

Demand and availability of feed resources for large ruminants across different districts of Odisha



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Livestock**

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Demand and availability of feed resources for large ruminants across different districts of Odisha

Under the project: Feed and Fodder Production in Different Agro-Climatic Zones and its Utilizations for the Livestock of Odisha

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Abstract

Feed plays an important role in livestock rearing and constitutes more than 60% of total livestock rearing cost. Therefore, availability and access to good quality feed will help farmers to achieve higher milk yield. However, dairy animals in Odisha don't get feed as per their requirement, and as a result they don't produce milk to their full potential. In this context, the present paper tried to estimate the availability of different feed (green, dry and concentrate feed) across different districts and also agro-climatic zones of Odisha based on the 2012 livestock census and 2018-19 cropping pattern data. It is observed that Odisha has 59.01% shortage in green fodder, 46.34% paddy straw and 33.14% total dry fodder including paddy straw.

I. Introduction

Feed scarcity is the main limiting factor for improving livestock productivity. Birthal and Jha (2005) found that the actual milk yield of bovines is less than 26–51% below the attainable yield due to lack of better feeding mechanism and access to good quality feed. To improve livestock productivity, the availability of quality feed has to increase, and the cost has to be affordable to the farmers. With growing demand for animal feed, new technologies and techniques need to be continuously developed and transferred at larger scale, which will help stabilize feed and food price. Hence, proper assessment and efficient management of available feed resources are vital to improve the productivity of animals and the socio-economic development of the State. It also helps the planner to make long-term planning and execute appropriated decisions at the right time.

Reliable estimates of feed demand and supply are not available in Odisha, though some attempts have been made in the past to estimate availability of different types of feed at the national level (GOI 1974; Hazra and Rekib 1991; Singh and Majumdar 1992; Pandey 1995; Singh et al. 1997; Ramachandra et al. 2007). In the context of this report, an attempt has been made to estimate the requirement and availability of different types of feed across districts and agro-climatic zones of Odisha.

2. Data and method

Data

The assessment of feed resources for livestock in Odisha was carried out for the entire State based on secondary data. The secondary data on area and production of cereals, pulses, oilseed and land use (gross cropped area, acreage under forest, permanent pastures, grazing land, cultural waste land and current fallows) were collected from the Directorate of Economics and Statistics, and Department of Agriculture and Farmers' Empowerment of the Government of Odisha for the period 2017–18. The data on district-wise livestock population of 2012 was collected from Department of Statistics, Directorate of Animal Husbandry & Veterinary Services (DAH & VS) Odisha, Cuttack.

Methods

According to Devendra (1997), the three major categories of feeds are:

1. pastures and forages: these include native and improved grass, herbaceous legumes and multipurpose trees.
2. crop residues (dry fodder): cereal straws, stover, groundnut haulms, etc.
3. agro-industrial by-products: cereal bran, coconut cake, palm kernel cake, soya bean, meal, molasses, distillers dried grain and others.

The availability of dry fodder, greens and concentrates was calculated using a suitable extraction ratio, also called residues to product ratio (RPR). The cereal (i.e. rice, wheat, maize and millet) and pulses crops (i.e. green gram, black gram, groundnut, horse gram and cowpea) were considered for estimation of available crop residue (Table 1). The conversion ratio used for this study are given in Table 2.

Table 1: Crops and land indicators included in the estimation

Type of fodder	Crop name/indicators
Dry fodder	Rice, wheat, maize, ragi, green gram, black gram, groundnut, horse gram and cowpea
Green fodder	a) Sugarcane production, b) cultivated fodder (actual), c) permanent pastureland, d) other trees and groves, e) culturable wasteland, f) area under current fallow, g) area under another fallow.

Table 2: Residues to product ratio (RPR) used in the assessment of livestock feed resources

Categories of feed sources	Residues to product ratio			
	Crop residues	Brain/hull	Oilcakes	Green fodder (t/ha)
Straw and stovers				
Rice (<i>Oryza sativa</i>)	1.10	0.08	-	-
Wheat (<i>Triticum aestivum</i>)	1.00	0.08	-	-
Bajra (<i>Pennisetum typhoides</i>)	2.50	-	-	-
Maize (<i>Zea mays</i>)	2.50	-	-	-
Sorghum (<i>Sorghum bicolor</i>)	2.50	-	-	-
Small millets (<i>Panicum miliare</i> , <i>P. miliaceum</i> , <i>Setaria italic</i> , etc.)	2.50	-	-	-
Pulses				
Gram (<i>Cicer arietinum</i>)	1.7	0.03	-	-
Red gram (<i>Cajanus cajan</i>)	1.7	0.03	-	-
Other pulses (Cowpea, Blackgram and others)	1.7	0.03	-	-
Oilseeds				
Groundnut (<i>Arachis hypogaea</i>)	2.0	-	0.60	-
Soya bean (<i>Glycine max</i>)	1.60	-	0.73	-
Linseed (<i>Linum usitatissum</i>)	-	-	0.67	-
Rapeseed and mustard (<i>Brassica</i> sps.)	-	-	0.67	-
Sunflower (<i>Helianthus annus</i>)	-	-	0.70	-
Safflower (<i>Carthamus tinctorius</i>)	-	-	0.70	-
Niger seed (<i>Guizotia abyssinica</i>)	-	-	0.72	-
Sesamum (<i>Sesamum usitatissum</i>)	-	-	0.60	-
Coconut (<i>Cocos nucifera</i>)	-	-	0.056	-
Cotton (<i>Gossypium</i> sps.)	-	-	0.049	-
Castor (<i>Ricinus communis</i>)	-	-	0.50	-
Greens				
Sugarcane (<i>Saccharum officinalis</i>)	-	-	-	0.25**
Permanent pastures and grazing lands	-	-	-	5.00
Land under miscellaneous tree crops and groves not included	-	-	-	1.00
Forest Land				
Cultural wasteland	-	-	-	1.00
Current fallow	-	-	-	1.00
Other fallow	-	-	-	1.00

Source: Directorate of economics and statistics (2007), Srinivas and Anatharaman (2005)

Feed requirement estimation

The quantum of green fodder, dry fodder and concentrate feed was converted into dry matter (DM) by applying a factor of 0.20 for green fodder, 0.90 for dry fodder and 0.92 for concentrate feed. We estimated the feed requirement for livestock based on the 2012 livestock census and 2017–18 crop production data. It is assumed that 2.5 kg of DM is required for 100 kg of body weight of livestock (cow/buffalo). For details, please see Table 3.

- Requirement of concentrate: 1/3 of total DM
- Requirement of roughages: 2/3 of total DM
- Requirement of dry fodder: 65% of total DM roughages
- Requirement of green fodder: 35% of total DM roughages
- For estimating the availability of green fodder both cultivated fodder and grass available in forest floor, fallow land, grazing land and uncultivated land were considered.
- The conversion factor for paddy to CR: 1 : 1.10 was used as per expert recommendations from Odisha University of Agriculture and Technology (OUAT).

Table 3: Feed Requirement for different livestock species across different age group

Livestock	Weight range		Average weight	DM Requirement in 100 kg	DM requirement as per animal	product-ion of Milk (6 litres for crossbred and 2 litres for indigenous)	DM require-ment for repro-duction	Total DM require-ment	Concent-ration (33.33% or 1/3 of DM)	Rough-ages (66.67% or 2/3 of DM)	Dry fodder (65% of total rough-ages)	Green fodder (35% of total rough ages)	Concent-ration in Kg (92% dry matter)	Dry fodder in Kg (90% dry matter)	Green Fodder in Kg (20% dry matter)
	Lower	Higher													
For -															
A	Indigenous														
1	Female ≤ 1 yr	22	80	60	2.6	1.56		1.56	0.52	1.04	0.68	0.36	0.57	0.75	1.82
2	Female ≤ 1-3 yr	90	371	125	2.6	3.25		3.25	1.08	2.17	1.41	0.76	1.18	1.56	3.79
3	Female > 3 yr milk	143	500	230	2.4	5.52	0.72	6.24	2.08	4.16	2.70	1.46	2.26	3.00	7.28
4	Female > 3 yr dry	130	514	250	2.1	5.25	0.85	6.1	2.03	4.07	2.64	1.42	2.21	2.94	7.12
5	Female > 3 yr not calved once	188	350	250	2.3	5.75		5.75	1.92	3.83	2.49	1.34	2.08	2.77	6.71
6	Female > 3 yr others	275	375	250	2.3	5.75		5.75	1.92	3.83	2.49	1.34	2.08	2.77	6.71
7	Male ≤ 2 yr	72	163	113	2.5	2.825		2.825	0.94	1.88	1.22	0.66	1.02	1.36	3.30
8	Male > 2 yr breeding only	130	400	300	2.7	8.1		8.1	2.70	5.40	3.51	1.89	2.93	3.90	9.45
9	Male > 2 yr drought	130	420	325	2.7	8.775		8.775	2.92	5.85	3.80	2.05	3.18	4.23	10.24
10	Male > 2 yr draught and breeding	139	420	325	2.7	8.775		8.775	2.92	5.85	3.80	2.05	3.18	4.23	10.24
11	Male > 2 yr Others	140	350	300	2.7	8.1		8.1	2.70	5.40	3.51	1.89	2.93	3.90	9.45
B CB/ Exotic															
1	Female ≤ 1 yr	43	140	97	2.6	2.522		2.522	0.84	1.68	1.09	0.59	0.91	1.21	2.94
2	Female ≤ 1-2.5yr	120	300	200	2.6	5.2		5.2	1.73	3.47	2.25	1.21	1.88	2.50	6.07
3	Female > 2.5 yr milk	160	514	300	2.4	7.2	2.16	9.36	3.12	6.24	4.06	2.18	3.39	4.51	10.92
4	Female > 2.5 yr dry	200	534	325	2.1	6.825	0.85	7.675	2.56	5.12	3.33	1.79	2.78	3.70	8.95
5	Female > 2.5 yr not calved once	165	400	300	2.3	6.9		6.9	2.30	4.60	2.99	1.61	2.50	3.32	8.05

Livestock	Weight range	Average weight	DM Requirement in 100 kg	DM requirement as per animal	product- ion of Milk (6 litres for crossbreed and 2 litres for indigenous)	DM require- ment for repro- duction	Total DM require- ment	Concent- rate (33.33% or 1/3 of DM	Rough- ages (66.67% or 2/3 of DM	Dry fodder (65% of total rough- ages)	Green fodder (35% of total rough ages)	Concent- rate in Kg dry matter)	Dry fodder in Kg (90% dry matter)	Green Fodder in Kg (20% dry matter)
6	Female > 2.5 yr others	400	2.3	6.9		6.9	2.30	4.60	2.99	1.61	2.50	3.32	8.05	
7	Male ≤ 1-1.5 yr	120	2.5	3		3	1.00	2.00	1.30	0.70	1.09	1.44	3.50	
8	Male > 1.5 yr breeding only	350	2.7	9.45		9.45	3.15	6.30	4.10	2.21	3.42	4.55	11.03	
9	Male > 1.5 yr drought	350	2.7	9.45		9.45	3.15	6.30	4.10	2.21	3.42	4.55	11.03	
10	Male > 1.5 yr draught and breeding	350	2.7	9.45		9.45	3.15	6.30	4.10	2.21	3.42	4.55	11.03	
11	Male > 1.5 yr Others	350	2.7	9.45		9.45	3.15	6.30	4.10	2.21	3.42	4.55	11.03	
C Buffaloes														
1	Female ≤ 1 yr	130	2.6	3.38		3.38	1.13	2.25	1.46	0.79	1.22	1.63	3.94	
2	Female ≤ 1-3.5yr	215	2.6	5.59		5.59	1.86	3.73	2.42	1.30	2.03	2.69	6.52	
3	Female > 3 yr milk	320	2.5	8	1.53	9.53	3.18	6.35	4.13	2.22	3.45	4.59	11.12	
4	Female > 3yr dry	350	2.4	8.4		8.4	3.08	6.17	4.01	2.16	3.35	4.45	10.79	
5	Female > 3 yr not calved once	350	2.4	8.4		8.4	2.80	5.60	3.64	1.96	3.04	4.04	9.80	
6	Female > 3 yr others	350	2.4	8.4		8.4	2.80	5.60	3.64	1.96	3.04	4.04	9.80	
7	Male ≤ 2 yr	180	2.6	4.68		4.68	1.56	3.12	2.03	1.09	1.70	2.25	5.46	
8	Male > 2 yr breeding only	325	2.75	8.9375		8.9375	2.98	5.96	3.87	2.09	3.24	4.30	10.43	
9	Male > 2 yr drought	325	2.75	8.9375		8.9375	2.98	5.96	3.87	2.09	3.24	4.30	10.43	
10	Male > 2 yr draught and breeding	325	2.75	8.9375		8.9375	2.98	5.96	3.87	2.09	3.24	4.30	10.43	
11	Male > 2 yr Others	325	2.75	8.9375		8.9375	2.98	5.96	3.87	2.09	3.24	4.30	10.43	

3. Result and discussion

Cropping system in different agro-climatic zones of Odisha

Odisha is characterised by complex and mixed agro-climatic situations, and wide variations exist within and between agro-climatic regions. The east and north-eastern parts of Odisha have more Kharif (rainy season crop) and Rabi (winter season crop) intercropped pulses crops like black gram and green crop intercropped with paddy. Paddy is the major crop in this region. The western part is a mixture of paddy, maize, cotton and other cash crops. The details of cropping patterns in different agro-climatic zones is presented in Table 4.

Table 4: Major crops grown in different agro-climatic zones of Odisha

Zones and districts covered	Climates	Soils type	Cropping system
Zone 1: North-western Plateau Zone (Sundargarh, parts of Deogarh, Sambalpur and Jharsuguda)	Warm and humid	Red, mixed red and black, mixed red and yellow	Upland area: rice+ horse gram /mustard, niger, maize-mustard, rice-castor Medium land area: rice-mustard/linseed/ black gram Lowland area: rice-black gram/lentil/linseed
Zone 2: North Central Plateau Zone (Mayurbhanj, major parts of Keonjhar except Anandapur and Ghasipura block)	Warm and humid	Red, lateritic, black	Upland area: groundnut, maize-horse gram, groundnut-castor Medium land area: rice-mustard, rice-green gram/ black gram, rice-chickpea, rice-sunflower Low land area: rice-black gram
Zone 3: North-eastern Coastal Plain Zone (Balasore, Bhadrak, parts of Jajpur and hatdih, Ghasipura and Anandpur block of Keonjhar)	Hot and moist sub-humid	Red, mixed red and black and black	The following are the principal cropping system in rainfed upland, medium and lowlands. Rainfed upland: rice-mung/pulses/black gram/ groundnut-jute Low Land: jute-rice-pulses, rice-black gram/mung.
Zone4: East and South-eastern Coastal Zone (Kendrapara, Khurda, Jagatsinghpur, part of Cuttack, Puri, Nayagarh and part of Ganjam)	Hot and moist sub humid	Red and yellow, Red and black, black, brown forest, lateritic	Cropping intensity of the zone is 168%. The cropping pattern of the zone is as follows: rice-rice, rice-pulse, rice-pulse/ groundnut, rice-potato-til, green gram, early rice-cauliflower, cabbage, okra, sugarcane.
Zone 5:North-eastern Ghat Zone (Phulbani, Rayagada, Gajapati, part of Ganjam and small patches of Koraput)	Hot and moist sub humid	Alluvial, red, lateritic, mixed red and black	Unirrigated upland area: rice-green gram/black gram/ horse gram, finger millet Irrigated upland area: rice-potato-summer vegetable, rice-green gram/vegetable, summer vegetable

Zones and districts covered	Climates	Soils type	Cropping system
Zone 6: Eastern Ghat Highland Zone (10 blocks of Koraput, Nabarangpur)	Hot and moist sub humid	Red, brown forest, red and yellow, mixed red and black	Upland area: ragi, rice, niger, horse gram, pearl millet, maize Medium land area: Vegetables, rice-maize, rice-ragi, maize-vegetables, rice-lentil, rice-wheat-black gram Low land area: rice (monocrop), rice-rice
Zone 7: South-eastern Ghat Zone (Koraput, Malkangiri and Similiguda)	Hot and moist sub humid	Lateritic, red and yellow, mixed red and black	Rice is the principal crop occupying 63% of the gross cropped area of the Zone. Other important crops that are widely cultivated are millet (20%), mesta (1.3%) and sesamum (37.08%). A number of fruit crops particularly mango, lime and guava are successfully grown in the zone.
Zone 8: Western Undulating Zone (Kalahandi and Nuapada)	Moist sub humid	Red, lateritic, deltaic alluvial, coastal alluvial and saline	Rainfed mono cropped: rice, maize, groundnut, black gram, ragi, sesamum, horse gram, pigeon pea Rainfed double cropped: rice-horse gram, groundnut-horse gram/mustard, maize-mustard/niger/sesamum Irrigated area: rice-wheat, rice-rice, rice-vegetables, vegetables-sugarcane.
Zone 9: West Central Table Land Zone (Bargarh, Bolangir, Boudh, Sonapur, parts of Sambalpur and Jharsuguda)	Hot and Humid, Hot and moist sub humid	Saline, lateritic, alluvial, red and mixed red, and black	Cropping intensity is 154.0% in the zone. There are seven farming situations in the zone and the cropping system of each farming situation is different depending on rainfall and socio-economics conditions. Major cropping system: Double/triple crop: Rice-vegetables, rice-black gram, groundnut-vegetables, rice-groundnut, rice-mustard, rice-green gram.
Zone 10: Mid Central Table Land Zone (Angul, Dhenkanal, parts of Cuttack and Jajpur)	Hot and moist sub humid	Brown forest, lateritic alluvial, red, mixed red and black	Rice is the principal crop in the area, comprising of 53% of the gross cultivated area. Pulses comprising horse gram, green gram, black gram constitutes 15% of gross cropped area.

Effective demand of different feed and fodder

Table 5 represents the district-wise feed requirement. The feed requirement was estimated by aggregating the feed requirement for both cattle and buffalo at different age group (dry cattle, milking animal, young, male and others). The descriptive statistics indicated that as per the 2012 livestock census, there is a requirement of 13,647,000 MT dry fodder, 33,022,000 green fodder and 10,537,000 MT concentrate feed, respectively. Among the different districts, high requirement of dry, green and concentrate feed is in Mayurbhanj district (as livestock population is high), while it is very low in Jharsuguda district.

Table 5: District wise feed and fodder requirement

	District	Dry fodder (000, MT)	Green fodder (000, MT)	Concentrate feed (000, MT)
1	Anugul	518	1,254	394
2	Balasore	719	1,743	542
3	Bargarh	444	1,076	339
4	Bhadrak	462	1,120	350
5	Bolangir	509	1,232	400
6	Boudh	232	562	181
7	Cuttack	553	1,341	426
8	Deogarh	203	493	154
9	Dhenkanal	440	1,066	342
10	Gajapati	234	566	182
11	Ganjam	696	1,688	554
12	Jagatsinghpur	317	767	245
13	Jajpur	461	1,118	350
14	Jharsuguda	149	362	114
15	Kalahandi	431	1,044	341
16	Kandhamal	487	1,179	384
17	Kendrapara	349	845	271
18	Keonjhar	759	1,838	576
19	Khurda	317	769	244
20	Koraput	657	1,592	517
21	Malkangiri	423	1,024	325
22	Mayurbhanj	987	2,392	747
23	Nabarangpur	545	1,320	422
24	Nayagarh	269	651	206
25	Nuapada	274	665	216
26	Puri	469	1,136	362
27	Rayagada	412	999	336
28	Sambalpur	366	885	278
29	Subarnapur	209	506	160
30	Sundargarh	756	1,832	579
	Odisha	13,647	33,064	10,537

Table 6 presents the requirement of feed in different agro-climatic zones of Odisha. The table indicated that there is high requirement of green fodder (5,817,000 MT), dry fodder (2,400, 0000 MT) and concentrate (1,859,000 MT) in East and South-eastern Coastal Zone. The lowest feed required in South-eastern Ghat Zone of Odisha is 563,000 MT for dry fodder, 1,365, 000 MT for green fodder and 435,000 MT for concentrate feed.

Table 6: Requirement of different types of feed across different agro-climatic zones of Odisha

Agro-climatic zone number	Agro-climatic zone name	Total dry fodder requirement (000, MT)	Total green fodder requirement (000, MT)	Total concentrate requirement (000, MT)
1	North-western Plateau Zone	1,044	2,528	797
2	North Central Plateau Zone	1,571	3,805	1,190
3	North-eastern Coastal Plain Zone	1,725	4,181	1,306
4	East and South-eastern Coastal Zone	2,400	5,817	1,859
5	North-eastern Ghat Zone	1,668	4,042	1,326
6	Eastern Ghat Highland Zone	960	2,325	749
7	South-eastern Ghat Zone	563	1,365	435
8	Western Undulating Zone	760	1,841	599
9	West Central Table Land Zone	1,747	4,232	1,348
10	Mid Central Table Land Zone	1,208	2,927	928
Odisha		13,647	33,064	10,537

Available of different feed from different sources

In India, the entire feed requirement for livestock is met from crop residues and by-products such as grasses, weeds and tree leaves gathered from cultivated and uncultivated lands; and grazing on common lands and harvested fields (Dikshit and BIRTHAL 2010). A similar pattern is also observed in Odisha. Very few farmers cultivate green fodder for livestock feed. Land allocation for cultivation of green fodder is limited and hardly ever exceeds 4.75% of the gross cropped area (Suresh et al. 2012). Table 7 represents availability of different types of feed from different sources. The descriptive statistics indicated that there is availability of 7,316, 000 MT of paddy straw available for livestock feed and 9,124,000 MT total dry fodder including paddy straw, 13,553,000 green fodder available for livestock feed in Odisha. Among districts, high amount of paddy straw (732 thousand MT) is available in Mayurbhanj while it is low in Kandhamal. Available of total dry fodder including paddy straw is high in Mayurbhanj (7,32,000 MT) and lowest in Jharsuguda (92, 000 MT). When it comes to green fodder, the highest amount (914 thousand MT) is available in Mayurbhanj district and lowest (109 thousand MT) in Jagatsinghpur district.

Table 7: Availability of different feeds from different sources across districts of Odisha in 2017–18

	District name	Total paddy straw available for livestock (000, MT)	Total dry fodder available for livestock (000, MT)	Total green fodder available for livestock (000, MT)
1	Anugul	139	208	668
2	Balasore	551	581	244
3	Bargarh	348	417	345
4	Bhadrak	343	354	102
5	Bolangir	138	220	562
6	Boudh	121	139	325

	District name	Total paddy straw available for livestock (000, MT)	Total dry fodder available for livestock (000, MT)	Total green fodder available for livestock (000, MT)
7	Cuttack	268	324	336
8	Deogarh	96	111	273
9	Dhenkanal	97	152	423
10	Gajapati	90	137	451
11	Ganjam	360	520	739
12	Jagatsinghpur	171	216	109
13	Jajpur	165	234	188
14	Jharsuguda	86	92	191
15	Kalahandi	479	603	608
16	Kandhamal	53	107	985
17	Kendrapara	188	228	134
18	Keonjhar	441	539	612
19	Khurda	152	179	180
20	Koraput	321	433	757
21	Malkangiri	196	234	628
22	Mayurbhanj	732	770	914
23	Nabarangpur	344	549	520
24	Nayagarh	140	186	388
25	Nuapada	67	137	298
26	Puri	192	241	188
27	Rayagada	142	207	626
28	Sambalpur	169	203	655
29	Subarnapur	336	364	152
30	Sundargarh	391	438	949
	Odisha	7,316	9,124	13,553

Note: considering 67% of paddy straw; 10% of wheat straw; 34% maize stover; 45% ragi straw; 59% green gram straw; 58% of black gram straw; 53% of horse gram straw; 60% of cow pea straw; 46% of groundnut haulm is available for livestock feed. This is based on the ILRI Feed Assessment Survey.

Table 8 depicts the available dry and green fodder in different agro-climatic zones of Odisha. The statistics indicated that highest amount of paddy straw is available in North-eastern Coastal Plain Zone (1,128 thousand MT) and lowest in South-eastern Ghat Zone (265 thousand MT). Total dry fodder including paddy straw is highest in East and South-eastern Coastal Zone (1,495 thousand MT) and lowest in South-eastern Ghat Zone (327 thousand MT). In case of green fodder, highest amount of green fodder is available in North-eastern Ghat Zone (2,662 thousand MT) and lowest in North-eastern Coastal Plain Zone (638 thousand MT).

Table 8: Available of dry and green fodder in different agro-climatic Zones of Odisha

Agro-climatic zone number	Agro-climatic zone name	Total paddy straw available for livestock (000, MT)	Total dry fodder available for livestock (000, MT)	Total green fodder available for livestock (000, MT)
1	North-western Plateau Zone	528	598	1,388
2	North Central Plateau Zone	1,071	1,185	1,385
3	North-eastern Coastal Plain Zone	1,128	1,246	638
4	East and South-eastern Coastal Zone	1,181	1,495	1,541
5	North-eastern Ghat Zone	561	836	2,662
6	Eastern Ghat Highland Zone	539	803	1,009
7	South-eastern Ghat Zone	265	327	790
8	Western Undulating Zone	581	795	959
9	West Central Table Land Zone	1,117	1,340	1,957
10	Mid Central Table Land Zone	345	499	1,225
Odisha		7,316	9,124	13,553

Percentage of dry and green fodder shortage

As per ICAR-NIANP estimate, there is 36% shortage in green fodder, 60% in protein concentrates and 23% shortage in dry fodder in India (GOI 2017). Table 9 presents the percentage of feed shortage in different districts of Odisha and Table 10 presents the percentage of dry and green fodder shortage in different agro-climatic zones of Odisha. It was observed that Odisha has 59.01% shortage in green fodder, 46.34% in paddy straw and 33.14% in total dry fodder including paddy straw. Among the districts, Kalahandi and Subarnapur don't have shortage in dry fodder (having surplus paddy straw as well dry fodder). However, there is significant shortage in dry fodder in Kandhamal (89.21%) followed by Dhenkanal district (77.96 %). In case of green fodder, highest percentage of green fodder shortage is seen in Bhadrak district (90.88%) followed by Balasore (86.01%) and 85.73% in Jagatsinghpur.

Table 9: Percentage of availability in green and dry fodder in different districts of Odisha

	District name	Paddy straw available for livestock (%)	Total dry fodder available for livestock (%)	Green fodder available for livestock (%)
1	Anugul	73.15	59.87	46.72
2	Balasore	23.36	19.17	86.01
3	Bargarh	21.56	6.00	67.95
4	Bhadrak	25.69	23.40	90.88
5	Bolangir	72.78	56.74	54.36
6	Boudh	47.71	39.98	42.10
7	Cuttack	51.62	41.52	74.92

	District name	Paddy straw available for livestock (%)	Total dry fodder available for livestock (%)	Green fodder available for livestock (%)
8	Deogarh	52.91	45.44	44.55
9	Dhenkanal	77.96	65.43	60.35
10	Gajapati	61.69	41.49	20.23
11	Ganjam	48.26	25.36	56.21
12	Jagatsinghpur	46.00	31.65	85.73
13	Jajpur	64.26	49.37	83.20
14	Jharsuguda	42.53	38.68	47.16
15	Kalahandi	-11.20	-39.82	41.72
16	Kandhamal	89.21	77.94	16.45
17	Kendrapara	46.13	34.65	84.19
18	Keonjhar	41.85	28.97	66.69
19	Khurda	52.01	43.45	76.58
20	Koraput	51.10	34.13	52.42
21	Malkangiri	53.68	44.66	38.63
22	Mayurbhanj	25.85	21.99	61.79
23	Nabarangpur	36.95	-0.78	60.59
24	Nayagarh	48.01	30.60	40.46
25	Nuapada	75.41	50.01	55.17
26	Puri	59.12	48.60	83.45
27	Rayagada	65.48	49.69	37.30
28	Sambalpur	53.73	44.57	25.97
29	Subarnapur	-60.72	-74.49	70.03
30	Sundargarh	48.33	42.07	48.18
	Odisha	46.39	33.14	59.01

Table 10 presents the percentage of shortage in green and dry fodder in different agroclimatic zones of Odisha. It was observed that there is high percentage of paddy straw (71.40%) and dry fodder (58.69%) shortage in Mid-central Table. It is important to note that there is no shortage in total dry fodder in West Undulating Zone, though there is shortage of 23.54% in paddy straw, if farmers feed only paddy straw in the area. When it comes to green fodder, highest percentage shortage in green fodder was seen in North-eastern Coastal Plain Zone (84.75%) followed by East and South-eastern Coastal Zone (73.50%). The lowest percentage shortage was observed in North-eastern Ghat Zone (34.14%).

Table 10: Percentage of shortage in green and dry fodder in different agro-climatic zones of Odisha

Agro-climatic zone number	Agro-climatic zone name	Total paddy straw shortage (%)	Total dry fodder shortage (%)	Total green fodder shortage (%)
1	North-western Plateau Zone	49.39	42.70	45.09
2	North entral Plateau Zone	31.79	24.58	63.61
3	North-eastern Coastal Plain Zone	34.61	27.76	84.75
4	East and South-eastern Coastal Zone	50.80	37.72	73.50
5	North-aastern Ghat Zone	66.40	49.89	34.14
6	Eastern Ghat Highland Zone	43.87	16.29	56.59
7	South-eastern Ghat Zone	53.03	42.03	42.08
8	Western Undulating Zone	23.54	-4.58	47.93
9	West Central Table Land Zone	36.09	23.30	53.77
10	Mid Central Table Land Zone	71.40	58.69	58.16
Odisha		46.39	33.14	59.01

4. Conclusion

From the above analysis, it is observed that there is availability of 7,316,000 MT of paddy straw, 9,124,000 MT of total dry fodder including paddy straw and 13,533,000 MT of green fodder in Odisha against the requirement of 13,647,000 and 33,022,000 MT of dry and green fodder, respectively. Odisha has 59.01% shortage in green fodder, 46.34% in paddy straw, and 33.14% in total dry fodder including paddy straw. Among the districts, highest percentage of green fodder shortage was seen in Bhadrak district (90.88%) followed by Balasore (86.01%) and Jagatsinghpur (85.73%). Among the agro-climatic zones, high percentage shortage in green fodder was observed in North-eastern Coastal Plain Zone (84.75%) followed by East and South-eastern Coastal Zone (73.50%). The lowest shortage was observed in North-eastern Ghat Zone (34.14%).

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