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Research Article

Pattern of Bovine Population and Milk Production in Rural Areas of Bikaner District of Rajasthan

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ABSTRACT

Livestock rearing is one of the most important economic activities in the rural areas providing stable and supplementary income round the year. There are large inter-regional and inter-state variations in milk production as well as per capita availability in India. The total milk production in Rajasthan was 23.68 million tonnes in 2018-19, and ranked second in India. In spite of high livestock population and total milk production in India, per animal average milk production is low. The present study was undertaken with the objective to study growth of livestock population in Rajasthan as well as in Bikaner district, pattern of bovine population and milk production in rural areas of Bikaner district of Rajasthan. The Bikaner district of Rajasthan was selected for the study purposively for having largest cattle population in Rajasthan. Out of eight tehsils in Bikaner district, one tehsil having highest cattle population in each of three distinct types of irrigation conditions was selected purposively. Total 180 farmers were selected from the six selected villages. The selected farmers were categorized into small, medium and large herd-size categories using cumulative square root frequency method. Considering the differences in regional endowments of animal wealth and species, the animals have been converted into SAUs. The secondary data required for estimation of growth rate were collected for the period from 1987-88 to 2018-19. The primary data were collected from the sample farmers for the year 2019-20. Growth in livestock population was estimated using compound growth rates of livestock population for Rajasthan and Bikaner. Total livestock population of Rajasthan during the census's 1956 to 2019 registered compound growth rate of 5.0 % per census, respectively. The growth rate estimated revealed that cattle and buffalo population of Bikaner had enrolled a growth of 13.0 per cent per census. Size of herd was slightly higher in canal irrigated area and productivity of milk was highest in case of crossbred cows.

Keyword: *Livestock population, Growth, Milk production, Cattle population, Herd-size categories.*

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INTRODUCTION

Animal husbandry is an integral component of agriculture supporting livelihood of more than two-thirds of the rural population. Livestock rearing is one of the most important economic activities in the rural areas providing stable and supplementary income round the year. Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households. India continues to be the largest producer of milk in the world. Several measures have been initiated by the Government to increase the productivity of livestock, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the tenth plan (2006-07) to 187.75 million tonnes in 2018-19 showing an annual growth of 6.50 per cent per annual. The per capita availability of milk was around 394 grams per day in 2017-18. Projected milk production by 2021-22 is 254.5 million tones as per the vision 2022 document. Nearly 35 per cent of the milk production was contributed by Indigenous Buffaloes followed by 27 per cent by crossbred cattle. The Indigenous cattle contributed 10 per cent of the total milk production in the India whereas non-descript cattle contributed 11 per cent milk production and non-descript buffaloes contributed 14 per cent milk production. (Department of Animal Husbandry, Dairying and Fisheries, Govt. of India, 2019).

The milch animals have a significant contribution in the economy of country for the poor people of rainfed agro-ecosystem for their sustainable living because of severe risk involved in the crop production due to uncertainty of rain and drought (Misra & Ramakrishna, 2007). There is great diversity in Indian agro-climatic zones. The agriculture is more severely affected by drought rather than livestock. In the years of drought, crop production can be as low as 10 percent of normal year, in the same situation milk production may still remain same or more than 50 per cent. Thus, the milch animal rearing activity provides source of livelihood and supplementary occupation to majority of farmer living in the drought prone rainfed areas where crop production on its own way not be very productive and engaging them fully or partially (Samra et al., 2006). Rajasthan is considered as 'Denmark of India'. The livestock population of the state was 567.75 lakh (2012). The total milk production in Rajasthan was 23.68 million tonnes in 2018-19, and ranked second in India. Animal husbandry is a major economic activity contributing approximately 11.19 percent to the total GSDP of the state in 2018-19. The state is second highest in milk production in the country. Of the total milk produced, 53 per cent is buffalo milk, 36 per cent is cattle milk and 11 per cent is goat milk (https://www.nddb.coop/information/stats).

Livestock rearing is one of the most important economic activities in the rural areas providing stable and supplementary income round the year. There are large inter-regional and inter-state variations in milk production as well as per capita availability in India. The total milk production in Rajasthan was 23.68 million tonnes in 2018-19, and ranked second in India. In spite of high livestock population and total milk production in India, per animal average milk production is low.

The present study was undertaken with the objective to study growth of livestock population in Rajasthan as well as in Bikaner district, pattern of bovine population and milk production in rural areas of Bikaner district of Rajasthan.

MATERIALS AND METHODS

The Bikaner district of Rajasthan was selected for the study purposively as it was having largest cattle population (table 1). Another reason for selecting the district was that it has higher Indigenous Cattle population, and livestock production in the area is second largest enterprise after crop production. (Department of Animal Husbandry, Dairying and Fisheries, Govt. of Rajasthan, 2019).

Table 1: Top six districts of Rajasthan having highest cattle population

(Livestock Census 2019)

S.No.	Districts	Total Cattle Population	Indigenous Cattle Population
1	Bikaner	1194729	1064552
2	Jodhpur	1069027	980639
3	Barmer	905199	903639
4	Udaipur	831496	751285
5	Bhilwara	705423	565403
6	Jaipur	691457	388894

Bikaner district has three distinct types of agricultural situations in the region viz., canal irrigated, tube well irrigated and unirrigated. Loonkarnasar*tehsil* in Canal Irrigated area was selected having highest number of cattle and a buffalo, likenwise Nokha*tehsil* was selected in tube well irrigated area and Kolayat *tehsil* was selected in un-irrigated area.

From each *tehsil* two villages were selected on the basis of the distance from the *tehsil* headquarter. Two villages from each *tehsil* were selected out of which one village was selected randomly from the villages within the radius of 25 km of *tehsil* headquarter and other village was selected randomly from the villages outside the 25 km radius from *tehsil* headquarter. Therefore, total 180 farmers were selected from the six selected villages. The selected farmers were categorized into small, medium and large herd-size categories using cumulative square root frequency method. Considering the differences in regional endowments of animal wealth and species, the animals have been converted into SAUs using factors suggested by Sirohi et al. (2015) for the west region. Thus, the sample was comprised of 88 small herd size milk producers category (2-7 SAUs), 61 medium herd size (more than 7-12 SAUs) and 31 large herd size milk producers category (more than 12 SAUs). The data collected have been analyzed using different statistical measures and interpreted across herd-size categories of milk producers as well as overall. The primary data were collected from the sample farmers for the year 2019-20. Secondary data relevant for the study were collected from the data published by Department of Animal Husbandry, Dairying and Fisheries, Directorate of Animal Husbandry and Veterinary Services and the Directorate of Economics and Statistics of Government of Rajasthan.

The data collected have been analyzed using different statistical measures and interpreted across herd-size categories of milk producers as well as overall.

The compound growth rates of population of livestock population were estimated to study growth of livestock population in Bikaner district as well as Rajasthan as a whole. Growth rate was calculated based on the inter census period data. For the calculation of growth rate, following formulae was employed.

$$Y = ab^t u_t \ldots (1)$$

Where,

Y = Population of milch animals

b= (1+r): where r is compound growth rate

t= Time element that takes the value 1, 2, 3……n

u_t= Disturbance term in year 't'

The eq. (1) was transformed into log linear form and written as;

$$\log Y = \log a + t \log b + U_t \ldots\ldots (2)$$

Eq. (2) was estimated by using Ordinary Least Squares (OLS) technique.

Compound annual growth rate (g) was computed as:

$$g = [(\text{Antilog of } b) - 1] \times 100 \ldots\ldots (3)$$

Where 'g' is compound annual growth rate in per cent per annum. Estimation of standard error of growth rate was done and its significance was tested with't' statistic.

To study pattern of bovine population and milk production tabular analysis was done using frequencies, percentages and averages was done.

RESULTS AND DISCUSSION

Temporal change in composition of livestock population in Bikaner district

The total livestock population composition of different species of livestock animal had changed noticeably during the period from 1956 to 2019, as shown in table 2. The total livestock population was increased from 32426.98 thousand in 1956 to 56775.24 thousand number in 2019. The highest population of livestock was recorded in 2012. An increasing trend in number of total livestock population was observed from 1956 to 2019, except in the years 1987 and 2002. Total bovine population in Bikaner has shown increasing trend in terms of number during the period from 1956 to 2019, and it has increased from 15512.16 thousand in 1956 to 27605.78 thousand in 2019.

Table 2: Temporal change and contribution of cattle and buffalo in total livestock population of Rajasthan
(in thousands)

Year	Total livestock population in Rajasthan ('000)	% change over the period	Total bovine population in Rajasthan ('000)	% change over the period	Total bovine population in Bikaner ('000)	% change over the period
1956	32426.98	-	15512.16	-	288	-
1961	33508.95	103.33	17155.03	110.59	327	113.54
1966	37475.51	111.83	17345.50	101.11	401	122.63
1972	38886.56	103.76	17071.05	98.42	252	62.84
1977	41359.27	106.35	17968.28	105.26	326	129.37
1982	49650.22	120.04	19547.68	108.79	391	119.94
1987	40995.58	82.56	17327.17	88.64	473	120.97
1992	48445.59	118.17	19441.55	112.20	528	111.63
1997	54348.90	112.18	21914.91	112.72	668	126.52
2002	49136.35	90.40	21267.34	97.05	741	110.93
2007	56663.18	115.31	23211.48	109.14	802	108.23
2012	57732.20	101.88	26300.56	113.31	1099	137.03
2019	56775.27	98.34	27605.78	104.96	1400	127.39

Source: 20th Livestock Census, Department of Animal Husbandry, Dairying and Fisheries (Govt. of India, 2019).

Percent share of bovine population in total livestock population in Rajasthan as well as in Bikaner is given in table 3. It can be seen in table that the percent share of bovine population in Rajasthan was ranging mostly between 40 to 50 per cent. Per cent share of bovine population of Bikaner in over all bovine population of Rajasthan improved from 1.85 % in 1956 to 5.81 % in 2019. There is almost continuous increase in percent share of bovine population of Bikaner district in Rajasthan bovine population year by year as evident from table which shows that bovine population in Bikaner has been increasing faster than Rajasthan as a whole.

Table 3: Share of bovine population in total livestock population of Rajasthan

Year	Total livestock population in Rajasthan ('000) (A)	Total bovine population in Rajasthan('000) (B)	B as % of A	Total bovine population in Bikaner ('000) (C)	C as % of B
1956	32426.98	15512.16	47.84	288	1.86
1961	33508.95	17155.03	51.20	327	1.91
1966	37475.51	17345.50	46.28	401	2.31
1972	38886.56	17071.05	43.90	252	1.48
1977	41359.27	17968.28	43.44	326	1.81

1982	49650.22	19547.68	39.37	391	2.00
1988	40995.58	17327.17	42.27	473	2.73
1992	48445.59	19441.55	40.13	528	2.72
1997	54348.90	21914.91	40.32	668	3.05
2002	49136.35	21267.34	43.28	741	3.48
2007	56663.18	23211.48	40.96	802	3.46
2012	57732.20	26300.56	45.56	1099	4.18
2019	56775.27	27605.78	48.62	1400	5.08

Source: 20th Livestock Census, Department of Animal Husbandry, Dairying and Fisheries (Govt. of India, 2019).

The growth of livestock population in Rajasthan during the census's 1956 to 2019 is presented in table 4. It can be seen that total livestock population of Rajasthan during 1956 to 2019 registered compound growth rate of 5.0 % per census, which was significant at 0.1 per cent level of probability. Bovine population of Rajasthan also registered positive growth rate of 4.0 per cent per census. The bovine population of Bikaner has enrolled a positive growth but at a very high rate as compared to state as a whole i.e. 13.0 per cent per census. This clearly indicates that in Bikaner district livestock rearing is becoming more popular as an important source of farm income.

Table 4: Growth of bovine population in Rajasthan and Bikaner district (1956 to 2019)

Particulars	Growth rates	Regression coefficient	Standard error	R^2
Total livestock population of Rajasthan	5.00*	2.57	.005	.89
Bovine population of Rajasthan	4.00*	2.56	.005	.88
Bovine population of Bikaner	13.00*	2.57	0.16	.88

* Significant at1% level of probability

Pattern of population of milch animals and milk production

Table 5shows the herd-size category wise distribution of sample households selected for the study from three *tehsil*s of Bikaner district. The proportion of small, medium and large herd size categories in the sample households were 48.89, 33.89 and 17.22 per cent, respectively. Average number of total livestock animals on small, medium and large categories of households has been 6.90, 9.08 and 15.00 units, respectively. Average number of milch animals per household according small, medium and large milch size categories was 4.18, 6.00 and 10.08 SAUs units, respectively.

Table 5: Distribution of sample households according to average herd size in different herd size categories

Particulars	Herd –size category			Total/Overall Average
	Small (2-7 SAUs)	Medium (>7-12SAUs)	Large (>12SAUs)	
Households Number	88(48.89)	61 (33.89)	31 (17.22)	Total- 180 (100)
SAU of Total Livestock Animals /HH	6.90	9.08	15.00	Average – 8.22
SAU of Milch Animals/HH	4.18	6.00	10.08	Average - 5.61

SAU indicate Standard Animal Unit and figures in parentheses show per cent of total in the category.

Table 6 shows *tehsil* wise per household average herd size of livestock and milch animals in three *tehsils* representing canal irrigated, tubel well irrigated and rainfed areas. Herd strength and the number of milch animals in the household directly affect the economy of the milk producers. Different types of animals were maintained in various households. On an average, a milk producer household maintained a herd size of 6.73 standard animal units in canal irrigated area (*Lunkaransar tehsil)* as compared to 5.79

standard animal units in tube well irrigated area (Nokha *tehsil*) and 4.31 in un-irrigated area (Kolayat *tehsil*). Size of herd was slightly higher in canal irrigated area, followed by tube well irrigated area and un-irrigated area, respectively, which implied that households in irrigated areas had more number of livestock and milch animals on farm.

Table 6: *Tehsil* wise per household average herd size of livestock and milch animals (SAUs/Household)

Herd Size Category	Lunkaransar		Nokha		Kolayat	
	Livestock Animals	Milch Animals	Livestock Animals	Milch Animals	Livestock Animals	Milch Animals
Overall	10.19	6.73	8.12	5.79	6.33	4.31

Productivity of milch animals

Milk yield is the main output of milk producers. It has economic significance that ultimately brings returns to the milk producers. The many factors depend upon milk yield such as feed and fodder fed to the animals, health care and management, animal breed, etc. The milk yield per milch animal per day is presented in table 7. On perusal of the table it was found that in case of Indigenous cow overall milk yield per day was 6.62 litres per milch animal per day in the Lunkaransar *tehsil*, which varied from 5.77 litres per milch animal per day for Nokha *tehsil* to 5.17 per milch animal for overall of Kolayat *tehsil*. In case of crossbred cows, the overall average milk yield of Lunkaransar *tehsil* was found to be 8.59 litres per day which varied from 8.54 litres per day for milch animal in Nokha tehsil to 6.98 litres per day for in Kolayat *tehsil*. In case of buffaloes, the per day per animal milk yield in Lunkaransar was 5.91 litres per day, varying from 6.34 litres in Nokha *tehsil* to 4.36 litres in Kolayat.

It can be concluded that the productivity of milk was highest in case of crossbred cows. On the basis of results, it can be inferred that average productivity of milk yield of indigenous and crossbred cows in canal irrigated area (Lunkaransar) was higher as compared to tube well irrigated (Nokha) and unirrigated area (Kolayat). Lunkaransar is also called as Denmark of Rajasthan and where it seems that resource endowments in terms of irrigated land. This leads to better green fodder and feeding of animals right from their birth, quality feed like compound feed (vita feed), proper time of feeding, proper feed management and handling of animals, etc. Thus, it can be concluded that Lunkaransar *tehsil* milk producers were able to manage their milch animals more efficiently in terms of their milk output for indigenous and crossbred cows. Regarding buffaloes, it can be inferred that average milk yield in Nokha *tehsil* was significantly higher than that of Lunkaransar and Kolayat *tehsil*. According to livestock census 2012, number of buffaloes and total milk production of buffaloes was hightest in Nokha *tehsil* than Lunkaransar and Kolayat. Households of Nokha *tehsil* rear Murrah breed and milk production of Murrah buffaloes are higher than other breeds of buffaloes.

Table 7: Distribution of average productivity of daily milk yield by groups across herd size categories (Liter/day/milch animal)

	Milch Animal breed		
Tehsil	Indigenous Cow	Crossbred Cow	Buffalo
Lunkaransar	6.62	8.59	5.91
Nokha	5.77	8.54	6.34
Kolayat	5.17	6.98	4.36

CONCLUSION

The study revealed that of the pattern of milch animal of milk production in rural areas revealed thatherd-size category wise distribution of sample households selected for the study from three *tehsils* of Bikaner district. Average number of milch animals per household according small, medium and large milch size categories was 4.18, 6.00 and 10.08 SAUs units, respectively. *tehsil* wise per household average herd size of livestock and milch animals in three *tehsils* representing canal irrigated, tubel well irrigated and rainfed areas. Size of herd was slightly higher in canal irrigated area, followed by tube well irrigated area and un-irrigated area, respectively, which implied that households in irrigated areas had more number of livestock and milch animals on farm. It can be concluded that the productivity of milk was highest in case of crossbred cows. On the basis of results, it can be inferred that average productivity of milk yield of indigenous and crossbred cows in canal irrigated area (Lunkaransar) was higher as compared to tube well irrigated (Nokha) and unirrigated area (Kolayat). Thus, it can be concluded that Lunkaransar *tehsil* milk producers were able to manage their milch animals more efficiently in terms of their milk output for indigenous and crossbred cows. Regarding buffaloes, it can be inferred that average milk yield in Nokha *tehsil* was significantly higher than that of Lunkaransar and Kolayat *tehsil*. According to livestock census 2012, number of buffaloes and total milk production of buffaloes was hightest in Nokha *tehsil* than Lunkaransar and Kolayat. Households of Nokha *tehsil* rear Murrah breed and milk production of Murrah buffaloes are higher than other breeds of buffaloes. It can be seen that total livestock population of Rajasthan during 1956 to 2019 registered compound growth rate of 5.0 % per census, which was significant at 0.1 per cent level of probability. Bovine population of Rajasthan also registered positive growth rate of 4.0 per cent per census. The bovine population of Bikaner has enrolled a positive growth but at a very high rate as compared to state as a whole i.e. 13.0 per cent per census. This clearly indicates that in Bikaner district livestock rearing is becoming more popular as an important source of farm income.

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