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Feed and fodder availability in Punjab state vis-a-vis livestock population -An estimate

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ABSTRACT

The aim of present study was to estimate the feed and fodder demand for the existing livestock population and supply in Punjab. The study was based on secondary data collected from different sources. The livestock population were converted in to Adult Cattle Unit (ACU) on the basis of species, age and sex. The body weight of each ACU was considered 350 kg and dry matter consumption was assumed 2% of the body weight.The total adult cattle unit (ACU) in the state is 5.85 Million, which required 14.94 million tonnes feed and fodder on dry matter basis. The total annual availability of feed and fodder in the state was estimated 24.24 million tonnes against the requirement of 14.94 million tonnes and thereby excess of around 62.18% per annum. The availability of feed and fodders was excess in 18 districts except Amritsar and SAS, Nagar district of the state. Average dry matter availability in the state was 11.35 kg/ACU per day against requirement (7 kg). The policies to develop blocks of fodder in the state and transport to the deficit areas of the country need priority attention to solve the problem of fodder in deficit areas.

Key words: Adult cattle unit, Dry matter, Fodder requirement, Fodder supply

Animal husbandry is playing a vital role for sustainable and profitable crop farming and ensuring livelihood security for rural poor as it provide triple benefits namely milk, meat and manure and considered as "Bank on hooves". Paddy-wheat is the main cropping pattern in Punjab and crop residues are major source of roughage for livestock in the state. Availability of crop residues are affected by number of factors. Assessment of feed and fodder demand for existing livestock population is essential to ensure availability and future planning. Although several attempts were made to estimate feed and fodder availability in the country for livestock (GoI 1974, Sen and Ray 1941, Mudgal and Pradhan 1988, Hazra and Rekib 1991, Singh and Mujumdar 1992, Pandey 1995, Singh *et al*. 1997, Raju *et al*. 2002, Sampath *et al*. 2005, Ramachandra *et al*. 2007, Thirunavukkarasu *et al*. 2011), however, no systematic attempts have been made in Punjab state.

MATERIALS AND METHODS

Present study was conducted in Punjab to assess the feed and fodder demand to sustain the existing livestock population and supply in the region. Punjab state has a total of 20 districts. The study was based on secondary data pertaining to livestock population, per day and per year feed and fodder requirement on dry matter basis for each livestock were collected from various published sources. Livestock population in the state was converted in standard adult cattle unit (ACU) according to species, age and sex (male and female) as per Ramachandra *et al.* 2007 (Table 1) and Livestock Census, 2012 (GoI, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and State Department Animal Husbandry, Punjab) is considered to find out the adult cattle unit (ACU). District wise fodder requirement for ruminants (cattle, buffaloes, sheep and goats), equine and camel were calculated on the basis of standard cattle unit (ACU) of 350 kg body weight by assuming 2% dry matter intake per day for every adult

Table 1. Conversion factors used for calculating adult cattle units (ACU)

Species	Age	Conversion factor
Buffalo	Less than 1 year	0.17
	1.0-2.5 year	0.50
	More than 2.5 year	1.14
Cattle	Less than 1 year	0.11
	1.0-2.5 year	0.34
	More than 2.5 year	1.00
Sheep/ Goat	Less than 1 year	0.03
	More than 1 year	0.10
Equine	Less than 3 year	0.33
	More than 3 year	0.57
Camel	Less than 4 year	0.57
	More than 4 year	1.00

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Table 2. Straw-grain ratio and extraction rate of different crops

Name of crop	Straw-grain ratio		Extraction rate	
	Straw	Oil cakes	Grains	Bran/ husk
Paddy	1.3		0.02	0.08
Wheat	1.0	-	0.02	0.08
Sorghum and Pearl millets	2.5	-	0.05	-
Maize and Finger millets	2.5	-	0.10	-
Small millets	2.5	-	0.10	-
Barley	1.3	-	0.10	-
Other cereals	2.0	-	0.10	-
Total pulses	1.7	-	-	0.03
Ground nut	2.0	0.70	-	-
Rape and mustard	-	0.70	-	-
Sugarcane	0.25	-	-	-
Cotton	-	0.0499	-	-

Table 3. Green fodder yield for land use classification

Land use category	Green fodder (tonnes/ha/year)
Gross cropped area	1.6
Forests	1.5
Permanent pastures	5.0
Cultivable wasteland	1.0
Current fallows	1.0
Other fallows	1.0
Miscellaneous tree crops	1.0

cattle unit (7 kg dry matter for 350 kg body weight) which is an accordance with GoI (2002) and Ramachandra *et al*. (2007). As poultry farming is an important occupation in the state, hence feed requirement for poultry were estimated on assumption that each layer and breeder on an average consumed 40 kg/year and broiler would consumed 3.2 kg with 5 batches of broiler reared in a year (Indian Poultry Year book 1990). The remaining concentrate along with crop residues and green have been accounted for estimation of dry matter requirement for the livestock in the state. The dry fodder availability from different crops were assessed from production data for the year 2013–14 (Statistical Abstract, Punjab 2014) by grain to straw ratio as per Ramachandra *et al.* (2007) (Table 2). It was assumed that 95% of crop residues are consumed by the livestock (CSO 2012) and only 20% paddy straw is used for livestock and remaining is destroyed either by burning or other ways by the farmers (Sidhu *et al*. 1998, Gadde *et al*. 2009). The dry matter in dry fodder and concentrate was estimated as per earlier workers (Ranjhan *et al*. 1999). Green fodder availability was also estimated by using production potential per unit hectare from land classification data. The land utilization pattern data were classified as gross cropped area (GCA), forest area, cultivable waste land, permanent pasture, other fallows and area under trees from which green fodder is available for livestock feeding.The availability of green forage from the gross cropped area (GCA) on the assumption that 4% of the GCA is under fodder cultivation with an average yield of 40 tonnes/ha/year. It was assumed that only 50% of the forest area are available for fodder production and the average fodder yield is around 3 tonnes/ ha/year. The estimate of green fodder availability is made

Table 4. District wise availability of dry fodder from different crops in Punjab

(Dry matter, 000T)

District	Paddy	Wheat	Other cereals	Pulses	Total
Amritsar	115.15	798.57	8.55	0.01	922.28
Barnala	111.15	509.58	4.45	0.002565	625.1786
Bathinda	111.3723	1,076.445	7.99425	0.012825	1,195.824
Faridkot	98.4789	513.855	0.00	0.00513	612.339
Fatehgargh Sahib	78.0273	365.085	8.55	0.00	451.6623
Firozpur	235.4157	1744.2	13.338	0.038475	1,992.992
Gurdaspur	130.0455	845.595	64.125	0.03591	1,039.801
Honshiapur	56.0196	573.705	487.35	4.10913	1,121.184
Jalandhar	132.4908	715.635	55.575	0.01026	903.7111
Kapurthala	100.2573	468.54	42.75	0.00	611.5473
Ludhiana	252.7551	1,134.585	35.01225	0.028215	1,422.381
Mansa	74.2482	730.17	3.762	0.00513	808.1853
Moga	181.1745	788.31	0.00	0.012825	969.4973
Muktsar	101.5911	904.59	4.65975	0.01026	1,010.851
Patiala	213.1857	985.815	15.1335	0.002565	1,214.137
Rupnagar	28.4544	262.485	158.175	0.00	449.1144
SAS, Nagar	21.1185	194.94	94.05	0.01539	310.1239
Sangrur	286.767	1,339.785	17.65575	0.02565	1,644.233
S B S Nagar	44.9046	317.205	106.875	0.00	468.9846
TaranTaran	132.0462	796.005	8.55	0.01026	936.6115
Total	2,504.6541	15,065.1	1,136.5515	4.337415	1,8710.64

by using conversion factors (Table 3). The dry matter content in green fodder was assumed to be 25% (Anandan and Sampath 2015).

RESULTS AND DISCUSSION

Estimation of dry fodder availability: Sustainability of the dairy farming is based on nutritional management of the animals. Dry matter intake should be balanced for optimum production as different fodder and feed ingredients have variable dry matter. The dry matter availability from dry fodder was estimated from paddy, wheat, other cereals and pulses crops. The total dry matter was estimated 18.71 million tonnes (Table 4) and accounting 4.69% in National level (GoI 2012). Wheat straw was found major source of dry matter in dry fodders and contributing 80.52% followed by paddy straw 13.39%, stalks 6.07%, while pulses fodder contribute only 0.02% in total dry matter availability in the state. Among different districts, Firozpur contributed highest percentage followed by Sangrur, Ludhiana, Patiala, Moga, Bathinada and Gurdaspur. These 7 districts shared more than ½ of total dry fodder production of the state. Nearly 56.32% (7.05 Million tonnes) paddy straw and 52.54% wheat straw (7.91 Million tonnes) of the state was produced in these districts.

Estimation of green fodder availability: The total green fodder production in the state on dry matter basis was estimated 3.31 million tonnes (Table 5). Major part (95.15%) of green fodder production comes from cultivated forage crops. Berseem (*Trifolium alexandrinum*) and oat (*Avena sativa*) was main crops of fodder during Rabi season and Maize (*Zea mays*) and multicut sorghum (*Sorghum bicolor*) was during *Zaid* and *Kharif* season in the state. Grasses from forests, grazing land and permanent pasture and sugarcane (*Seccharum officinarum*) tops contributing about 5% in green fodder production. Among different districts, Gudashpur produced 11.72%, followed by Ludhiana (7.30%), Bathinda (7.30%), Patiala (6.45%) and Firozpur (6.09%) of green fodder of the state. These five districts produced more than 35% green fodder of the state.

Estimation of concentrate availability: The availability of concentrate on dry matter basis was estimated 2.64 million tonnes (Table 6). Grains from different crops, wheat bran, rice bran and rice polish shared 98.39% and only 1.61% was shared by oilseed cakes, husk and crushed pulses. It indicates that oilseed and pulses production in the state is not upto the mark. District wise analysis showed that Firozpur accounted 10.84% followed by Sangrur (9.83%), Ludhiana (8.53%), Bathinda (6.80%) and Moga (5.5%) in state concentrate production. These five districts accounted to the tune of 41.23% of the state. The poultry is an important business in the state, which needed 16.25% concentrate, available in the state and remaining concentrate was available for livestock up to the tune of 2.21 million tonnes.

Estimation of livestock adult cattle unit: Total adult cattle units (ACU) in the state were 5.84 million (Table 7), buffaloes followed by cattle, goat, sheep, equine and camel. Firozpur district had highest ACU followed by Ludhiana, Amritsar, Sangrur and Gurdaspur of the state. The maximum numbers of cattle were in Firozpur, buffaloes in Amritsar, sheep in Muktsar, goat in Bathinda and equines in Gurdaspur district in the state.

Feed and fodder demand and supply: The annual demand of feed and fodders on the basis of ACU and per unit intake

Table 5. District wise availability of green fodder from different sources

(Dry matter, 000T)

District	Forest	Cultivated fodder	Other source	Sugarcane tops	Total
Amritsar	1.13	166.80	0.50	2.06	170.49
Barnala	0.38	98.80	0.25	0.50	99.93
Bathinda	0.38	223.20	0.00	0.00	223.58
Faridkot	0.75	99.60	0.00	0.00	100.35
Fatehgargh Sahib	0.38	76.40	0.00	1.25	78.03
Firozpur	4.50	196.00	0.25	0.88	201.63
Gurdaspur	11.25	362.00	5.75	9.31	388.31
Honshiapur	39.375	138.00	4.50	7.68	189.56
Jalandhar	2.25	169.20	0.00	3.94	175.39
Kapurthala	0.38	107.60	0.00	1.69	109.67
Ludhiana	3.75	237.2	0.00	0.88	241.83
Mansa	0.38	146.40	1.50	0.00	148.28
Moga	1.13	153.20	0.50	0.00	154.83
Muktsar	0.75	182.00	4.00	0.00	186.75
Patiala	4.50	204.80	3.00	1.44	213.74
Rupnagar	11.63	58.40	5.25	0.81	76.09
SAS, Nagar	6.75	48.40	2.00	0.31	57.46
Sangrur	0.38	248.00	0.25	1.37	250.00
S B S Nagar	6.00	76.40	0.50	2.06	84.96
TaranTaran	1.88	158.80	0.00	0.37	161.05
Total	97.88	3151.20	28.25	34.56	3311.89

Table 6. District wise dry matter availability from concentrate (000T)

District	Grains, wheat bran, rice bran and rice polish	Oil cakes and husk	Total concentrate in the state	Concentrate required for poultry	Available for livestock
Amritsar	131.04	1.08	132.12	2.54	129.58
Barnala	99.00	0.64	99.64	23.48	76.16
Bathinda	159.04	1.72	160.75	6.01	154.74
Faridkot	93.96	0.01	93.97	3.64	90.32
Fatehgargh Sahib	70.38	1.95	72.33	15.01	57.32
Firozpur	279.99	6.42	286.41	3.98	282.43
Gurdaspur	144.36	2.61	146.97	120.73	26.24
Honshiapur	103.59	6.43	110.02	18.23	91.79
Jalandhar	131.31	3.48	134.79	6.22	128.57
Kapurthala	91.71	1.58	93.29	3.18	90.11
Ludhiana	223.41	2.05	225.45	89.22	136.23
Mansa	107.21	1.70	108.91	1.55	107.36
Moga	156.33	0.77	157.10	1.24	155.85
Muktsar	136.71	0.83	137.55	7.70	129.85
Patiala	140.76	2.46	143.22	40.15	103.07
Rupnagar	45.81	2.71	48.52	4.38	44.14
SAS, Nagar	33.03	0.65	33.68	28.14	5.53
Sangrur	258.23	1.41	259.63	47.76	211.87
S B S Nagar	56.07	3.65	59.72	2.26	57.46
TaranTaran	137.61	0.41	138.02	3.79	134.24
Total	2599.54	42.55	2642.10	429.24	2212.86

Table 7. District wise adult cattle unit (ACU) in Punjab state

District	ACU of Cattle	ACU of Buffaloes	ACU of Sheep	ACU of Goats	ACU of Equines	ACU of Camels	Total ACU
Amritsar	119,582.41	407,948.60	275.70	1,150.99	1,830.63	2.71	530,791.04
Barnala	40,309.60	129,741.02	204.15	674.75	615.03	11.57	171,556.12
Bathinda	76,278.63	188,363.37	573.34	2,692.39	989.10	129.11	269,025.94
Faridkot	44,566.57	91,517.40	447.23	1,269.02	845.04	19.27	138,664.53
Fatehgarh Sahib	43,672.65	113,787.90	73.28	440.80	332.79	0.57	158,307.99
Firozpur	188,615.96	360,505.49	2,748.40	2,813.00	1,337.85	255.64	556,276.34
Gurdaspur	149,500.76	258,300.63	286.90	1,301.03	2,787.36	24.27	412,200.94
Honshiapur	103,897.78	195,456.15	99.46	1,378.57	1,196.73	4.56	302,033.25
Jalandhar	94,836.57	199,763.98	225.61	1,290.16	868.80	5.99	296,991.11
Kapurthala	45,039.36	100,178.81	42.06	424.64	281.10	2.71	145,968.67
Ludhiana	143,497.56	388,554.34	276.40	1,872.51	2,068.29	5.57	536,274.69
Mansa	49,893.84	180,306.60	678.39	1,137.88	763.83	24.55	232,805.09
Moga	73,248.58	169,728.90	266.49	1,224.49	863.73	8.13	245,340.32
Muktsar	74,788.75	120,066.47	1,141.75	2,552.47	1,378.77	34.13	199,962.34
Patiala	79,100.10	271,607.88	1,054.99	1,210.27	823.14	0.00	353,796.48
Rupnagar	41,332.58	119,381.97	8.17	436.67	285.60	11.13	161,456.12
SAS, Nagar	26,493.04	124,059.58	608.43	561.09	321.18	13.55	152,056.87
Sangrur	112,491.12	376,766.01	608.92	1,671.71	1,353.87	41.53	492,933.16
S B S Nagar	34,160.51	92,891.13	44.51	499.72	287.70	4.28	127,887.85
TaranTaran	86,079.07	275,356.73	532.23	1,044.12	1,167.03	2.14	364,181.31
Total	1627,385.50	4164,282.93	10,196.41	25,646.28	20,397.57	601.41	5848,510.10

Table 8. Supply, demand and gap of livestock feed and fodder among different district of Punjab.

Districts	ACU	Dry matter required (000T)	Dry matter available (000T)	Difference (000T)	Gap/excess %
Amritsar	530791.04	1356.17	1222.35	-133.82	-9.88
Barnala	171556.12	438.33	801.26	362.93	82.80
Bathinda	269025.94	687.36	1574.141	886.78	129.01
Faridkot	138664.53	354.29	803.01	448.722	126.65
Fatehgarhshahib	158307.99	404.48	587.01	182.53	45.13
Firozpur	556276.34	1421.29	2477.05	1055.76	74.28
Gurdaspur	412200.94	1053.17	1454.35	401.18	38.09
Honshiapur	302033.25	771.70	1402.53	630.83	81.75
Jalandhar	296991.11	758.81	1207.67	448.86	59.15
Kapurthala	145968.67	372.95	811.32	438.37	117.54
Ludhiana	536274.69	1370.18	1800.44	430.25	31.40
Mansa	232805.09	594.82	1063.82	469.00	78.85
Moga	245340.32	626.85	1280.18	653.33	104.23
Muktsar	199962.34	510.90	1327.45	816.54	159.82
Patiala	353796.48	903.95	1530.95	627.00	69.36
Rupnagar	161456.12	412.52	569.34	156.82	38.01
SAS, Nagar	152056.87	388.51	373.12	-15.39	-3.96
Sangrur	492933.16	1259.44	2106.11	846.66	67.23
S B S Nagar	127887.85	326.75	611.41	284.65	87.12
TaranTaran	364181.31	930.48	1231.90	301.41	32.39
Total	5848510.10	14942.94	24235.38	9292.44	62.18

was estimated to be 14.94 million tonnes on dry matter basis (Table 8). There is a wide inter district variability in demand of feed due to difference in number of ACU. The district wise variations were also observed in Rajasthan (Chand *et al*. 2015) and Himachal Pradesh (Dev *et al*. 2006). The highest dry matter requirement was in Firozpur district followed by Ludhiana, Amritsar, Sangrur and Gurdaspur as these district have higher population of animals. The supply of feed and fodders on dry matter basis was a tune of 24.24 million tonnes and it was excess upto a tune of 9.29 million tonne (62.17%) against requirement of the state. The contribution of dry fodder towards to overall dry matter was 77.20% and green fodder and concentrate shares 13.67% and 9.13% in total dry matter available in the state.The maximum availability of feed and fodder was in Firozpur district followed by Sangrur, Ludhiana, Bathinda, Patiala and Gurdaspur, as these districts have higher production and more area of crops in comparison to other districts of the state. It was interesting that 2 districts namely Amritsar (–9.88%) and SAS, Nagar (- 3.96%) were deficit in dry matter as compared to requirement out of 20 district. The excess feed and fodder was found in Muktsar (159.82%) followed by Bathinda (129.01%), Faridkot (126.65%), Kapurthala (117.54%) and Moga (104.23%) as compared to their requirements. On an average, potential dry matter availability was 11.35 kg/ACU/day as against requirement (7 Kg) in the state. District wise analysis revealed that maximum dry matter per day was available to each adult cattle unit in Muktsar (18.19 kg) and minimum was in Amritsar (6.31 kg). It was suggested that excess fodder may be transported to the deficit area of the state as well as in country and to reduce the transportation cost and space for store the straw may be compress in block form by installing the feed block formation machines at block level in the state. There is need to educate the farmers about ill effects of burning of paddy straw and also need to strengthen the extension system and law enforcement to stop the burning of paddy straw in the state.

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