.5	8.1	8.1	5.1	4.2	4.4	4.0
Overall (N=90)	6.6	6.6	9.6	4.7	3.6	3.7	7.2	7.2	4.8	3.8	4.4	3.8

TABLE 5  
Season-wise feed and fodder intake at per ACU level

Particular	Green Fodder	Dry Fodder	GF:DF	Roughage	Oilseed Cakes	Compound feed	Homemade feed	Concentrate	Roughage: concentrate	Total
<b>Summer</b>										
Small	4.3	2.5	64.2:37.3	6.7	1.3	1.1	0.8	3.2	67.7:32.3	9.9
Medium	3.9	2.6	60.0:40.0	6.5	1.6	0.7	1.0	3.2	67.0:33.0	9.7
Large	4.5	2.7	62.5:37.5	7.2	1.3	1.1	0.6	2.9	71.3:28.7	10.1
Overall	4.2	2.6	61.8:38.2	6.8	1.4	1.0	0.7	3.1	68.7:31.3	9.9
<b>Rainy</b>										
Small	7.6	0.8	90.5:9.5	8.4	0.8	0.5	0.9	2.2	79.2:20.8	10.6
Medium	6.6	1.3	83.5:16.5	7.9	0.9	0.9	0.7	2.6	75.2:24.8	10.5
Large	8.4	1.0	89.4:10.6	9.4	0.7	0.9	0.5	2.1	81.7:18.3	11.5
Overall	7.6	1.0	87.4:11.5	8.7	0.8	0.8	0.7	2.3	79.8:21.1	10.9
<b>Winter</b>										
Small	4.6	2.6	63.9:36.1	7.2	1.5	0.9	0.7	3.0	69.9:29.1	10.3
Medium	4.7	2.6	64.4:35.6	7.3	1.8	0.6	0.9	3.4	68.9:32.1	10.6
Large	6.2	2.7	70.5:30.7	8.8	1.2	1.0	0.6	2.9	75.2:24.8	11.7
Overall	5.3	2.6	67.1:32.9	7.9	1.5	0.8	0.7	3.1	71.8:28.2	11.0

of green fodder and less of concentrates. The proportion of green fodder and dry fodder in roughages should normatively be 80:20, which actually stood at 61.8:38.2 in summer, 87.9:12.1 in rainy and 66.7: 33.3 in case of winter but that should not be a matter of concern if the individual values are as per the norms.

### Dry matter adequacy status

An effort has been made to make an assessment of total DM adequacy status so as to ensure that increase in the proportion of those having adequate DM intake over the proportion of those having adequate green fodder availability can well be treated as strategy to offset green fodder inadequacy (by supplementing with feeds and concentrates) adopted by the farmers to tide over the shortfall. According to standard reference requirement value of 4.02 kg of green fodder on DM basis per ACU, it was enumerated that overall, 44.4 per

cent of the sampled farms had adequate green fodder in summer season, 83.3 per cent in rainy season and 63.3 per cent were having nutritionally adequate dry matter intake in winter season (refer Table 3). The total dry matter was found to be adequate in 88.9 per cent of the farms in summer, 87.8 per cent in case of winter season. In rainy season, adequacy remained more or less similar with 83.3 per cent in case of DM from green fodder and 81.1 per cent in case of total dry matter intake (Table 6). In rainy season, all the dry matter requirements were met through the supply of green fodder, hence showing negligible difference. Overall, 94.7 per cent of large, 88.5 per cent of the medium and 73.1 per cent of the small farmers had adequate total dry matter intake on their farms. The total DM adequacy in higher proportion of large farms may well be attributed to the affordability and higher level of awareness regarding the importance of feed and fodder in improving the livestock productivity.

TABLE 6  
Season wise total dry matter adequacy status at the sampled farms

Particulars		Summer		Rainy		Winter		Overall	
		F	%	F	%	F	%	F	%
Small (n <sub>1</sub> =26)	Adequate	22	84.6	19	73.1	20	76.9	19	73.1
	Inadequate	4	15.4	7	26.9	6	23.1	7	26.9
Medium (n <sub>2</sub> =26)	Adequate	24	92.3	22	84.6	23	88.5	23	88.5
	Inadequate	2	7.7	4	15.4	3	11.5	3	11.5
Large (n <sub>3</sub> =38)	Adequate	34	89.5	32	84.2	36	94.7	36	94.7
	Inadequate	4	10.5	6	15.8	2	5.3	2	5.3
Total (N=90)	Adequate	80	88.9	73	81.1	79	87.8	78	86.7
	Inadequate	10	11.1	17	18.9	11	12.2	12	13.3

## CONCLUSION

Despite the warnings voiced about the country's dangerous feed and fodder situation, the state of Punjab is lucky to have quite ample dry matter availability on an overall basis. The nutritionally insufficient dry matter intake from green fodder during lean seasons in the majority of farms indicates to the need to sensitize farmers about better land resource management and appropriate fodder crop selection to ensure year-round availability of green fodder. The extension machinery needs to be an ideal bridge to make the farmers understand the importance of green fodder in economizing the livestock production and enhancing productivity, which in its own right would translate into higher profitability.

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