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Forage supply in Rajasthan- a regional analysis

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Abstract

The structural changes taking place in the livestock population in the state of Rajasthan indicated that farmers make need based adjustments in the herd composition of animals maintained on the farm. The share of cattle population has come down from 37.89 percent in 1951 to 22.2 percent in 2003 and that of buffalo has gone up from 10.53 percent in 1951 to 21.18 percent in 2003. The rapid and intensive mechanization-taking place in agriculture seems to have adversely affected the draught animal power use in agriculture, which in turn resulted in the decline of draught animals in the state from 7.6 lakh in 1983 to 5 lakh in 2003.There is a revealed preference for buffalo and goat in the state, which may be attributable to the increased demand for milk and acceptance of milk production as an important risk minimizing economic activity in rural areas of the state. The absence of systematic database for forage production in the state is a major bottleneck to devise strategies for sustainable development of livestock sector in the state. The results of this study amply reveal wide gap in the demand and supply of forage in the state. Only two districts, namely Jaisalmer and Sirohi were found having surplus forage production. The forage production through all sources has been more than three fourth of the requirement in districts like Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Churu, Ganganager, Kota and Hanumangarh. The high grazing pressure (animals/unit area) or the low grazing intensity (land/animal) is also a matter of great concern. Grazing pressure measured as adult cattle units per hectare of grazing land comes to 6.14 in Alwar, 8.93 in Bharatpur, 5.82 in Dausa, 10.90 in Hanumangarh, 5.22 in Jhunjhunu and 4.66 in Sikar. The grazing pressure is more where fodder supply is short of its demand. This situation is likely to adversely affect the sustainable development of livestock sector in the state unless fodder security measure are initiated.

Key words : Fodder resources, Grazing, Livestock, Rangeland

Introduction

It is generally felt that even in normal rainfall years, the fodder availability through all sources in the state of Rajasthan is short of requirement for the ever growing animal population. Only sporadic and localized efforts have been made to assess fodder security of animals in the state. However, the livestock rearing farmers make it a point to ensure on-farm fodder supply for the animals by suitably designing the cropping pattern in most part of the state. Though, cultivated fodder production for green and dry fodder is not a widely accepted practice, major chunk of the fodder requirement is met out through crop residues followed by grazing and browsing of animals on rangelands available in the state.

The livestock sector has a crucial role in determining the household nutrition, income level as well as employment pattern of rural masses in the state. The livestock plays a pivotal role in shaping the rural economy by providing gainful employment to small and marginal farmers, landless agricultural labourers, farmwomen and other deprived groups in the state. Drought is a regular feature of the state and as and when crops fail partially or fully, it is always the livestock sector, which is at the rescue of large number of rural farmers. The state is endowed with species and breeds, which can withstand extreme climatic situations. The animal husbandry sector has the added advantage of ensuring regular flow of income in the household while the income from crop sector is not only seasonal, but also prone to high risk (Vaidyanathan, 1988). There exists high nexus between crop and livestock sector due to the flow of inputs and outputs from one sector to the other (Birthal *et al.*, 1991). Hence any cropping pattern, which leads to adverse impact on fodder availability, is not readily acceptable to a large number of farmers in the state.

The Aravali range of hills delineate the state of Rajasthan into two distinct topographical regions. While the west of Aravali is a desert region, the east is more heterogeneous in terms of soil type, access to water resources, cropping

pattern, livestock composition and other agro-climatic features. The western Rajasthan has livestock dominated agricultural systems. The agro-climatic features of the eastern region permit varying proportions of crop-livestock sequences. The land-water resources and also the demographic structure make the dominance of animal husbandry in the agricultural systems prevalent in most part of the state. Animal husbandry has emerged as a labour intensive activity in the state. The peculiar land resources also acts as a supporting factor for the development of livestock sector in the state. The large coverage of barren land, culturable waste land, pasture and grazing land and the extent of fallow land allows the regular and seasonal grazing of animals in all the regions (Varghese and Varghese, 2002). Apart from the scope for regular employment and income generation and possible support from the land and human resources for the sustainable development of livestock sector, the risk prone crop based agriculture has also been acting as a major factor to resort to animal husbandry as a means of livelihood by a large section of people in the state. The scanty and erratic rainfall followed by recurrent drought acts as a compulsion for the rural farm households to adopt livestock as a rescue measure to get over the risk in agriculture. The assessment of demand-supply situation of forage in the context of increasing livestock population as well as changing composition is a matter of prime importance. In view of the overwhelming importance of the livestock sector in devising the rural economy of Rajasthan, it is worthwhile to make an assessment of emerging scenario in terms of overall trend and structural changes in livestock population in the state, district wise forage requirement and supply as well as the grazing pressure and grazing intensity so as to help planners of livestock sector to devise strategies for sustainable livestock development.

Methodology

The forage supply sources generally include rangeland and other grazing area; straw and other residues from crop production and cultivated production of forage. It is assumed that the rangeland, which has forage potential may include 50 per cent of forest area, complete barren and uncultivated land, permanent pastures and other grazing land, land under miscellaneous tree crops, culturable wasteland and fallow land (current and others). Besides, major part of the state being mono-cropped with crops only in *kharif* season, even part of net sown area is available for grazing seasonally. Average forage production of 2 tones per ha in a normal rainfall year was assumed in the area defined as rangeland (Tyagi, 1999).

For the purpose of converting the green fodder into dry fodder 1:0:25 ratio was assumed (Tyagi, 1999). In order to estimate production of dry fodder as residue of crop production, the grain-straw ratio in Rajasthan (Varghese *et al*., 1990) was used.

In order to assess the grazing pressure and also the fodder requirement the livestock population was converted into Adult Cattle Unit (ACU), using standard weight/conversion ratio (Tyagi, 1999)

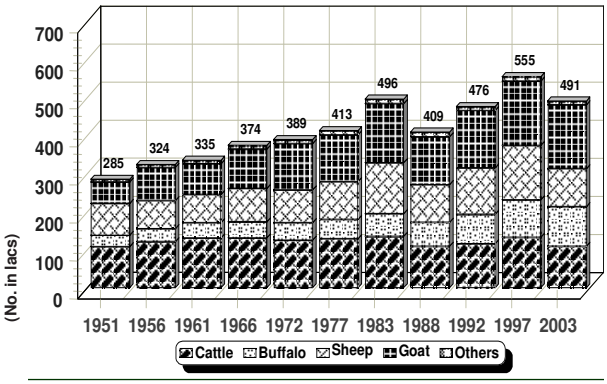
One cow unit of 350 kg has been assumed as one standard adult cattle unit (ACU). The adult cattle unit for various species of animal mentioned were calculated as:

$$\text{One ACU} = \frac{\text{Average weight of a unit animal x Population (in the category)}}{350}$$

The per day requirement of forage for each category of animal was worked out using the norms of 2 per cent of the body weight of animals (Tyagi, 1999)

Structural changes in livestock population

The trend in livestock population and its structural changes over the years is given in Fig. 1



(1951-2003)

Fig. 1 : Size and compositional changes in livestock population in Rajasthan

The total livestock population during the last five decades has almost doubled in the state of Rajasthan by 1997. While the size of cattle population fluctuated between 10.8 to 13.5 million numbers, the increase in buffalo population during this period is more than three times. As far as the growth in population of small ruminants is concerned, the goat population has been growing at rates faster than the sheep population. The camel and other type of animals, which are generally used for draught purposes initially has shown increase upto early eighties and

thereafter, the population of these categories of animals has been steadily decreasing in the state. The other animals included horses, mules, donkeys, *etc,* whose number is also on a decline in the state.

The fodder requirement depends on the growth in numbers as well as structural changes in the livestock population over the years. The cattle population, which constituted nearly 38 per cent of the total livestock population in early fifties in the state, has come down to little more than 22 per cent during 2003. On the contrary, the share of buffalo population which centered around 10 to 12 per cent of the total livestock population till early eighties has increased to the extent of 21.2 per cent of the total livestock population in 2003. The share of sheep population ranged between 20 to 29 per cent of the total livestock population in different years and that of goat population ranged between 19 per cent to 34 per cent of the total livestock population in different years. The spectacular decline in the draught animal population in the state is attributable to the rapidly increasing trend in mechanization for land operations, transport and lifting water from the wells. It is worth mentioning that the composition of livestock has undergone remarkable changes over the years in that state. The share of large animals in the total livestock, which centered around 45-50 per cent in early period is now centered around 40-45 per cent. The hardship in the insured supply to forage could be one of the possible reasons behind the reduced share of large animals.

Extent of rangeland and grazing pressure

Though, the information on livestock population is available for the last many years, there is no documented information on supply of and demand for fodder in the state of Rajasthan. The fodder supply required for various species of animal is met-out through the sources such as crop residues, exclusive fodder production and seasonal forage grown naturally on various types of land categorized as rangelands including grazing by animals on such land. The woody shrubs and tree Species like khejri (*Prosopis cineraria*) and Deshi babool (*Acacia nilotica*), ber (*Zizyphus spp.*) *etc*. also form major sources of forage and these tree species are grown on cultivated land, shelterbelts along roads, canals, railway lines and also on other types of land particularly on rangelands. The production of forage reported on rangelands obviously includes forage produced through these shrubs/tree species.

Depending upon the nature and type of cropping pattern, forage is invariably available in all the districts of the state as crop residues. Forage supply is also possible through land use classes such as forest land, barren land, pasture and grazing land area under miscellaneous trees, culturable wasteland fallow land. For the purpose of estimation of forage supply through rangeland only 50 per cent of the forest was assumed as potential for forage supply.

The district wise size of rangeland, grazing pressure and intensity of grazing are given in Table 1. The relative share of rangeland to geographical area varies between 6.79 per cent in Hanumangarh to 88.66 per cent in Jaisalmer. The districts like Bhilwara, Dungarpur, Jaisalmer, Sirohi and Udaipur have more than 50 per cent of geographical area under rangeland. However, the districts like Bharatpur, Churu, Jhunjhunu and Hanumangarh have less than one fifth of geographical area under rangeland.

The grazing pressure can be defined as the number of adult cattle units per hectare of grazable area. The grazable area is the same as the rangeland defined earlier. The grazing intensity is the reciprocal of grazing pressure and is the land available for unit adult cattle.

There are 1.83 adult animals for every hectare of grazable land in the state. The grazing pressure on unit area of rangeland varies between 0.21 adult cattle unit in Jaisalmer to 10.90 adult cattle unit in Hanumangarh district. The districts like Alwar, Banswara, Bharatpur, Churu, Dausa, Dungarpur, Ganganagar, Jaipur, Jhunjhunu, Nagaur, Sikar and Tonk have more than 3 adult cattle units for every hectare of grazable area. The grazing pressure is relatively low for districts like Jaisalmer, Barmer, Bikaner, Jodhpur, Rajsamand and Udaipur. As far as grazing intensity is concerned, it varies between 0.09 hectare per adult cattle unit in Hanumangarh to 4.69 ha per adult cattle unit in Jaisalmer. For the state as a whole the grazing intensity is 0.55 hectare per adult cattle unit.

Forage requirement and supply

The details of district wise forage requirement and supply are given in Table 2. The estimated gross forage supply comes to 55.98 million tones for the state as a whole, out of which 29.02 million tones is through rangeland, 24.70 million tones through crop residues and 2.27 million tones through exclusive fodder production. The total forage requirement @ 2 per cent of body weight of animals per day comes to 67.90 million tones in a year. The fodder supply through all sources is only 82.45 per cent of total requirement implying thereby a net deficit of 11.91 million tones in a year. Obviously, there is a remarkable storage

Table 1: District wise rangeland, grazing pressure and intensity in rajasthan

District	Rangeland (ha)	Percent of rangeland to geographical area (%)	Total livestock in ACU (number)	Grazing pressure (ACU/ha)	Intensity of grazing (land in ha/ACU)
Ajmer	359201	42.64	965900	2.69	0.37
Alwar	168030	21.93	1031511	6.14	0.16
Banswara	215825	42.61	825182	3.82	0.26
Baran	256573	36.67	579314	2.26	0.44
Barmer	1260317	44.73	1350514	1.07	0.93
Bharatpur	73010	14.40	652045	8.93	0.11
Bhilwara	572348	55.11	1323984	2.31	0.43
Bikaner	1257840	45.99	983442	0.78	1.28
Bundi	218417	37.59	586597	2.69	0.37
Chittor	504282	48.69	1115622	2.21	0.45
Churu	234834	13.93	833689	3.55	0.28
Dausa	89086	26.17	518133	5.82	0.17
Dholpur	122647	40.76	335548	2.74	0.37
Dungarpur	207529	53.82	627670	3.02	0.33
G.nagar	233220	21.34	802262	3.44	0.29
H.garh	65880	6.79	718397	10.90	0.09
Jaipur	306262	27.69	1342569	4.38	0.23
Jaisalmer	3403855	88.66	726497	0.21	4.69
Jalore	384287	36.38	786125	2.05	0.49
Jhalawar	23918	37.84	642747	2.69	0.37
Jhunjhunu	115287	19.48	601409	5.22	0.19
Jodhpur	921907	40.86	1361435	1.48	0.68
Kota	165884	31.83	445284	2.68	0.37
Nagaur	428204	24.27	1297965	3.03	0.33
Pali	526596	42.71	1050716	2.00	0.50
R.Mand	323537	71.09	622831	1.93	0.52
S,M,Pur	345067	34.35	984557	2.85	0.35
Sikar	181686	23.47	845763	4.66	0.21
Sirohi	273866	52.88	430344	1.57	0.64
Tonk	183470	25.25	661644	3.61	0.28
Udaipur	871502	50.60	1524514	1.75	0.57
Whole of Rajasthan State	14509660	42.38	26574211	1.83	0.55

loss for dry fodder in all the regions of the state due to lack of technological support for scientific storage of fodder in the state. There is no estimate available for various types of losses of dry fodder in the state. The Sirohi and Jaisalmer are the only two districts where forage supply is more than requirement. The districts that meet more than three fourth of the forage requirement include Bharatpur, Bhilwara, Bikaner, Bundi, Chittorgarh, Churu, Ganganagar, Kota, and Hanumangarh.

In districts like Baram, Barmer, Bikaner, Jaisalmer, Jalore, Jodhpur, Rajsamand and Udaipur, the rangelands are the major contributing sources of the forage pool of these districts. In all other districts, the crop residues are the major sources of forage supply. For the state as a whole about 51.83 per cent of forage supply is through rangeland, 44.12 per cent through crop residues and remaining 4.05 per cent through exclusive forage production. These estimates are based on robust estimates of productivity through various sources. There is a great need to scientifically assess the productivity potential of forage through different sources in different regions of the state.

Summary

The structural changes taking place in the livestock population of the state in favour of buffalo and goat indicates that farmers make need based adjustments in the herd composition of animals maintained on the farm. The rapid and intensive mechanization taking place in agriculture seems to have adversely affected the draught animal power use in agriculture, which in turn resulted in the decline of draught animal population in the state. Besides, there is a revealed preference for buffalo and goat in the state, which may be attributed to the increased demand for milk and acceptance of milk production as an important economic activity in rural areas of the state.

Table 2: District wise forage requirement and supply in Rajasthan

District	Forage supply (million tones)				Total forage requirement (million tones)	Surplus/ deficient forage (million tones)	Extent of supply to requirement (%)
	From rangeland (@ t/ha)	Agro-waste production	Total cultivated fodder	Total forage supply			
Ajmer	0.718	0.758	0.089	1.566	2.648	-0.902	63.45
Alwar	0.336	1.427	0.117	1.880	2.636	-0.755	71.32
Banswara	0.432	0.663	0.003	1.098	2.108	-1.010	52.08
Baran	0.513	0.345	0.020	0.877	1.480	-0.603	59.26
Barmer	1.260	0.649	0.017	1.926	3.451	-1.524	55.81
Bharatpur	0.146	1.031	0.130	1.307	1.666	-0.359	78.45
Bhilwara	1.145	1.277	0.106	2.527	3.383	-0.855	74.69
Bikaner	1.258	0.561	0.076	1.895	2.513	-0.618	75.40
Bundi	0.437	0.835	0.089	1.360	1.499	-0.139	90.72
Chittor	1.009	1.333	0.087	2.429	2.850	-0.421	85.22
Churu	0.235	1.395	0.038	1.668	2.130	-0.462	78.31
Dausa	0.178	0.554	0.069	0.801	1.324	-0.523	60.49
Dholpur	0.245	0.330	0.012	0.588	0.857	-0.270	68.61
Dungarpur	0.415	0.414	0.009	0.838	1.604	-0.765	54.24
G.nagar	0.466	1.096	0.213	1.776	2.050	-0.274	86.63
H.garh	0.132	1.456	0.157	1.745	1.836	-0.091	95.05
Jaipur	0.613	1.599	0.141	2.352	3.430	-1.078	68.57
Jaisalmer	3.404	0.062	0.005	3.470	1.856	1.614	186.96
Jalore	0.769	0.502	0.072	1.343	2.009	-0.666	66.85
Jhalawar	0.478	0.517	0.022	1.018	1.642	-0.625	62.00
Jhunjhunu	0.115	0.731	0.058	0.904	1.537	-0.633	58.81
Jodhpur	0.922	0.696	0.124	1.742	3.478	-1.737	50.08
Kota	0.332	0.515	0.035	0.882	1.138	-0.256	77.50
Nagaur	0.428	1.104	0.053	1.585	3.316	-1.731	47.80
Pali	0.527	0.643	0.196	1.366	2.685	-1.318	50.87
R.Mand	0.647	0.392	0.037	1.076	1.591	-0.515	67.63
S,M,Pur	0.690	0.940	0.051	1.681	2.516	-0.835	66.81
Sikar	0.182	0.226	0.062	0.470	2.161	-1.691	21.75
Sirohi	0.548	0.868	0.086	1.502	1.100	0.402	136.54
Tonk	0.367	0.729	0.045	1.141	1.691	-0.549	67.47
Udaipur	1.743	1.055	0.042	2.840	3.895	-1.055	72.91
Whole of Rajasthan State	29.019	24.701	2.27	55.985	67.897	-11.912	82.45

The scope to encash goat into any time money, due to its dual purpose, regular market demand, social factors and agro-climatic suitability would be the reasons behind regular increase of goat population in the state.

The absence of systematic database for forage production in the state is a major bottleneck to devise strategies for the sustainable development of livestock sector in Rajasthan. The productivity of forage on various types of fodder producing land is also not known. The crude method used in this study amply shows evidence of wide gap in the demand and supply of forage in the state, which in turn makes it necessary to have effective "herd planning" as a potential strategy for sustainable development of livestock sector in the state of Rajasthan.

The high grazing pressure (animals/unit area) or the low grazing intensity (land/animal) is a matter of great concern. The grazing pressure is more where fodder supply is short of its demand. This situation is likely to adversely affect the sustainable development of livestock sector in the state. Keeping in view the large scope of livestock sector to contribute towards accelerated growth of agricultural sector and the demand-supply gap in forage production in the state, it is important to have quality improvement in animals; scientific assessment of the forage productivity on various categories of rangeland including that of tree species; reduce storage losses of forage through technological support and to minimize the losses due to reduction in the livestock population in drought years.

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