Range Mgmt. & Agroforestry 36 (2) : 211-216, 2015
ISSN 0971-2070

Economics of bovine production reared on common pasture lands

Khem Chand*[1], B. L. Jangid, P. P. Rohilla and Vikas Kumar[1]
ICAR-Central Arid Zone Research Institute, Jodhpur-342003, India
[1]Present address: ICAR-Indian Grassland and Fodder Research Institute, Jhansi-284003, India
*Corresponding author e-mail: kcmamnani@gmail.com
Received: 22nd December, 2014 Accepted: 16th November, 2015

Abstract
The present study was conducted in Pali district of western Rajasthan, which represents both arid and a semi-arid tract and purposively selected for the study. The study was based on primary data, which were collected from 72 bovine rearers from six villages, selected using stratified random sampling. The composition of bovine was found to be changing in favor of buffalo species with 1.93% growth rate during 1966 to 2007. Primary data on various costs and returns were collected during the year 2004 to 2007 using personal interview technique. On an average, a farmer invested around Rs 101512 on a bovine unit of 6.47 adult cattle unit (ACU) in study area. Bovine rearing was found profitable enterprise with net return of Rs. 108049 per year with average herd size of 6.47 ACU. The technical efficiency of cattle and buffalo at the average level of input use indicated a potential of increasing milk production and the returns by 30 and 25%, respectively by adopting better management practices without incurring additional expenditure.

Keywords: Bovine production, Common pasture lands, Economics, Milk marketing, Technical efficiency

Introduction

The global population is predicted to increase from the current 7 billion people to more than 9.5 billion by the year 2050 and there will be 70% increase in demand for meat, milk, and eggs (FAO, 2009). Therefore, the livestock industry must produce more food using fewer inputs as competition for land, water and energy intensifies at global level including India. Livestock is an integral part of the rural economy of India in general and Rajasthan state in particular. The share of livestock in agricultural GDP of this state is comparatively higher than other states of the country. Looking to unfavorable weather conditions in the arid zone, where income from crop sector is uncertain, farmers sustain their life through regular generation of cash income from bovines. Under present scenario all the farming communities in the region produce milk for the market and earn cash income to meet daily cash requirements of their family members. Looking to economic and employment potential of this sector in the region, present study was conducted to generate information on management, profitability and technical efficiency of dairy animals, which also grazed on common pasture lands.

Materials and Methods

For drawing representative sample, all nine tehsils of the Pali district were categorized into three livestock densities (*viz*., low, medium and high) on the basis of deviation from mean density of district. Three tehsils *viz*. Rohat, Sumerpur and Raipur were selected from low, medium and high livestock density category, respectively. Further, two villages from each tehsil, one with institutional veterinary services and other without institutional veterinary services were selected for primary data collection. To make the study sample 72 bovine rearers (Table 1), a sub sample of 12 bovine rearers from each selected village was drawn using stratified random sampling. The primary data were collected by personal interview technique using a pre-tested structured schedule. Data were analyzed using frequency, percentage, mean, ranking, tabular and regression analysis etc. Depreciation rates for building, machinery and equipment were calculated @ 5, 10 and 20%, respectively. Depreciation rates for milch animals were calculated @ 10 and 20%, for animals in 4 to 5th lactation and more than 5th lactation, respectively. No depreciation was calculated for the young stock, heifers and milch animals up to 3rd lactation. The technical efficiency of bovine production was calculated using frontier production function technique.

Results and Discussion

***Status of pasture and grazing lands*:** In the study region large areas under common property resources (CPR's) in the form of permanent pasture and other grazing lands,

is available for grazing of animals. The region is also well known for its traditional grazing resources as *gochars* (common land kept for grazing of cows) and *orans* (sacred grooves). During the study it was found that though these resources are in degraded conditions and infested with undesirable plant species like *Prosopis Juliflora* but still large areas are supporting grazing of bovine population of the region and sustaining the livestock production as livelihood support enterprise. The decadal average of area under permanent pastures indicated increase in pastures and grazing area compared to sixties (Table 2). Further it had positive growth rate during sixties and seventies and in first decade of 21st century. It had negative growth trend during eighties and nineties that might be due to allotment of these lands for various development activities or partly distribution to weaker sections under various welfare programmes.

Table 1. Distribution of sample herds in different tehsils

Tehsils	Villages	Farm households
Rohat	Mandawas (VF)	12
(low density)	Nimbli Patelan (WVF)	12
Sumerpur	Bankli (VF)	12
(medium density)	Dujana (WVF)	12
Raipur	PipliaKalan (VF)	12
(high density)	Karmawas Maliyan (WVF)	12
Pali		72

Note: VF= Veterinary facility, WVF= Without Veterinary facility

Table 2. Annual compound growth rate (ACGR) under permanent pasture and other grazing lands in study area

Year	Average area (ha)	ACGR (%)
1960-61 to 1969-70	80924	2.16***
1970-71 to 1979-80	91866	0.25*
1980-81 to 1989-90	92607	(-) 0.34**
1990-91 to 1999-00	90293	(-) 0.01^{NS}
2000-01 to 2009-10	90789	0.09*

Note: *** (P<0.01), **(P<0.05) and *(P<0.10); NS- Non significant

Bovine composition on sample herds

Farmers in the study area reared both cattle and buffalo for milk production purposes. Buffalo was found to be the dominant species in the herds' composition (60% of total population). On an average a farmer in Pali district had 6.47 units of bovines, which comprised of 46.38% milch animals, 18.90% heifers and 34.72% young stocks (Table 3).

Investment pattern

Fixed investment on a dairy herd comprised of investment on animals, cattle-shed and store, machinery and equipment etc. Investment on an average dairy herd was Rs 101512 out of which, the share of milch animals alone accounted for about 52%. The findings were in conformity with Srivastava (1995) who recordrd an investment of 56-58% on milch animals. The proportionate investment on cattle shed and store, machinery and equipment was found to be 33 and 4%, respectively (Table 4). It was evident from the investment pattern that cost of milch animals was the most important component of total fixed capital investment. Highest investment on cattle shed and store was found in Sumerpur tehsil where farmers had comparatively large land holdings and better income from agriculture with canal irrigation.

Resource use pattern

Land utilization pattern: The farmers of study area keep part of their protected land as cultivated land for crops, fodder and fallow as pasture land for grazing of dairy animals. The fodder need of the animals is generally met out from the by-products of crops grown in their fields and surplus stover/straw is stored for 2-3 years to meet out its demand in future. Farmers, who were not able to meet their own livestock fodder requirement, procured it either from fellow farmers or from surrounding regions. Average size of operational holding was found to be 70.26 *bigha* (11.24 ha), out of which 8.14% was kept as pasture and 90.68% area was used under different crops cultivation (Table 5). Overall, 65% of sample farmers in the district were having irrigation facility through well, tube well and canal irrigation.

Grazing management: Both common pasture land and a part of the agriculture land were the sources of grazing for animals in Pali district. Due to continuous degradation of common pasture lands, farmers kept some part of their cultivable land fallow for grazing purpose only. Around 50% farmers reserved a part of agriculture land for grazing purpose while 40% did not depend upon grazing and followed stall feeding. The common pasture land in all the villages was heavily infested with *Prosopis Juliflora*. As grass was available only for 3-4 months during monsoon period for grazing, the remaining part of the year animals were stall fed. Generally grazing was managed on collective basis and everybody paid his share of money to the caretaker/shepherd based on number of animals grazed.

Cost and returns from milk production

Fixed cost: The fixed cost per year per ACU for bovines was Rs 1358, 2549 and 2179 in Rohat, Sumerpur and

Table 3. Composition of bovine on sample farms (number/herd)

Particulars/ species	Cattle	Buffalo	Bovine
1. Milch animals	2.01 (45.17)	2.67 (47.43)	4.68 (46.38)
In milk	1.51 (33.93)	1.82 (32.33)	3.33 (33.00)
Dry	0.50 (11.14)	0.85 (15.10)	1.35 (13.35)
2. Heifer	0.81 (18.28)	1.09 (19.36)	1.91 (18.90)
3. Young stock	1.63 (36.55)	1.87 (33.21)	3.50 (34.72)
Total (1+ 2 +3)	4.45 (100.00)	5.63 (100.00)	10.09 (100.00)
ACU	2.59	3.88	6.47
Percent composition	40.03	59.97	100.00

Note: Figures in parenthesis indicate percent of total number of animals

Raipur, respectively. Overall fixed cost per year for a bovine unit in Pali district was Rs 2031. The share of interest and depreciation in the total fixed cost was around 56.30 and 43.70%, respectively (Table 6).

Table 4. Investment pattern on bovine herds (Rs/herd)

Items	Amount (Rs)
Animals	
i) Milch animals	52375 (51.60)
ii) Heifers	7602 (7.49)
iii) Young stock	4244 (4.18)
Subtotal (i to iii)	64221 (63.27)
Cattle shed and store	33078 (32.58)
Machinery and equipment	4213 (4.15)
Total	101512 (100.00)

Note: Figures in parentheses indicate percent of total investment

Table 5. Average size of operational holding (bigha) in Pali

Land category/ tehsil	Area in bigha
Irrigated	30.47 (43.37)
Un Irrigated	33.24 (47.31)
Barren	0.83 (1.18)
Pasture	5.72 (8.14)
Total	70.26 (100.00)

Note: Figures in parenthesis indicate percent of total 1 bigha = 0.16 ha

Cost and returns from milk production

Fixed cost: The fixed cost per year per ACU for bovines was Rs 1358, 2549 and 2179 in Rohat, Sumerpur and Raipur, respectively. Overall fixed cost per year for a bovine unit in Pali district was Rs 2031. The share of interest and depreciation in the total fixed cost was around 56.30 and 43.70%, respectively (Table 6).

Maintenance cost and returns: The average cost of maintaining a milch animal was the maximum in winter season, followed by summer and rainy season. The proportion of variable cost in total cost of maintaining a milch animal accounted for around 91% which varied from 88% in Sumerpur tehsil to 92% in Rohat tehsil. Similar findings were reported earlier (Rao *et al.,* 1991; Akanksha and Guleria, 2015; Seema Jhagrawat *et al.,* 2015; Chand *et al.,* 1998; 2002).

Table 6. Fixed cost (Rs)/year on bovine units in Pali district

Particulars	Average
I. Interest @ 8.25 percent	
Building	2728.92 (20.77)
Machinery and equipment	347.62 (2.65)
Adult animals	4320.96 (32.88)
Sub total	7397.49 (56.30)
II. Depreciation	
Building	1653.89 (12.59)
Machinery and equipment	422.14 (3.21)
Adult animals	3666.27 (27.90)
Sub total	5742.30 (43.70)
Total (I+II)	13139.79 (100.00)
Adult cattle unit (ACU)	6.47
Fixed cost per ACU	2030.88

Note: Figures in parenthesis indicate percent of total fixed cost

In the overall cost of maintenance per milch animal per day, feed cost alone accounted for 77% (cattle) to 80% (buffalo) (Table 7). The findings were in conformity with reports of World Bank (1999). The overall net returns per year from a cattle and buffalo unit were Rs 8444 and Rs 22211, respectively (Table 8). Bovine rearing was found profitable enterprise with net return of Rs. 108049 per year with average herd size of 6.47 adult cattle unit (ACU). The highest price per litre of milk was realized by the herd owners in summer season followed by rainy and winter season. The milk price was maximum in summer due to high demand and low supply of milk due to lower productivity in summer.

Technical efficiency

Milk production functions: The milk production functions of both cattle and buffalo were estimated using Ordinary Least Square (OLS) method. Green fodder, concentrate and labour were the important input in the cattle and buffalo milk production having positive and significant

Table 7. Maintenance cost (Rs/animal/day) of cattle and buffalo in Pali

Particulars	(Cattle)		(Buffalo)	
A. Variable cost	Qty. (kg)	Value (Rs)	Qty. (kg)	Value (Rs)
Green fodder	6.78	8.58	8.04	10.24
Dry fodder	7.69	15.16	10.57	19.09
Concentrate	2.44	18.01	3.40	28.38
Total Feed	16.91	41.75 (77.14)	22.01	57.71 (80.22)
Grazing and labour charges		5.79		6.50
Misc. Exp.		1.52		1.85
Total variable cost		49.06 (90.65)		66.06 (91.82)
B. Fixed cost				
Interest		2.84		3.29
Depreciation		2.22		2.59
Total fixed cost		5.06 (9.35)		5.88(8.18)
C. Total cost (A+B)		54.12 (100.0)		71.94 (100.00)

Note: Figures in parenthesis indicate percentage of total maintenance cost

Table 8. Returns (Rs/animal/day) from cattle and buffaloes in Pali

Particulars	Cattle		Buffalo	
	Per day	Per year	Per day	Per year
Milk Yield (Lit)	7.01	2557.43	8.79	3209.16
Consumption (Lit)	1.12	408.80	1.62	590.49
Sale (lit)	5.89	2148.63	7.17	2618.67
Price (Rs.)	10.73	10.73	14.75	14.75
Value of total milk (Rs.)	75.21	27441.26	129.69	47335.13
Value of dung (Rs)	2.07	755.55	3.10	1133.12
Gross return/ day (Rs)	77.28	28196.81	132.79	48468.25
Total cost/ day (Rs)	54.12	19752.58	71.94	26257.69
Net Return/ day (Rs)	23.17	8444.23	60.85	22210.55
B/C ratio	1.43	1.43	1.85	1.85

regression coefficients **(**Table 8-9).The findings were in agreement with Chand *et al*. (2001) where it was found that output elasticity of feeding concentrates was highest (0.76) in the cattle herd in Bikaner district of Rajasthan. The non-significant regression coefficient of dry fodder in cattle and buffalo production indicated little variation in the use of this input, as farmers fed dry fodder to fulfill the energy requirement of animals and did not differentiate the quantity of dry fodder based on milk yield of animals. The quantity of green fodder and concentrate was differentiated based on milk yield both in cattle and buffalo. This was the reason that regression coefficient of green fodder and concentrate were positive and significant for all the tehsils in both species.

Measures of technical efficiency: Technical efficiency at the average level of input use was 70.47 and 75.25% in cattle and buffalo, respectively (Table 11). The findings were in conformity to Srivastava (1995) who indicated higher technical efficiency in buffaloes (75%) than cattle. This clearly indicated that there were a potential of 30 and 25% to increase milk production and the returns from cattle and buffalo species without incurring extra expenditure. The technical efficiency of dairy farms observed by Singh and Kumar (2015) in Bihar state ranged between 54 to 65% on different dairy farms and it was lower than present study region indicating higher management inefficiency in that state. The critical analysis of present management practices followed by farmers were not on scientific lines e.g. during survey it was observed that many times green and dry fodder were provided without chaffing that required more energy for animals in swallowing and digestion, consequently affecting milk production and its technical efficiency.

Milk marketing

Milk produced by farmers is marketed mainly through cooperative dairy (52.8%) followed by direct sale to consumers / hotels (18.1%), milk vendors (15.3%) and private dairy (12.5%). Assured & timely payment and correct measurements in cooperative dairy were the major advantages (Table 12).

Table 9. Estimated parameters of OLS and frontier production functions of cattle

Tehsil	Analytic Approach	Constant	Parameters					Adjusted R^2 (%)
			Green fodder (X1)	Dry fodder (X2)	Conc. (X3)	Human labour (X4)	Misc. Expenses (X5)	
Rohat	OLS	3.8505***	Not	(-)0.2737	0.4877***	0.2541	0.6510***	74.00***
		(1.1214)	available	(0.2174)	(0.0874)	(0.3655)	(0.2482)	
	Frontier	4.2299	Not	(-)0.2737	0.4877	0.2541	0.6510	
Sumerpur	OLS	0.5426	available	0.2068	0.2900*	0.3607**	1.2254	50.00***
		(0.9796)	0.4170***	(0.1672)	(0.1495)	(0.1540)	(1.1338)	
	Frontier	0.9811	(0.1115)	0.2068	0.2900	0.3607	1.2254	
Raipur	OLS	2.4755***	0.4170	(-)0.0080	0.2955***	0.1266*	0.1187	75.00***
		(0.3130)	0.2983***	(0.1221)	(0.0855)	(0.0942)	(0.1637)	
			(0.1059)					
	Frontier	2.7099	0.2983	(-)0.0080	0.2955	0.1266	0.1187	

Note: Figures in parentheses are standard errors of the regression coefficients; R^2 = Adjusted coefficient of multiple determination; *** (P<0.01), **(P<0.05) and *(P<0.10); NS- Non significant

Table 10. Estimated parameters of OLS and frontier production functions of buffalo

Tehsil	Analytic Approach	Constant	Parameters					Adjusted R^2 (%)
			Green fodder (X1)	Dry fodder (X2)	Conc. (X3)	Human labour (X4)	Misc. Expenses (X5)	
Rohat	OLS	1.7076**	Not	0.0131	0.6782***	0.7536***	0.2764*	79.00***
		(0.7598)	available	(0.1155)	(0.0579)	(0.2104)	(0.1734)	
	Frontier	2.0343	Not	0.0131	0.6782	0.7536	0.2764	
			available					
Sumerpur	OLS	2.6791***	0.1117**	0.0154	0.4017***	0.0810*	0.3137*	56.00***
		(0.2815)	(0.0525)	(0.0422)	(0.0712)	(0.0503)	(0.1959)	
	Frontier	5.1429	0.1117	0.0154	0.4017	0.0810	0.3137	
Raipur	OLS	3.2465***	0.1181**	(-)0.0382	0.3573***	0.0690*	0.0860	67.00***
		(0.2161)	(0.0498)	(0.0495)	(0.0684)	(0.0397)	(0.1356)	
	Frontier	3.4682	0.1181	(-)0.0382	0.3573	0.0690	0.0860	

Note: Figures in parentheses are standard errors of the regression coefficients; R^2= Coefficient of multiple determination; *** (P<0.01), **(P<0.05) and *(P<0.10); NS- Non significant

Table 11. Measures of bovines' technical efficiency (%) in different tehsils of Pali district

Species/ Tehsil	Average
Cattle	
Potential return (Rs)	122.07
Existing return (Rs)	86.02
Technical efficiency (%)	70.47
Buffalo	
Potential return (Rs)	184.56
Existing return (Rs)	138.89
Technical efficiency (%)	75.25
Bovine's Technical efficiency (%)	73.11

Conclusion

Farmers rearing bovines under semi intensive management system was found profitable with net return of Rs. 108049 per year with average herd size of 6.47 adult cattle unit (ACU). About three-fourth expenditure in

Table 12. Advantages perceived by milk producers for cooperative marketing (n =38)

Advantages	Producers' perception	
	Frequency	Percent
Timely payment	38	100.0
Payment at comparatively less interval	36	94.7
Assured payment	38	100.0
Correct and better price	34	89.5
Correct measurements	36	94.7
Computerized milk collection	21	55.3
Clean and hygienic milk collection	30	78.9
Working of cooperative market in village	36	94.7
Fraudulent practices by private dairy/ vendors	27	71.1
Timely availability of quality input (animal feed, mineral mixture etc.) at reasonable price	29	76.3

-curred on feed and fodder in bovine rearing showed that more attention should be paid on efficient feeding schedules with balanced nutrition to maintain health and high milk production. The technical efficiency of cattle and buffalo at the average level of input use indicated a potential of increasing milk production and the returns by 30 and 25% with adoption of better management practices. Though cooperative dairy is playing important role in assuring better price to milk producers, there is still scope to computerize procurement operations and bring more transparency in fixing price of milk **(**Lehman *et al.,* 1994).

References

Akanksha and J. S. Guleria. 2015. Economic analysis of dairy farming in Kangra block (Kangra district) of Himachal Pradesh. In: Proc. *National Seminar on Livestock Economy of India: Issues, Challenges and Future Prospects,* IDS, Jaipur. pp. 58-63.

Chand, Khem, Kulwant Singh and Rajvir Singh 2002. Economic analysis of commercial dairy herds in arid region of Rajasthan. *Indian Journal of Agricultural Economics* 57: 224-233.

Chand, Khem, Kulwant Singh and Rajvir Singh. 2001. Economic efficiency of commercial dairy herds in arid region of Rajasthan, *Agricultural Economics Research Review* 14: 121-133.

Chand, Khem and Shalander Kumar. 1998. Economic analysis of milk production on commercial buffalo herds. *Agricultural Economics Research Review* 11: 48-52.

FAO. 2009. How to Feed the World in 2050. Food and Agriculture Organization of the United Nations, Rome.

Jhagrawat, Seema, D. C. Pant, S. S. Burark and G. L. Meena. 2015. An economic analysis of milk production under dairy cooperatives and women dairy cooperatives in southern Rajasthan. In: Proc. *National Seminar on Livestock Economy of India: Issues, Challenges and Future Prospects,* IDS, Jaipur. pp. 85-94.

Lehman, R., V. Raj, N. Ray, Subharahmanayam and S. Waetly. 1994. Bovine and dairy development in Andhra Pradesh. Indo-Swiss project (1994), Hyderabad, Andhra Pradesh.

Rao, B.D., T.G. Reddy and C.B. Singh. 1991. Economics of buffalo milk production on commercial dairy farms. *Indian Journal of Dairy Science* 44: 15 19.

Singh, D. K. and S. Kumar. 2015. Technical efficiency of dairy farmers in Bihar: status and determinants. In: Proc. *National Seminar on Livestock Economy of India: Issues, Challenges and Future Prospects.* IDS, Jaipur. pp. 154-163.

Srivastava, R. S. 1995. Technological change and economic efficiency on dairy farms: A frontier production function approach. Ph.D. Thesis, NDRI, Karnal, Haryana.

World Bank. 1999. India Livestock sector review: enhancing growth and development. World Bank and Allied Publishers, New Delhi. (www.statistics.rajasthan.gov.; Accessed on July 13, 2015).