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Estimation of Green Fodder Production and Availability at Farm Level in The Central Zone of Punjab

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ABSTRACT

The paper estimates the green fodder production and availability in Ludhiana district using primary data from 90 farmers spread over standard land holding categories. The study revealed that out of green fodder production of 656.8 q/farm, 110.5q (constituting 17.2 % of maize, 28.2 % of sorghum, 21.9 % of pearl millet, 17.2 % of maize and 13.8 % of berseem produced) has been sold and remaining 546.3 q was available for feeding purposes. The availability of green fodder as per cent of production has been enumerated as 95 per cent (382.3 q) in case of small, 89.8 per cent (539.6 q) in case of medium and 76.3 per cent (663.1 q) in case of large farms. During summer and rainy season, the farmers fed their animals mainly pearl millet and maize while berseem was the most commonly fed fodder crop during winters. There was no significant difference between the green fodder availability (fresh basis) in rainy and winter season but the green fodder availability (DM basis) in summer and winter season was statistically lower than that in rainy season. Due to high percentage of dry matter in maize (23.3 %) and pearl millet (19.4 %), proportion of dry matter in roughage during rainy and monsoon season was more in comparison to that in summer and winter, when berseem (with 12.5 % dry matter) is primarily fed to the animals.

KEYWORDS: Availability, Dry matter, Green fodder, Production

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INTRODUCTION

Fodder is an agricultural term for animal feed and fodder crops are those plants that are raised to feed livestock. The use of green fodder is a crucial factor impacting the productive performance of the animals and at the same time it is known to be useful in cutting down the feeding cost and consequently attaining higher returns.

India has one of the largest livestock populations in the world. The yield of the dairy animals in the state, though higher than the national average, is much less than the levels attained in developed countries (Grover and Kumar, 2013). Sustained rise in per capita income and emerging new middle- and high-income groups, particularly in developing countries are causing significant changes in food consumption pattern, resulting in increased demand for livestock products. In developing countries, most animals belong to the class, which is typically characterized by low productivity levels and therefore globally more gains can be generated from large numbers of producers catching up through the application of good feeding and management practices rather than from pushing the frontier for the few high producers using high-tech approaches (Makkar and Ankers, 2014)

The enhancement of livestock productivity, therefore, is the pre-requisite to attain the overall growth of agriculture sector. 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 percent and only 30 percent improvement comes through genetic research. Sufficient supply of dry fodder, green fodder and concentrates is very important to enhance the productive performance of the animals. Feeds given to animals not only meet nutrient requirement but

fills the rumen to satisfy the animal. In view of microbial digestion system, feeds have to meet requirement of cattle production and microbes to promote digestion.

Due to ever increasing population pressure of human, arable land is mainly used for food and cash crops, thus there is a little chance of having good quality arable land available for fodder production, putting tremendous pressure on the availability of fodder (Nayak et al., 2010). To enhance the availability of the fodder there is need for agronomic interventions is to boost herbage yield through the enhancement of productivity of cultivated fodder (Kumar et al., 2018). Land allocation to cultivation of green fodder crops is limited and has hardly ever exceeded 5 per cent of the gross cropped area (GOI, 2009). Hence the supply of feed has always remained short of normative requirement (GOI, 1976; Ramachadra et al., 2007; Singh and Mujumdar., 1992), restricting realization of true production potential of livestock.

In the backdrop of this, present study was envisaged to assess the synergy between green fodder production and availability in central zone of Punjab.

MATERIALS AND METHODS

The formulations of the study are based on the primary data collected from 90 farmers from Ludhiana district by personal interview method through a specially structured interview schedule. Four stage random sampling technique was used for the selection of the sampling units, with selection of top-ranking district in terms of bovine population at the initial stage, followed by blocks in the next stage, villages in the third stage and finally the farmers. Ludhiana district was randomly selected out of five top- ranking districts of Punjab in terms of bovine population as per 2012 livestock census.

Livestock fodder availability was estimated on DM basis. The dry matter content of different fodder crops cultivated by the respondent farmers is taken for Maize, 23.3 %, Pearl millet : 19.4 %, Sorghum : 28.1 %, Berseem: 12.5 % , Oats : 26.3 %, Dry fodder and concentrates: 90 % (Anonymous, 2018):

Dietary requirement norms per adult cattle unit (ACU)

The feed and fodder requirement was calculated on the basis of DM intake assessment of 7.5 kg/d/ ACU for a standard ACU of 350 kg body weight (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, green and the dry fodder constitute 80 and 20 per cent respectively.

Dietary requirement norms per adult cattle unit (ACU)

Particulars	Kg DM	Comments
Total	7.50	@ 2.15 kg /100kg bw (ACU: 350KG)
Roughage, R	5.03	R:C::67:33
Concentrate, C	2.48	
Dry Fodder, DF	1.01	GF:DF::80:20
Green Fodder, GF	4.02	

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 DISCUSSION

Forage crops include cereals like maize, sorghum, barley, millet and oat. Other specialized forages include berseem (king of forages), shaftal and lucerne. In addition to these forage crops, there are other leguminous forage crops such as cowpea, cluster bean, soyabean etc., which are traditionally

grown in intercropping systems with forage cereals (Iqbal et al., 2015). Maize, pearl millet and berseem fodder together accounted for more than 80 per cent of the fodder acreage in the study area.

The fodder quality of green maize is considered best among non-legume forage crops. Maize is considered ideal *Kharif* season forage because it grows quickly, produces high yields, is palatable, is rich in nutrients, and helps to increase body weight and milk quality in cattle (Chaudhary et al., 2013).

Pearl millet is quick growing cereal as compared to maize and sorghum and it produces green fodder in short duration. It is a robust quick growing rainy season grass with large number of tillers, leaves and ear heads (Kumar et al., 2013).

Berseem is the premier *Rabi* crop which has replaced to a great extent, all other winter forage crops because of its ability to provide high yield of very nutritious and palatable fodder over a long period (Singh, 2016)

Importance of fodder crops in the cropping pattern

The perusal of the table revealed that 1.54 acres were apportioned to fodder crops by the small farmers, 2.26 acres by medium and 3.37 acres by large farmers (Table 1). On an overall basis, berseem was cultivated on 0.79 acres which occupied 31.5 per cent of the fodder cropped area. Berseem was cultivated on 31.2 per cent of the fodder area in the case of small farms, 33.2 per cent in the case of medium and 31.2 per cent of the fodder area in the case of large farms. Oat as fodder was cultivated on only 3.2 per cent of the fodder area during the *Rabi* season. All in all, maize, pearl millet and berseem fodder together accounted for more than 80 per cent of the fodder area in the study area. As discussed earlier, maize happened to be an important *Kharif* fodder crop which was cultivated on 0.66 acres and covered more than one fourth of the fodder area. Maize was cultivated on 0.43 acres by small farm categories, 0.58 acres by medium and 0.86 acres by large farmers but the proportion more or less remained the same for all the farm categories, varying from 25.5 per cent for large to 27.9 per cent for small farmers. The pearl millet, cultivated on an area of 0.17 acres accounted for 6.8 per cent of the fodder crop area during *Kharif* season, with medium farmers allocating one tenth of their fodder area.

Table 1. Importance of fodder crops in relation to fodder cropped area at the selected farms

Particular	Small (n_1=26)		Medium (n_2=26)		Large (n_3=38)		Overall (N=90)	
	Area (acres/ farm)	% of fodder area	Area (acres/ farm)	% of fodder area	Area (acres /farm)	% of fodder area	Area (acres /farm)	% of fodder area
				Kharif				
Maize	0.43	27.9	0.58	25.7	0.86	25.5	0.66	26.3
Pearl millet	0.09	5.8	0.22	9.7	0.18	5.4	0.17	6.8
Sorghum	0.08	5.2	0.03	1.3	0.28	8.3	0.15	6.0
				Summer				
Pearl millet	0.44	28.6	0.53	23.5	0.83	24.6	0.63	25.1
Sorghum	-	-	0.02	0.9	0.04	1.2	0.02	0.8
Oat	-	-	-	-	0.01	0.3	0.01	0.4
Maize	-	-	-	-	0.01	0.3	0.01	0.4
				Rabi				
Berseem	0.48	31.2	0.75	33.2	1.05	31.2	0.79	31.5
Oat	0.02	1.3	0.13	5.8	0.10	3.0	0.08	3.2
Fodder area	1.54	100.0	2.26	100.0	3.37	100.0	2.51	100.0

Green fodder production

It was observed that the selected farmers in the study area had cultivated maize, pearl millet, sorghum, berseem and oat fodder. The information pertaining to total green fodder production, which is referred to as the annual production hereafter, of different fodder crops (maize, pearl millet, sorghum, berseem and oats) at the selected farm households was recorded (Table 2). On the overall basis, average green fodder production has been estimated at 869.1 q on the large farms, 601.2 q on the medium and 402.2 q on the small farms. The overall green fodder production on an average was estimated at 656.8 q per farm. It can be readily observed that the berseem fodder constituted the highest proportion, which was nearly half of the total fodder produced during the year, with 49.2 per cent in the case of small, 49.4 per cent in the case of medium and 48.9 per cent in the case of large farms. The pearl millet was the next in terms of contribution to total fodder output recording 28, 27.5 and 23.8 per cent in case of small, medium and large farms respectively. The rest of fodder crops in descending order of production were maize, sorghum and oats contributing 16.6 per cent, 5.7 per cent and 3.1 per cent respectively to total fodder output. Although berseem and pearl millet accounted for nearly 31 per cent of the fodder area, the differentials in output can well be attributed to yield differentials. Similarly, Rajasthan underlined the deficit availability of 25 percent per annum in terms of feed and fodder against the estimated production of 51.54 million tons with the requirement of 68.61 million tonnes (Chand et al., 2015).

Table 2. Annual production of green fodder on selected farms

Land holding Category	Green Fodder, q/farm					
	Maize	Pearl Millet	Sorghum	Berseem	Oats	Total
Small	69.2	112.7	18.5	197.7	4.2	402.2
Medium	96.8	165.6	12.3	297.2	29.3	601.2
Large	143.9	207.0	68.0	424.9	25.3	869.1
Overall	108.7	167.8	37.6	322.4	20.4	656.8

Availability of green fodder

The production of green fodder need not necessarily be equal to its availability, because availability of green fodder may get affected by many factors, out of which sale is the most crucial one and the related information was recorded (Table 3)**.**

It can be observed that, out of green fodder production of 656.8 q/farm, 110.5 q (constituting 17.2 % of maize, 28.2 % of sorghum, 21.9 % of pearl millet, 17.2 % of maize and 13.8 % of berseem produced) was reported as sold and remaining 546.3 q was available for feeding purposes. On the small farms, whole of maize, berseem and oats was used in the farm itself whereas 11.3 per cent of pearl millet and 39.1 per cent sorghum were sold and the rest was used at farm. In case of medium farms, the entire production of sorghum and oats was used at farm and only a little percentage of berseem (6.6 %) and maize (8.1 %) was sold. Out of the total production of pearl millet, 21 per cent was sold and the rest was used for feeding purposes. On the overall level, the availability of green fodder as per cent of production was enumerated as 95 per cent (382.3 q) in case of small, 89.8 per cent (539.6 q) in case of medium and 76.3 per cent (663.1 q) in case of large farms. The large quantum of sale of fodder by large farmers can be attributed to their commercial orientation and the fact that they have more land area at their command.

Table 3. Production and availability of green fodder in the selected farms

	Particular	Green Fodder					
		Maize	Pearl Millet	Sorghum	Berseem	Oats	Total
Small (n_1=26)	Production by no/% of farmers	17/65.3	23/88.5	4/15.4	26/100.0	2/7.6	26/100
	Production, q/farm	69.2	112.7	18.5	197.7	4.2	402.2
	Sale by no/% producers	-	3/13.0	1/25.0	-	-	3/11.5
	Sale, q/farm	-	12.7	7.2		-	19.9
	Sale, % of production	-	11.3	39.1	-	-	5.0
	Available, q/farm	69.2	100.0	11.2	197.7	4.2	382.3
	Available, % of production	100.0	88.7	60.9	100.0	100.0	95.0
Medium (n_2=26)	Production by no/% of farmers	19/73.1	22/84.6	3/11.5	26/100.0	5/19.2	26/100
	Production, q/farm	96.8	165.6	12.3	297.2	29.3	601.2
	Sale by no/% producers	3/15.8	6/27.3	-	3/11.5	-	7/26.9
	Sale, q/farm	7.9	34.0	-	19.7	-	61.7
	Sale, % of production	8.1	20.5	-	6.6	-	10.3
	Available, q/farm	88.9	131.6	12.3	277.4	29.3	539.6
	Available, % of production	91.9	79.5	100.0	93.4	100.0	89.8
Large (n_3=38)	Production by no/% of farmers	30/78.9	34/89.5	12/31.6	38/100	10/26.3	38/100
	Production, q/farm	143.9	207.0	68.0	424.9	25.3	869.1
	Sale by % farmers	7/23.3	11/32.3	1/8.3	6/15.8	-	12/31.6
	Sale, q/farm	38.9	55.0	20.2	91.8	-	206.0
	Sale, % of production	27.0	26.6	29.7	21.6	-	23.7
	Available, q/farm	105.0	152.0	47.8	333.0	25.3	663.1
	Available, % of production	73.0	73.4	70.3	78.4	100.0	76.3
Overall (N=90)	Production by no/% of farmers	66/73.3	79/87.8	19/21.1	90/100.0	17/18.9	90/100
	Production, q/farm	108.7	167.8	37.6	322.4	20.4	656.8
	Sale by no/% producers	10/15.1	20/26.3	2/10.5	9/10.0	-	22/24.4
	Sale, q/farm	18.7	36.7	10.6	44.5	-	110.5
	Sale, % of production	17.2	21.9	28.2	13.8	-	16.8
	Available, q/farm	90.0	131.1	27.0	277.9	20.4	546.3
	Available, % of production	82.8	78.1	71.8	86.2	100.0	83.2

Green fodder availability by fodder type (fresh basis)

In summer season, pearl millet, berseem and maize were the major crops cultivated by the farmers for feeding livestock. Therefore, berseem and pearl millet constituted maximum proportion to the green fodder basket during summer season. It can be witnessed from Table 4 that during summer season

there was a total absence of sorghum and oats. The daily fodder availability of 134.9 kg/farm in summer season comprised of 70.5 per cent berseem, 24.6 per cent pearl millet and 4.9 per cent maize. During summer and rainy season, the farmers fed their animals mainly pearl millet and maize fodder because pearl millet and maize has higher dry matter, highly palatable and good source of energy. The overall green fodder availability in rainy season was 167.8 kg per farm per day comprised of 60.4 per cent pearl millet, 32.4 per cent maize and 7.1 per cent sorghum. As reported by the sampled farmers, berseem was the most commonly fed fodder crop during winters. The higher protein content, highly palatable and succulent nature of berseem could be the viable reasons for its popularity. During the winter season, berseem, maize, oats and sorghum were available to the extent of 70.2 per cent, 14.1 per cent, 8.7 per cent and 6.9 per cent, respectively. Pearl millet was not there during the winter season.

Table 4. Contribution of different fodders in green fodder availability (fresh basis)

Land holding category	Per cent Contribution					Green Fodder Availability, kg/d/farm
	Maize	Pearl Millet	Sorghum	Berseem	Oats	
			Summer			
Small	3.3	24.8	-	71.8	-	95.2
Medium	4.4	25.1	-	70.4	-	137.5
Large	5.9	24.2	-	69.9	-	160.3
Overall	4.9	24.6	-	70.5	-	134.9
			Rainy			
Small	32.5	63.5	4.0	-	-	125.3
Medium	33.7	62.8	3.4	-	-	159.4
Large	31.7	57.8	10.5	-	-	202.7
Overall	32.4	60.4	7.1	-	-	167.8
			Winter			
Small	18.5	-	4.3	74.5	2.7	103.5
Medium	14.4	-	3.2	69.8	12.7	154.1
Large	12.4	-	9.9	68.8	8.8	192.3
Overall	14.1	-	6.9	70.2	8.7	155.6

Green fodder availability by fodder type (DM basis)

The season wise availability of green fodder (DM basis) by different fodder types in selected farms was recorded (Table 5). In summer season, irrespective of farm size, the daily availability of green fodder (DM basis) to the tune of 19.9 kg/farm comprised of 59.8 per cent berseem, 32.4 per cent pearl millet and 7.8 per cent maize. During the rainy season, pearl millet, maize and sorghum were available to the extent of 55.1 per cent, 35.5 per cent and 9.4 per cent respectively. In winter season, the available green fodder constituted 53.8 per cent berseem, 20.2 per cent maize, 14.1 per cent oats and 11.9 per cent sorghum (DM basis). A total absence of pearl millet was observed in this season.

Table 5. Contribution of different fodders in green fodder availability (DM basis)

Land holding category	Per cent Contribution					Green Fodder Availability,
	Maize	Pearl Millet	Sorghum	Berseem	Oats	
			Summer			
Small	5.3	33.0	-	61.6	-	13.9
Medium	7.0	33.1	-	59.8	-	20.2
Large	9.3	31.7	-	59.0	-	23.7
Overall	7.8	32.4	-	59.8	-	19.9
			Rainy			
Small	36.0	58.6	5.3	-	-	26.3
Medium	37.4	58.0	4.6	-	-	33.5
Large	34.3	52.1	13.7	-	-	43.7
Overall	35.5	55.1	9.4	-	-	35.7
			Winter			
Small	27.7	-	7.9	59.9	4.6	16.1
Medium	20.5	-	5.5	53.5	20.5	25.1
Large	17.4	-	16.8	51.8	13.9	31.9
Overall	20.2	-	11.9	53.8	14.1	25.4

Green fodder availability (fresh basis)

The fodder availability (in absolute terms) on the small farms was found to be the minimum (95.2 kg/d/farm) in summer season and was lower than that in the case of winter (103.5 kg/d/farm) and rainy (125.3 kg/d/farm) season but these differences were not found to be statistically significant as enunciated by ANOVA application and similar was the situation in case of medium and large farms. At the overall level, fodder availability in summer season (134.9 kg/d/farm) was significantly ($p<0.05$) lower than that in winter (155.6 kg/d/farm) and rainy (167.8 kg/d/farm) season respectively. Higher availability of green fodder during rainy and winter season, in comparison to summer might be due to the high yield attainability of the berseem crop.

Green fodder availability (DM basis)

The season wise information pertaining to green fodder availability on dry matter basis was recorded (Table 6). The daily dry matter availability, irrespective of the farm size, was found to be the minimum in summer season (19.9 kg) and statistically lower ($p<0.05$) than that in winter (25.4 kg) and in rainy season (35.7 kg). It is startling to note that there was no significant difference between the green fodder availability (fresh basis) in rainy and winter season but the green fodder availability (DM basis) in winter season was statistically lower ($p<0.05$) than that in rainy season. Due to high percentage of dry matter in maize (23.3 %) and pearl millet (19.4 %), proportion of dry matter in roughage during rainy and monsoon season was more in comparison to that in summer and winter, when berseem (with 12.5 % dry matter) is primarily fed to the animals. Therefore, dry matter availability from green fodder during summer was found to be significantly lower than that observed in rainy season. In case of both small and medium farms, the daily dry matter availability was statistically at par in winter and summer season but significantly lower than that observed in rainy season. In case of Andhra Pradesh the dry agro climatic zones were deficient in total dry matter availability of feeds to meet the requirements of livestock and poultry. Furthermore, there was a severe shortage of green forages and concentrates to meet the requirements of milch cattle and poultry (Reddy et al., 2018).

Table 6. Season wise green fodder availability per day (fresh basis) at the selected farms kg/d/farm

Particular	Summer	Rainy	Winter	Overall
		Fresh Basis		
Small (n_1=26)	95.2[a]	125.3[a]	103.5[a]	106.2
Medium (n_2=26)	137.5[a]	159.4[a]	154.1[a]	149.9
Large (n_3=38)	160.3[a]	202.7[a]	192.3[a]	184.2
Overall (N=90)	134.9[b]	167.8[a]	155.6[a]	151.8
		DM basis		
Small (n_1=26)	13.9[b]	26.3[a]	16.1[b]	17.9
Medium (n_2=26)	20.2[b]	33.5[a]	25.1[b]	25.6
Large (n_3=38)	23.7[c]	43.7[a]	31.9[b]	32.1
Overall (N=90)	19.9[c]	35.7[a]	25.4[b]	26.1

[ab]Figures with different superscripts in a row differ significantly ($p<0.05$)

CONCLUSION

The production of green fodder need not necessarily be equal to its availability, because availability of green fodder may get affected by many factors, out of which sale is the most crucial one. The selected farmers in the study area had cultivated maize, pearl millet, sorghum, berseem and oat fodder. During summer and rainy season, the farmers fed their animals mainly pearl millet and maize fodder because pearl millet and maize has higher dry matter, highly palatable and good source of energy. Berseem was the most commonly fed fodder crop during winters. There was no significant difference between the green fodder availability (fresh basis) in rainy and winter season but the green fodder availability (DM basis) in summer and winter season was statistically lower than that in rainy season.

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