

Inter-Regional Differences in Production and Utilization Pattern of Milk and Milk Products in Rajasthan: An Empirical Study

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Abstract

The study was aimed to assess the inter-regional differences existing in production and utilization pattern of milk and milk products across regions in Rajasthan. The regions identified for the study were South and South-Eastern plains (S&S-E plains), Transitional & Eastern plains (T&E plains) and North & North-Western plains (N&N-W plains). The data was collected from 120 milk producing households spread across six villages (two villages from each regions) and also from Halwais and Creameries, four from each. The data were subjected to tabular analysis and regression for estimating the desired results for answering the derived objectives of the study and understanding the extent of factors affecting the marketed surplus of milk. The results revealed existence of significant differences across regions in the study area. With respect to inter regional differences in production level of milk it was found that the production of milk was the highest in T&E plains region with production of 29.58 litres per day per household followed by 11.85 litres per day per household in N&N-W plains and 9.35 litres per day per household in S&S-E plains regions. Though marketed surplus is directly proportional to production level, marketed surplus was highest in S&S- E plains, followed by T&E plains and lowest in N&N-W plains. This study has tried to examine the inter regional differences existing in Rajasthan in dairy production.

Keywords: Production, utilization pattern, milk & milk product

JEL Classification: D20, D10, Q10

Introduction

It is believed that inter regional differences are more prominent especially in the countries like India, where some states are bigger than many countries in the world (Banerjee & Kuri, 2015). Dairying has proven to be an economic shock absorber for the farmer in times of calamities and has significant consequences for reducing inequalities between various farming groups (Aubron et al, 2015). At present India is world's largest milk producer. The income elastic nature of dairy products, changing lifestyle of the people and greater interest in nutrition has led to increase the demand of milk and milk products (FAO, 2013). Rajasthan ranks second in milk production in India with large livestock resources and contributes 12.6 percent in the country's milk production with 870 gram per capita availability per day (GoI, 2019).

Rajasthan is the state where there are large differences across regions. The North western region is normally sandy and hot which is thinly populated and characterized by a

stagnant economy and lack of industrialization. Cattle and sheep are the principal assets available with the farmers of the region, but they have no financial incentive to improve the livestock in the absence of a substantial remuneration for their produce (Boyal and Mehra, 2017). Marketing of milk plays a positive role in improving the region's depressed economies and overall growth, In fact, dairy development in the arid areas acts as an instrument of drought proofing.

Eastern and transitional plains have more fertile and better watered land with some districts covered by Aravali range. Milch animals in this region are usually held under the mixed crop farming system.

The Southern and south eastern region of Rajasthan is characterized by sloppy lands, dominance of low value and low demand crops, inadequate infrastructure, small size of land holding, poor irrigation sources, poor livestock productivity, lack of off farm employment opportunities, poor market support, non-availability of credit and high rate of illiteracy. Region is having large number of milch animals but quality is not good. The major constraints faced

by tribal farmers of southern region are non-availability of green fodder throughout the year, inadequate knowledge about scientific feeding of dairy animals (Boyal and Mehra, 2017).

Measurement of differences at regional level would help in framing region specific plans and policies in just and ideal manner (UNCT&D, 2015). Thereby such a study will help in prioritizing the interventions for needy sector and sections. It is therefore, required is to have first-hand detailed information of the variance among the regions of the state in dairy farming practices, costs and returns in milk production, marketed surplus, market margins and its disposal pattern and further utilization. Assessment of production and consumption & utilization pattern in different regions provides an aid to better solution to the production and marketing related problems and formulates a workable plan for dairy development in the state. The study would be useful for farmers as well understanding the problems in milk production and its price fixation. So, keeping above in consideration the study was conducted with the following specific objectives:

- To estimate inter regional difference in production of milk and milk products by different producing units.
- To analyse marketing and utilization pattern of milk and milk products by different end users.

Data Sources and Methodology

One district from each region was selected based on highest cattle population according to 20th Livestock census. From the selected district one block and two villages from each block were selected randomly. For proper representation, a complete list of the entire households having at least one milch animal was prepared. The households were further classified into three category on the basis of herd size viz. small (1- 6 milch animals), medium (with 7- 11 milch animals), and large (above 11 milch animals) by using cumulative frequency square root method. The proportion of population in each herd size category of the milk producers was considered for the sample make-up. In all, a sample of 65 small, 38 medium, and 17 large milk producers was drawn totalling 120 which was pre-determined. Apart from this, four creameries and four halwais were selected randomly from each block.

The collected data were subjected to tabular analysis to study the socio-economic profile of the sample households, milk yield, production level of milk and milk products, to work out the cost and returns in milk production, marketed surplus, disposal pattern and also further utilization of milk of the selected sample households.

Marketed surplus is that quantity of produce which the producer farmer actually sells in the market, irrespective of his requirements for family consumption. The total milk production of the household is the total milk produced by

all the milch animals of the households. The quantity of milk retained at home for consumption or conversion into milk products was taken as the per day milk consumption of household.

Marketed Surplus of Milk = Total Milk Production – Milk Consumption

Factors Affecting Marketed Surplus

The important variables impacting the marketed surplus of milk have been considered to specify the function of milk as indicated by review of the past studies (Aggrawal, 2009).

The Marketed Surplus Function was specified as below

$$Y = f(X_1, X_2, X_3, X_4, X_5)$$

Where,

Y = Marketed surplus of milk (litre/ Day)

X₁=Family Size: The consumption of milk depends upon the size and composition of family. This will reflect in the marketed surplus. The total number of family members irrespective of their age and sex is constituted as family size.

X₂=Price of Milk: The price of milk changes in different seasons for the milk of different breeds of animals. Therefore, weighted average price of milk was taken as an explanatory variable in the marketed surplus function and calculated for each household as follows:

$$\text{Weighted average price} = \frac{\sum_{i=1}^w P_i W_i}{\sum W_i}$$

Where,

P_i is the price per litre of ith type of milk

W_i is the total quantity in volume of ith type of milk sold in the household.

X₃=Herd Size: Total number of dairy animals with the farmer.

X₄=Education Level: Education score of the head of the family.

X₅=Level of Milk Production: The total daily milk production from bovines in the milk producing household. (lit/day/animal)

Utilization pattern: The utilization pattern of milk and milk products was studied using tabular analysis. The utilization of milk as retention of liquid milk and conversion of milk into different products at the farm level say curd, butter milk, ghee, paneer, khoa etc. was considered to meet the objectives.

Disposal pattern: The disposal pattern such as sale of surplus milk into the market and the agency to whom sold i.e. co-operative societies, milk vendor or directly to the consumers, tea stall/ hotel and others was also mapped.

Results and Discussion

Among the category of dairy farmers, the average age found to be higher in large category farmers group (51 years)

followed by medium (50 years) and small farmers (44 years). Between regions no significant differences was observed. Among the selected households, the percentage of Illiterate household heads was 17.5 percent which was more prevalent in S&S-E plains region (22.5%) followed by N&N-E plains region (17.5%) and T&E plains region (12.5%). Only 19 percent farmers were found at the level of graduate and above.

The level of education moulds the dairy farm owner's response to adopt improved technology of dairy and influence the decision making about the selling of his product. Enlightened owners have a greater incentive to sell milk, to diversify farm business and to gain more income. (Boyal and Mehra, 2017)

Family size and its composition are an important factor in dairy enterprises; since animal rearing is a labour intensive activity and much of the labour requirement are met from family itself. The overall average family size in the study area was found to be 4.87 and region wise average family size varies from 4.62 in transitional and eastern plains to 5.05 in North and north western plains.

The overall herd size in study area was 7.17 milch animals, while it was highest under large category followed by medium and lowest under small category. Overall region wise it was highest in T&E plains followed by S&S-E plains and lowest in N&N-W plains. At state level herd size was 4.29, 8.76 and 14.64 under small, medium and large category respectively (Table2). The findings conform to the trends of earlier studies (Aggrawal, 2009; Boyal Mehra, 2017). A relation was observed between size of land holding and size of herd managed by these farmers. The proportion of animals to land was least in N&NW region owing mainly to low fertility of land and less availability of irrigation water.

It is obvious that carrying capacity of this region was low with respect to dairying. Region S&SE plains was found strong in this regard.

The average land holding in the study area was 4.72 hectares per household. Across regions, the land holding was higher (6.40 ha) in N&N-W plains, while it was only 3.68 ha in T&E plains. Across land holding across the three category of farmers, it was 3.97 ha, 5.45 ha and 6.02 ha for small, medium and large category farmers respectively. (Table 1)

Milk Production

There could be many factors underlying regional imbalances in growth of milk production. In general, imbalances are correlated with discrepancies in the breeds of different species of animal, variations in the distribution of breedable cattle population through various areas, discrepancies in feed and fodder resource base, differences in animal health coverage, variations in the climate area such as the temperate or tropical one, variations in the amount of insemination in field (Banerjee and Kuri, 2015).

Figure 1 shows that, the milk production is the highest in T&E plains region with production of 29.58 litres per day per household followed by 11.85 litres per day per household in N&N-W plains and 9.35 litres per day per household in S&S-E plains regions. The crossbred cows are found to be the dominant contributor to milk production in N&N-W plains and T&E plains with average daily production of 11.85 and 17.02 litres/household respectively, whereas, Buffaloes are found to be the major contributor to milk production in S&S-E plains region with production of 9.96 litres per day per household. Indigenous cows contributes least to milk production in the study area compared to Cross

Table 1. Size of land holding in different regions and categories (hectare)

Category/ Regions	Small	Medium	Large	Overall
N&N-W plains	5.6	7.73	7.86	6.40
T&E plains	1.82	4.23	5.92	3.68
S&S-E plains	3.71	4.32	5.49	4.1
Overall	3.97	5.45	6.02	4.72

Source: Authors estimation from primary data

Table 2. Size of herd in different regions and across categories (no. of milch animals)

Category/ Regions	Small	Medium	Large	Overall
N&N-W plains	4.04	9	12.5	6.07
T&E plains	4.37	8.71	15.4	8.64
S&S-E plains	4.5	8.54	14	6.79
Overall	4.29	8.76	14.64	7.17

Source: Authors estimation from primary data

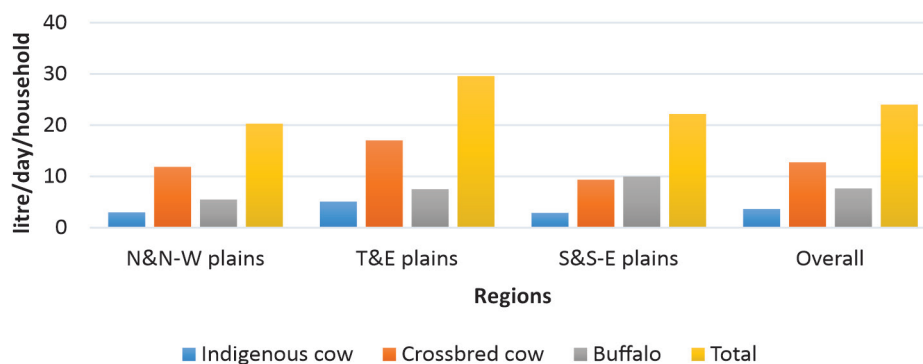


Fig. 1. Milk Production in different regions (litres/day/household)

bred cows and Buffalos. The average daily production of milk across the regions was 20.29, 29.58 and 22.18 litres/household in N&N-W plains, T&E plains and S&S-E plains regions respectively during 2019-20. The overall average daily production of milk in the study area was 24.01 litres/household. Deviating from general belief that CB cattle are reared in resource rich and better endowed regions, these animals are found to be the largest contributor of milk production in N&N-W and T&E plains

Production of Milk Products

The production level of milk products across regions was estimated and the results are presented in Fig. 2. In line with the production level of milk discussed above, the production of milk products was also found to be higher in the T&E plains region with production of 0.44 and 0.26 kg/day/household of curd and ghee respectively. The average daily production of curd and ghee in the study area was found to be 0.35 and 0.23 kg per household.

Creameries produce mainly the curd, paneer and ghee. As indicated in Table 3, the creameries were producing curd, paneer and ghee in study area. The overall milk collection by

creameries in state was 908.33 kg, from which production of curd was 42.91 kg, paneer 18.66kg, ghee 10.58 kg. In curd and ghee production, Southern and south eastern region was leading where paneer production was highest in Transitional and eastern plains.

Table 4 shows the average production of milk products by halwai. Halwais were producing sweets, paneer and curd from total milk collection. In state overall production of milk products was sweets 41.33kg, paneer 9.33kg and curd 10.41 kg by halwais.

Marketed Surplus

As evident from the Table 5, the overall highest marketed surplus was under large category (85.15%) followed by medium (74.86%) and lowest under small category (61.09%). Region wise overall highest average milk production was 29.59 litres in T&E plains followed by 22.19 litres in S&S-E plains and lowest in N&N-W plains 20.29 litres. If we look into the region wise average home retention of milk, then it was highest in T&E plains (7.36 lit/day) followed by N-N&W plains (6.38 lit/day) and S&S-E plains (4.42 lit/day). Consumption has direct relationship with the family

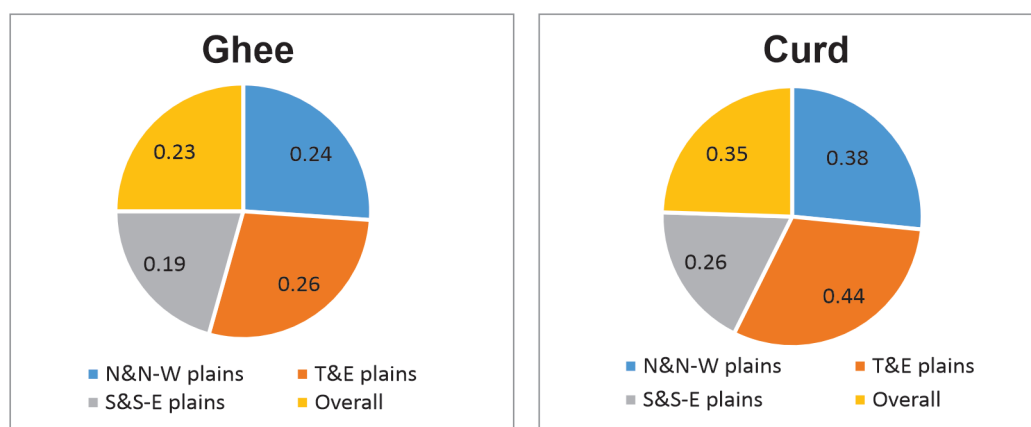


Fig. 2. Production of milk products by milk producers under different region (Kg/day/household)

Table 3. Production of milk products by creameries in different regions (Kg/day)

Products/ Regions	Milk collection	Curd	Paneer	Ghee
N&N-W plains	700	36.25	13.75	11
T&E plains	987.5	42.5	26.25	8.25
S&S-E plains	1037.5	50	16	12.5
Overall	908.33	42.91	18.66	10.58

Source: Authors estimation from primary data

Table 4. Production of milk products by halwai in different regions (Kg/day/halwai)

Products/ Regions	Milk collection	Sweets	Paneer	Curd
N&N-W plains	161.75	39	5.75	11.25
T&E plains	202.75	30	12.75	10.75
S&S-E plains	198.75	55	9.5	9.25
Overall	187.75	41.33	9.33	10.41

Source: Authors estimation from primary data

size which is evident in the study. Region wise, average marketed surplus was 13.95 litres in N&N-W plains, 21.99 litres in T&E plains and 16.99 litres in S&S-E plains. The overall proportion of marketed surplus of milk was observed highest in S&S-E plains (76.56 %) after that in T&E plains (74.32 %) and lowest in N&N-W plains (68.75 %). The large quantity of marketed surplus than home retention has also been reported by Feroze (2009) in Western zone of Haryana. Thus it can be interfered that the households now-a-days consume lesser quantity of milk and dispose off larger part of their milk production.

Factors Affecting Marketed Surplus

A number of factors influence the marketed surplus in a milk producing household like milk production level, price of milk, family size, education score, herd size, income of head etc. With a view to identify the factors responsible for marketed surplus of milk linear regression model was used and results are presented in Table 6.

A negative, but statistically significant regression coefficient of family size was observed at 0.35 ($p < 0.05$) which seems obvious and validated by several studies (Aggrawal, 2009; Boyal and Mehra, 2017). It indicated that the market

surplus of milk declined due to the rise in the family size as a consequence of the requirement for more milk consumption in the household.

The price of milk was observed statistically significant (coeff.=0.35) for marketed surplus. Overall in state, a rise in milk prices of one per cent contributed to a rise of 0.31 percent in marketed surplus. This shows the scope of increasing milk prices to induce producer sellers to produce and sparing more milk for market. As anticipated, the marketed surplus also increase as herd size increases (coeff.=3.19). The regression coefficient of household head's education score was however positive, but statistically, it was not significant.

The milk productivity was found to be positive and statistically significant (coeff. = 1.66). The, one per cent increase in milk yield resulted in an increase in marketed surplus of milk by 1.66 per cent. The available literature on this aspects supports the findings but with a varied degree of coefficient value.(review pending)

Utilization pattern of milk

The utilization pattern of milk in different regions of state has been analysed at 03 stages/processing sources viz. Households, Creameries and Halwais. In region N&N-W

Table 5. Level of production, home retention and marketing of milk across regions (Litres/day/household)

Region	Average milk production	Home retention	Per capita consumption	Milk sold	Marketed surplus (%)
N&N-W plains	20.29	6.38	1.26	13.95	68.75
T&E plains	29.59	7.36	1.68	21.99	74.32
S&S-E plains	22.19	4.42	0.89	16.99	76.56
Overall	24.02	6.05	1.24	17.64	73.43

Source: Authors estimation from primary data

Table 6. Factors affecting marketed surplus in different regions of Rajasthan

Variables	Regression Coefficients			
	N&N-W plains	T&E plains	S&S-E plains	Overall
Constant	-23.29	-21.70	-30.03	-22.46 (5.36)
Family Size	-0.45* (0.38)	-0.18* (0.47)	-0.36* (0.48)	-0.35* (0.25)
Price of Milk	0.43* (0.17)	0.16* (0.26)	0.47* (0.24)	0.31* (0.12)
Herd Size	2.95** (0.24)	3.37** (0.22)	3.00** (0.25)	3.19** (0.13)
Education Level	0.4 (0.40)	0.29 (0.50)	0.31 (0.48)	0.06 (0.26)
Milk productivity	1.34** (0.32)	1.84* (0.99)	2.57* (0.66)	1.66** (0.33)
R ² (%)	91.11	93.16	86.39	89.94

(Figure in parenthesis indicates the standard error of regression coefficient.)

* Significant ($p < 0.05$); ** Significant ($p < 0.01$).

Source: Authors estimation from primary data

plains out of total milk production, 13.01 percent was utilized in raw form, 18.23 percent in curdling process. In T&E plains, the figures are 10.88 percent and 14.80 percent, in S&S-E plains, 9.68 and 13.74 percent respectively. (Fig. 3)

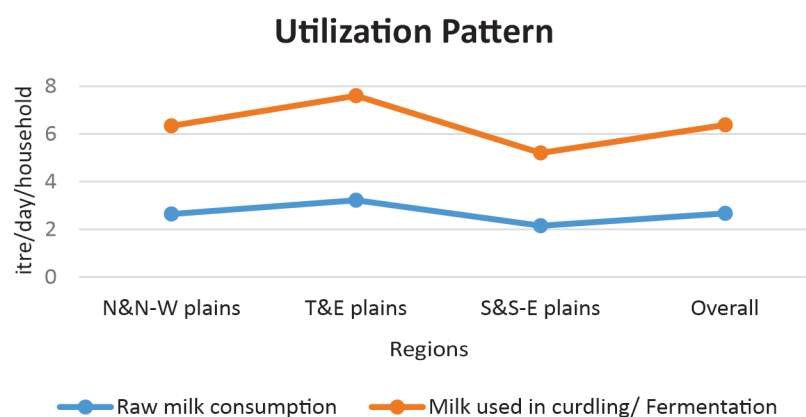
Table 7 shows the utilization pattern of milk in creameries. Generally they use their total milk in selling as raw milk and rest of milk is used in paneer, curd and ghee. Average collection of milk by creameries was highest in S&S-E plains where it was lowest in N&N-W plains. In T&E plains average milk utilization for paneer production by creameries was highest.

Halwais in the state, generally utilize their milk in sweet making, paneer production and curd production. Paneer is

sold directly to consumers and also utilized for preparation of other eatables. Some of the milk is used in tea preparation also. In N&N-W plains halwais uses 61.05 percent of milk in sweet making, 17.77 percent of milk in paneer production, 6.95 percent for curd and 14.21 percent of milk used for tea preparation. In T&E plains halwai uses 57.33 percent of their milk in sweet production and 31.44 percent of milk in paneer production. In S&S-E plains from total collection 61.63 percent of milk uses in sweet preparation. (Table 8)

Disposal pattern of milk

The marketing of milk in various region of Rajasthan is depicted in Table 10. The milk producers of N&N-W plains disposed of their surplus milk to direct consumers (4.11%),



Source: Authors estimation from primary data

Fig. 3. Utilization pattern of milk by milk producers in various regions

Table 7. Utilization pattern of milk by creameries in different regions (litres/day/creamery)

Regions	Total milk collection	Raw milk sold	Milk used in Paneer production	Milk used in Curd production	Milk used in Cream production
N&N-W plains	700	400.5 (57.33)	68.75 (9.82)	42.25 (6.03)	190 (27.14)
T&E plains	987.5	637.5 (64.55)	131.25 (13.29)	63.75 (6.45)	155 (15.69)
S&S-E plains	1037.5	675 (65.06)	57.5 (5.54)	80 (7.71)	225 (21.68)
Overall	908.33	571	85.33	62	190

(Figure in parenthesis indicates the percentage from total milk collection.)

Source: Authors estimation from primary data

milk vendors (7%), halwai (4.28%), creameries (10.89%), and co-operatives (53.76%) and to other milk based industries (20.44%). In T&E plains the milk producers disposed their surplus milk to co-operative (68.75%), creameries (13.84%), and halwai (10.81%), and milk vendors (5.30%) and to direct consumers (1.58%). The milk producers of S&S-E plains disposed off their surplus milk to directly consumers (2.33%), milk vendors (6.48%), halwai (8.85%), and creameries

(18.19%) and to co-operatives (59.08%). The most preferred agency for milk disposal was found to be cooperatives where 59.08 percent of marketed surplus milk is sold; followed by creameries (18.19%), Halwais (8.85%) and direct consumers (2.33%). The same trend has been depicted by different zones of the state except that N&N-W prefer Milk vendors over Halwais and Creameries. (Table 9).

Table 8. Utilization pattern of milk by halwais in different regions (litres/day/halwai)

Region	Total milk collection	Milk used in sweets making	Milk used in Paneer making	Milk used in Curd making	Milk used for Tea preparation
N&N-W plains	161.75	98.75 (61.05)	28.75 (17.77)	11.25 (6.95)	23 (14.21)
T&E plains	202.75	116.25 (57.33)	63.75 (31.44)	10.75 (5.30)	12 (5.91)
S&S-E plains	198.75	122.5 (61.63)	47.5 (23.89)	9.25 (4.65)	19.5 (9.81)
Overall	187.75	112.5	46.66	10.42	18.17

(Figure in parenthesis indicates the percentage from total milk collection)

Source: Authors estimation from primary data

Table 9. Disposal pattern of milk across the region (litres/day)

Region	Marketed surplus	Direct consumers	Milk vendors	Halwais	Creameries	Co-operatives	Others
N&N-W plains	548.45	22.55 (4.11)	38.4 (7)	23.5 (4.28)	59.78 (10.89)	294.9 (53.76)	112.15 (20.44)
T&E plains	879.9	13.95 (1.58)	46.65 (5.30)	95.1 (10.81)	121.8 (13.84)	603.4 (68.57)	-
S&S-E plains	679.73	12.69 (1.86)	51.61 (7.52)	68.08 (10.01)	201.93 (29.71)	347.22 (51.08)	-
Overall	702.69	16.39 (2.33)	45.55 (6.48)	62.22 (8.85)	127.83 (18.19)	415.17 (59.08)	37.38 (5.31)

(Figure in parenthesis indicates the percentage.)

Source: Authors estimation from primary data

Conclusion and Policy Implications

The study revealed significant differences across different regions of Rajasthan with respect to average age of milk producer, family size, literacy rate and land holding of the respondents. The analysis of production level of milk under various categories revealed that per litre per day per household milk production was highest from crossbred cow (12.74 litres) followed by buffalo (7.64 litres) and lowest from indigenous cow (3.63 litres). Region wise total milk production per day per household was highest in T&E plains followed by S&S-E plains and N&N-W plains. The analysis of marketed surplus revealed that overall marketed surplus was 73.43 per cent; inter category it was highest under large followed by medium and small category. Across the regions it was highest in S&S- E plains, followed by T&E plains and lowest in N&N-W plains. It was obvious that as the rural part of the Rajasthan lacked accessibility to urban markets, more than 59 per cent of milk was disposed off to co-operative societies as they were operating at village level to collect surplus milk of the rural producers. Availability of green fodder was less in the N&N-W plains due to less ground water availability. So, farmer should be encouraged to adopt modern techniques to cultivate green fodder. The marketed surplus was highest in S&S- E plains, followed by T&E plains and lowest in N&N-W plains. Co-operatives collected more than 59 per cent marketed surplus of milk these were found more favourable to the milk producers. Therefore, efforts to increase the share of cooperatives will boost the dairy development activities and economy of the milk producers in the study area.

References

- Aggrawal SB, Singh R, Shyani R L and Kalyankar S P 2009. Marketed Surplus of Milk in Different AgroClimatic Zones of Gujarat and Maharashtra. *Indian Journal of Dairy Science* **62**: 43- 47.
- Aubron C, Lehoux H 2015. Poverty and inequality in rural India. *Open edition journals* **32**-38. <https://journals.openedition.org/echogeo/14300>
- Banerjee A and Kuri P 2015. Regional Variation and Convergence in Agricultural Development in India. *Indian Studies in Business and Economics* chapter-6, 101-40. DOI: 10.1007/978-81-322-2331-3_6
- Boyal V K, Mehra J 2017. Livestock sector in Rajasthan: An appraisal and performance. *Indian Journal of Agricultural Economics* **72**: 117-26. DOI: 10.22004/ag.econ.302251
- Feroze S M 2009. Economic Analysis of Dairy Self help Goups in Western Zone of Haryana. Ph D. Thesis. National Dairy Research Institute, Karnal <https://www.researchgate.net/publication/292872701>
- Food and Agriculture Organisation 2013. Milk and Dairy Products in Human Nutrition, Rome. <https://www.fao.org/3/i3396e/i3396e.pdf>
- Government of India 2019. Basic Animal Husbandry Statistic, Department of Animal Husbandry, Dairying, Fisheries, Ministry of Agriculture and Farmer Welfare, New Delhi <https://dahd.nic.in/schemes/programmes/animal-husbandrystatistics>
- Government of India 2019. 20th Livestock census, Department of Animal Husbandry, Dairying, Fisheries, Ministry of Agriculture and Farmer Welfare, New Delhi <https://pib.gov.in/PressReleasePage.aspx?PRID=1588304>
- UNCTAD 2015. Investment policy framework for sustainable development, World Investment Report, UNCTAD, Switzerland. <https://investmentpolicy.unctad.org/investment-policy-framework>

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