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Spatio-Temporal Changes of Livestock in the Arid Region of Rajasthan

Abstract

In recent years, indigenous domestic animals like cows are being replaced by hybrid cows and buffaloes as they yield more milk and also the demand of bulls is decreasing rapidly in agricultural sector.

The data analysis of last four censuses indicates that population of buffaloes is increasing by 5.5% while the population of other animals such as cows, goats, sheep and camels is showing a decreasing trend. Therefore, the present study is an attempt to be fruitful in assess spatio-temporal changes of livestock in the arid region with an ecological point of view.

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Keywords: Indigenous cows,decreasing trend, and spatio-temporal changes.

Introduction

ALivestock constitutes about 19% of the total income of Rajasthan. For socio-economic uplift of people of the arid region, it is necessary to make judicious uses of the available indigenous natural resources. According to Livestock Census 2007, there is 566.63 lakh of livestock population with a density of 175 per sq.km. It is an important occupation of the farmers of the arid region. During 1956-2007, the livestock population increased from 255.16 lakh to 566.63 lakh.[1] In this period, there is an increase in the number of buffaloes, sheep and goats by 264.23%, 107.70% and 286.58% respectively while cow population has increased only 12.60% in Rajasthan and by only 7.76% in the arid region of Rajasthan. The high growth rate of buffaloes and goats further increases the deficits in demand and supply of forages.

Rajasthan is predominantly a pastoral state and the home of some famous cattle breeds of India. Since generations, animals have been supporting the farmers in their agro-based economy. Animals have supplementary and sustainable relationships with crops under mixed farming system prevalent in the state. Moreover, they are living banks for farmers and provide flexible reserves during a period of economic stress and buffer against crop failure. The farmers domesticate livestock for milk and consider it as draught power, a supplementary occupation to agriculture due to scanty, uncertain and uneven rainfall. The scarcity of water resources has made the western part of the state very inhospitable and desolate.

Bovine wealth is the backbone of mixed farming system among the total livestock in India as well as in Rajasthan. Difference in the growth rates of cattle and buffaloes indicates their relative importance and change in composition. Notable compositional changes are- (i) increase in the share of buffaloes and consequent reduction in the share of cattle, (ii) increase in the share of breedable females and decrease in the share of working adult males of cows and buffaloes, and (iii) among the young stock, the share of females rising and that of males falling. The sex and age specific composition of cattle and buffaloes has slowly but surely been moving in favour of increasing milk yield.[2]

Study Area

The western part of Aravallis is arid and semi-arid and it is well adapted to cattle breeds, perennial grasses, vast grazing land, development of dairy industry etc. are some of the favourable conditions.[3] It is located between 24°31' to 30°12' north latitudes and 69°15' to 76°42' east longitudes by covering an area of 196,750 sq km (61%) of the state. Its length is 640 km from north to south and width is 300 km from east to west.[4] It includes 12 districts i.e Sriganganagar, Hanumangarh, Churu,

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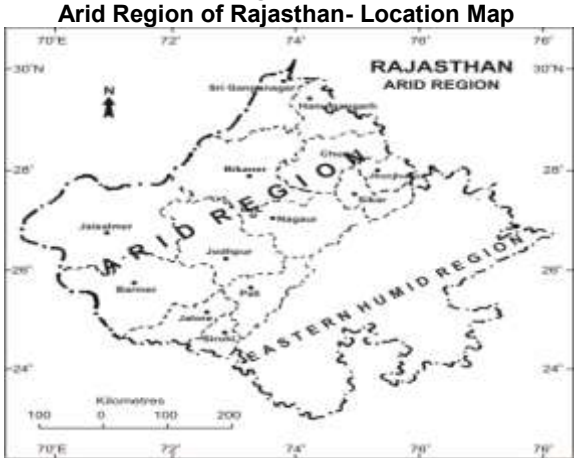
Sikar, Jhunjhunun, Nagaur, Bikaner, Jodhpur, Barmer, Jalore, Pali, and Jaisalmer (Fig. 1).

Figure 1 :
Arid Region of Rajasthan- Location Map



Its climate is characterized with large variations in temperature, extreme dryness and scanty rainfall. The rainfall is highly erratic and unpredictable. Approximately 95% of the rainfall is received during monsoon (June-September) and co-efficient of variability ranges from 40-60% and high evaporation (1500-2000 mm/year) in comparison to low rainfall, causes severe aridity.

Objective of the Study

1. To examine the factors responsible for the structural changes of livestock; and
2. To evaluate the trends of livestock growth in the study area.

Hypothesis

Animal rearing is one of the main economic activities in the study area. It is the only economic activity which provides income to poor and marginal farmers throughout the year. The following are the main hypotheses:

1. The hybrid cows and buffaloes are replacing indigenous breeds of cows;
2. The decreasing demand of draught animals with low milk yield and short lactation period is causing decrease in number of indigenous animals; and
3. Expansion of irrigation and mechanization in agriculture has also affected the livestock rearing.

Methodology

The primary data have been collected from 159 sample villages by intensive field survey through schedule-cum-interview method. Selection of sample villages located in 22 tehsils is done by keeping in view the number of districts. Finally, five households of each village (795) and ten households each from six major urban centres (60) have been taken for field survey. The primary data and information are based on a schedule containing breeds of animals, feeding, milk yield, income structure, mode of transportation and sale, artificial insemination, structure of indigenous cows, draught animals, hybrid cows and buffaloes, views about structural changes of livestock and their problems.

The secondary data have been obtained from various published and unpublished reports and periodicals of Rajasthan Co-operative Dairy Federation (RCDF), Jaipur; District Dairy Co-operative Societies; Department of Animal Husbandry, Rajasthan, Jaipur; Central Arid Zone Research Institute (CAZRI), Jodhpur; Institute of Development Studies (IDS), Jaipur; Uttari Rajasthan Milk Union Limited, (URMUL Trust), Bikaner; National Dairy Development Board (NDDB), Jaipur; Fodder Research Institute, Bikaner; Directorate of Economic and Statistics, Govt. of Rajasthan, Jaipur; College of Veterinary Science, Bikaner and other concerned departments of the central and state governments.

The primary data along with the secondary data have been analyzed through tabulation, charts, maps and diagrams to test the hypotheses and to conclude the study. The outcomes of the study would be useful for the planners in policy making for livestock improvements in the State.

Factors Responsible For Compositional Changes
Landuse Pattern

The data given in the table 1 shows comparative landuse of the arid region. In the year 1960, the forest cover was only 0.78% in the arid region which has increased by 2.5% in 2000. It is lower than that of the state 3.8%. But it is important to note that land not available for cultivation, fallow lands, cultivable wasteland and pastures show a declining trend in the arid region as well as in the state.

Table1: Arid Region of Rajasthan- Landuse Classification (1960-2010) (%)

Year	Forest	Not available for cultivation	Fallow land	Cultivable wasteland & pastures	Net sown area
1960	0.78	14.28	19.41	26.03	39.42
1970	0.78	14.45	14.50	25.54	44.73
1980	1.36	8.25	14.18	28.77	47.44
1990	1.86	8.55	13.67	26.36	49.56
2000	2.50	8.72	13.15	24.07	51.56
2010*	3.34	8.90	12.56	21.85	53.56

Source: Agricultural and Landuse Department, Rajasthan *estimated figure

It is very interesting to note that net sown area has increased from 30.99% in 1960 to 45.32% in 2000. It has increased by about one and a half times during 1960-2000. It indicates that the landuse pattern of state was changing gradually which causing a shrinkage in the lands available for animal grazing.

Mechanisation in Agriculture

At present most of the small, marginal and large farmers, 67% in Bikaner and 61% in Jodhpur region prefer tractors in place of draught animals.More significantly, tractorisation has reversed the traditional pattern of ownership of draught power. Presently, large farmers own more draught power per hectare than the small farmers. This has led to the concentration of a vital resource in a few hands. On the other hand, the availability of tractors on hire has helped many marginal and small farmers to reduce their expenditure on draught power. The shift from labour intensive animal power to capital-intensive technology has important socio-economic implications.

The growth in the number of oil-engines and electric pump-sets is far more impressive than that of tractors. The number of oil engines increased from 1.95 to 4.27 lakh from 1983 to 2003. During this period the availability of these equipments per lakh of gross cropped area increased from 151 to 2,035 and 131 to 2,892 respectively (Table 2).

Table 2 : Arid Region of Rajasthan - Mechanisation in Agriculture (in lakh)

Year	Cropped area (hec)	Tractors	Oil engines	Electric pumps	Cultivators	Threshers
1983	123455	24146	1.95	1.32	0.09	0.34
1997	112889	78452	2.78	2.02	0.28	0.66
2003	128651	96509	4.27	3.84	0.86	1.16
2007	131552	122416	7.43	5.02	1.45	3.05
2010	155223	147665	9.55	8.15	2.32	6.45

Statistical Abstract, Economic and Statistical Department, GoR, Jaipur

By the early eighties, it was estimated to have increased to 71 million units. The composition of farm power also underwent a remarkable change. The share of animal power that was about 90% in 1961 declined to 27% by 2003. The share of irrigation equipment increased from 6 percent to 45% and that of tractors from 2 to 18%. About 90% of the mechanical power in agriculture was derived from oil engines and electric pump-sets and the latter is increasing at a faster rate in recent years. Consequently, the consumption of electric power per hectare of cultivated area has increased rapidly. The cropped area has also increased from 123455 hectare in 1983 to 128651 ha in 2003 in the arid region of Rajasthan.[5]

Cropping Pattern

The farmers prefer commercial and food crops rather than fodder crops. During sixties there was dominance of pastures, grazing lands and areas of fodder crops. The area under fodder crops was 56% in 1951, has reduced to 47% in 1992-93 and about 36% in 2003-04. The area under oil seeds cultivation increased from 6.2% in 1951 to 21.4% in 2001-02. The overall area under fodder crops (food-grain and pulses) decreased from 77% to 56% during the same period. The trend has resulted in low production of feed and fodder for animals cause their deficit in the study area.

Expansion of Irrigated Area

The irrigated area by all sources was only 9.3% in 1951 has increased by about 45% in 2004-05 out of the total potentiality (53%) of irrigation in the arid region of Rajasthan. This expansion of irrigation has resulted inclusion of new lands which were earlier under fallow lands, pastures and grazing lands, thus causing a shrinkage in pastures and grazing lands.

Milk Yield and Lactation Period of Bovines

It has become a general thinking of public that indigenous cows are not good milk yielders and their lactation period is also very short (5 months) than buffaloes and hybrid cows (7 months). Therefore, the farmers prefer buffaloes and hybrid cows than the indigenous cows.

Livestock Structure

According to Livestock Census 1966, there were 42.30% cows, 34.24% buffaloes, 67.89% sheep, 41.27% goats and 87.03% camels of the state in the arid region of Rajasthan. It shared 47.87% of the total livestock wealth in the state. Out of the total livestock wealth of the study area, share of cows was 30%, buffaloes 6.76%, sheep 35.84% and goat 23.03% in the same year. It shows that the percentage of bovine population was highest out of the total livestock population in the study area. Barmer (25.91 lakh), Nagaur (17.54 lakh), Pali (15.93 lakh), Jalore (13.96 lakh) and Ganganagar (12.64 lakh) were the leading districts in the overall livestock population whereas Barmer, Ganganagar, Jalore, Jodhpur, Pali and Bikaner were the main districts of bovine population in 1966.

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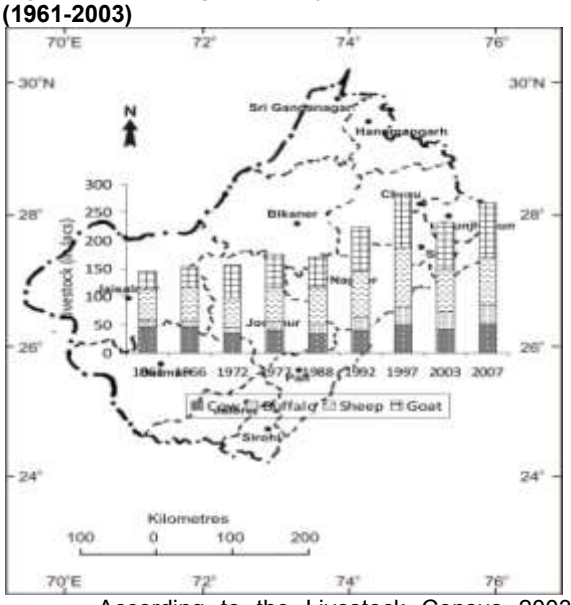
Table 3: Arid Region of Rajasthan- Milch Animals (1961-2007) (in lakh)

Year	Cow		Buffalo		Sheep		Goat	
	A. Reg.	Raj	A. Reg.	Raj	A. Reg.	Raj	A. Reg.	Raj
1961	46.90	135.52	9.92	42.17	55.91	82.42	32.28	74.01
1966	46.89	131.23	10.55	42.22	N A	88.06	35.92	103.23
1972	34.80	124.69	11.08	45.92	51.59	85.56	58.14	121.62
1977	40.34	128.96	13.79	50.71	N A	102.35	61.74	123.06
1983	N A	135.04	N A	60.43	N A	134.31	N A	154.80
1988	33.88	109.21	17.58	63.43	64.84	99.32	54.21	125.77
1992	39.14	116.66	22.97	77.54	83.61	124.91	78.25	152.84
1997	49.59	121.58	31.55	97.56	104.93	143.12	95.30	169.36
2003	41.16	108.53	32.02	104.46	74.32	100.31	84.42	168.08
2007	50.54	121.19	34.50	110.91	84.31	111.89	97.00	215.02

Source: Livestock Census 1951-2003, Animal Husbandry Department, GoR, Jaipur.

In 1988, the arid region of Rajasthan shared 31.02% of cows, 27.72% buffaloes, 65.28% sheep, 43.10% goats and 78.93% camels of the whole state. It indicates that livestock rearing was the main source of livelihood in the study area. According to the Livestock Census the share of sheep (36.50%) and goats (30.52%) increased than cows (19.07%) and buffaloes (9.09%) in the study area. The share of bovines was 36.76% in 1966, reduced to 28.97% in 1988 whereas the share of goat population increased from 23.03% in 1966 to 30.52% in 1988. It indicates that shortage of feed and fodder influenced domestication of small milch animals like goat than cow and buffalo. The leading districts of the total livestock were Nagaur (24.66 lakh), Ganganagar (20.35 lakh), Pali (20.06 lakh) and Jodhpur (18.30 lakh) in the year 1988.

Figure 2: Arid Region of Rajasthan- Milch Animals (1961-2003)



According to the Livestock Census 2003, there were 37.92% cattle, 30.65% buffaloes, 91.38% sheep, 88.13% goats and 94.80% of camels of the state in the western arid region. The data given in the table show that goats (35.05%) followed by sheep (31.25%), cows (17.31%) and buffalos (13.46%) constitute to the main part of the livestock. During the period 1966-2003, share of goats increased than that of sheep. It is important to note here that share of buffalo (6.76%) in 1966, has increased to 9.90% in 1988 and 13.46% in 2003. It indicates that out of the total livestock population the growth rate of buffalo is highest and it will cross the cow population in near future.

The livestock population of study area as well as the state has increased during 2003-2007. The study area shares 51.37% of the total livestock wealth of the State. It contributes 41.70% of cows, 31.10% buffaloes, 75.31% sheep and 45.11% of goats of the State (Table 1). According to the data shown in the table, cows shared 82.56% of the total bovine population of the study area in 1966 decreased to 65.83% in 1988, 56.24% in 2003 and 41.70% in 2007. During this period the contribution of buffaloes increased speedily and this trend is recorded in all districts of the study area. It is important that the number of indigenous cows is decreasing while the number of buffaloes and hybrid cows are showing growing trend. The number of cows was 46.90 lakh in 1961, decreased (33.88 lakh) in 1988 and has increased to 50.54 lakh in 2007. Where as the number of buffaloes was only 9.92 lakh in 1961, has reached to 34.50 lakh (4 times) in 2007. The number of sheep has increased from 55.91 lakh to 84.31 lakh and goats form 32.28 lakh to 97.0 lakh to respective years. The maximum growth rate (222.55%) among all of these domestic animals is recorded of buffaloes (Figure 2).

The arid region of Rajasthan is important in cow wealth. It had 34.60% cow wealth of the state in 1961 which decreased in 31.02% in 1988. It increased to 40.78% in the year 1997 but again it decreased slightly (37.92%) in 2003. Out of the total cow wealth of the region Pali (14.22%), Nagaur (13.28%), Jodhpur (12.33%), Barmer (11.49%), Bikaner (9.18%) and Ganganagar (8.36%) were the leading districts in 1988. After a period of about 2.5 decades, the situation changed. Ganganagar district shared the

maximum (17.21%) followed by Nagaur (13.74%) and Bikaner (13.34%). According to the Livestock Census 2003, Bikaner district ranks first with 14.78% followed by Barmer (13.05%), Jodhpur (12.63%) and Nagaur (8.81%) in the whole study area. It indicates that the cow wealth has increased rapidly in south western districts where irrigation facilities are yet to be developed. The contribution of Ganganagar (10.51%) alongwith Hanumangarh district (8.32%) is the maximum and shares one-sixth part of the total cow wealth.

The most important point to be noted here is that the cow wealth increased only in two districts-Bikaner (41.35%) and Ganaganagar (10.33%) while in the rest of the districts it decreased sharply Pali (-56.78%), Jaisalmer (-38.96), Jhunjhunun (-40.63%), Nagaur (-41.74%), Churu (-24.05%) during 1961-2003. During this period the growth rate also decreased in the western region (-112.22%) alongwith Rajasthan state (-19.91%). When the whole period is considered the total number of cow population shows a declining trend. The causes responsible for it are use of machine in agriculture, low milk yield and short lactation period.

The share of buffalo wealth has increased tremendously during 1961-2003 period in all districts (Table). The highest growth rate is noted in Barmer district (367.06%), followed by Sikar (357.51%), Jhunjhunun (314.78%), Jalore (289.42%), Jodhpur (254.36%), Bikaner (244.56%), Nagaur (273.36%), Churu (70.99%) and Ganganagar (42.11%). The growth of buffaloes in the arid region is higher (222.55%) than the Rajasthan state (147.68%).

In the arid region of Rajasthan the share of buffalo population was highest in Pali (15.55%), Ganganagar (19.07%), Churu (11.45%), Nagaur (11.32%) and Sikar (11.17%) whereas it was iowest in Jaisalmer (0.13%) and Barmer (2.82%) in 1961.

In 1988, Ganganagar district shared (25.50%) followed by Sikar (15.80%), Nagaur (12.45%), Jhunjhunun (12.38%), Pali (8.65%) and Jalore (7.99%) of the total buffaloes in the study area. During this period the share of Ganganagar district increased by about 6.5% higher than the year 1961 and shared one-fourth of the total buffalo population.[6]

According to the Livestock Census, 2003 the buffalo population was maximum in Sikar (15.85%), Nagaur (13.11%), Jhunjhunun (11.83%), Jalore (11.13%), Hanumangarh (9.60%) and Ganganagar (8.40%) while it was minimum in Jaisalmer (0.06%) and Barmer districts (4.08%). The share of buffalo population of the arid region of Rajasthan in whole of the state was 23.54% in 1961, which increased to 27.72% in 1988 and 30.65% in 2003. In this way, it can be concluded that the buffalo population is increasing since 1961 while the cow population is noticed to be decreasing. It shows that the contribution of buffaloes is increasing as for as total bovine population is concerned. When the cattle rearers were asked about their preference for buffaloes over cows, it was stated that buffalo gave more milk, could be kept in houses,had long lactation period, higher rate of milk and more fat content in their milk. These were reasons enough for their preference for bufaloes over cows.

It is very important to note that the share of cow population out of the total Livestock population was 42.26% in 1951 that decreased to 22.08% in 2003, while the overall cattle population increased by 0.66% during the same period. It shows that the significance of cattle is decreasing mainly due to low milk yield and low demand of draught animals. The share of buffalo population showed an increasing trend from 11.93% in 1951 to 21.28% in 2003 with a very fast growth rate (242%) in the same period. The sheep population increased almost by the same proportion while share of goat population increased form 21.80% to 34.17% during the period. The goat population increased from 55.62 lakh in 1951 to 168.09 lakh in 2003 with 202.21% growth rate.

Outcome of the Study

Factors Responsible for Structural Changes

The respondents throughout the study area claimed that low milk yield (32%), short lactation period (28%) and shrinking of grazing land (21%) were the major reasons behind the ignorance of indigenous cow breeds. The other factors emerged as low demand of draught power (11%), equal price of milk (7%) and commercialization of livestock rearing (6%). The rural farmers replied that the milk-man paid almost the same rates for hybrid cow milk. A few of the farmers also said that there was no difference in the milk of hybrid and indigenous cows. If it is fed well its milk quantity becomes better.

The livestock rearers of the sample villages when asked about the possible impacts of the composition of livestock, replied that the indigenous breeds (31%), had better adaptability to local climate and could, survive on normal feeding of grasses and roughages.Also the indigenous cow breeds require about 3/5 of the quantity of fodder required by hybrid cows and buffaloes. The other possible impacts are loss of natural resources 15%, increase in veterinary expenditure 17%, useless calves 9%, low calving period 8%, barrenness of hybrid cows 11%, and higher input cost 9%.

Choice of Machine

It is concluded that even today 61% of the farmers prefer draught power as it is a better means for tilling, ploughing and cleaning activities. It does not require much investment and can survive on normal feeding (10-15 kg) of roughages and concentrates which cost Rs 70-100/day. For these grazing lands, pastures and field produces can be used. Some of the old farmers responded that were eco-friendly also when they were used in agriculture,there was abundant groundwater, vast grazing lands, perennial grasses, shrubs and plants and was prosperity in the society. They also replied that there was lot of milk, butter, curd and ghee to eat but nowadays, all these things have almost gone beyond on reach,ghee Rs 350-450/kg, cow milk 27-35/lit, buffalo Rs 35-43/kg, curd Rs 40-50/kg.

There are only 3% farmers mainly in the southern parts and some scattered farmers of the area (marginal and small) that clean their crops by using traditional methods. The rest of the farmers use threshers and tractors (machines) for threshing their crops. It is observed during the field survey in the harvesting period of rabi and kharif crops that farmers have to wait for 10-15 days for tractors and threshers to come and clean their crops. It is opined by the aged farmers that the youngsters do not perform any field or cattle work. They always depend on the use of machines. The utilization of tractors and threshers is influenced by the size of land holdings, quantity of production and economic status of farmers.

The farmers prefer tractors for their better work (14%), covering faster areas (13%), no feeding cost During the rest period (13%), cheaper hiring-prices (7%), easy ploughing, sowing, harvesting and threshing (10%), time saving (9%), labour saving as number of Families members is declining due to breaking of joint family (5%), other sources of income (8%),frequent droughts (17%), and adequacy for large land holdings (4%).

The livestock rearers have preferred drought power as they are- useful for marginal and small land-holdings (27%), negligible feeding cost during good monsoon period (24%), convenient for cultivation (11%), low investment (8), simple and cheap equipments (13%), use of household labour (10%) and their eco-friendliness (7%).

Preference in Feeding and Care

In the rural areas, only cattle feed cost is taken into account. But when the cattle rearers buy roughages and concentrates from market, their cost is included. It is observed during the field survey that bovines are fed green fodder with roughages in irrigated areas of Ganganagar, Hanumangarh and Bikaner districts. They also feed 1-2 kg of cattle feed like grain-bran, churi, khal etc. to bovines. In the feeding expenditure this area leads in the state due to purchage of fooder during drought years, and more feeding of concentrates like khal, churi, chapat, cattle-feed, brans, green fodder etc.

Secondly,for marginal, small and landless cattle rearers of both rural and urban areas, cost of feeding remains higher. It is interesting to note that farmers of dry area feed bovines well for higher milk yield as other sources of income are limited. Thirdly, the cattle rearers who are engaged in dairy industry expend about 2-3 times more than the normal cattle rearers. The commercial cattle rearers agree that in dairy industry, more than 65% expenditure is done on purchase of feed and fodder, 5% on labour and 10% on medical and miscellaneous expenditures. Therefore, it is concluded that there is about 20% profit range in the livestock rearing. If we add, sale of calves and cow-dung, family fuel and labour cost, the benefit range reaches up to 40% of the total feeding cost.

When the cattle rearers are asked about the preference of feeding to bovines and other livestock, they give first priority to milking bovine, then pregnant stock, young stock and the dry and barren cattle come in the last. However, draught animals that are being used are also given priority with milking bovines.

Opinion about Slaughtering of Cow Wealth

The farmers of any category do not prefer slaughtering as a better alternative for welfare of cattle wealth in Rajasthan. Out of the total (855), 81% respondents were strongly against slaughtering of cow wealth and 16% suggested of taking alternative measures like improvement of goshalas, supply of fodder, facility of drinking water, donation from public etc. others replied that a cow whether male or female should not be culled. It should take the natural death while 3% of the farmers did not respond.

Suggestions for Improvement of Livestock

The cattle rearers of the study area in the sample villages have suggested that livestock rearing can be a good source of regional and sustainable development of the local resources through feeding management (27%), supply of good quality bulls (17%), management and revival of grazing lands (15%), effective veterinary services (10%), financial assistance (9%) and proper utilization of dependent animals (22%).

Conclusion

The findings of the present study have two major policy implications: One, in recent years there is a proportionate decline in the share of indigenous cows in the total composition of livestock due to decline in demand of draught animals in agriculture. This suggests that it is important to give due consideration to multi-purpose animals. In this regard, it may be necessary to stress on up-gradation of indigenous cows for their higher yield of milk and low feeding cost but also as the farmers seem to prefer them as a milch stock. Two, the supply of feed is likely to become a major constraint in the study area. In the past, by adjusting the composition of bovine stock, the farmers were able to meet the increasing feed requirements.

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