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## Economics of rearing the heifers under semi-arid region of Gujarat

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### Abstract

Animal husbandry sector is contributing significantly in the rural economy; where dairy sector is the life line of millions of rural poor in the country. It is also a fact that the dairy sector is one of the fastest expanding occupations and demand for milk is growing day by day not only in cities but also in small towns and rural areas, while rearing dairy heifers from birth to first calving is an expensive investment and it takes a significant time to repay. Therefore, data for this investigation was collected from 120 dairy farmers of the Banaskantha district of Gujarat, and these dairy farmers were classified based on land holdings as marginal, small, medium and large categories of dairy farmers, which were 28.33, 25.84, 27.50 and 18.33 per cent, respectively. The percentage of CBC heifers kept by different categories of farmers was 2.93, 3.17, 3.20 and 2.11 percent for marginal, small, medium, and large farmers, respectively, while the percentage of buffalo heifers kept on these farms was 1.23, 0.88, 0.98, and 0.70 percent. The overall rearing cost of a CBC heifer for all categories of dairy farmers was Rs. 76.49 per animal per day. Similarly, the overall rearing cost of a buffalo heifer was Rs. 77.17 per animal per day. On the basis of these observations, it is concluded that the rearing cost of buffalo heifers was higher than CBC heifers and that these costs may be brought down by adopting better feeding and management practices by the dairy farmers of the region.

**Keywords:** Heifer, fixed cost, variable cost, land holding, categories of farmers

### 1. Introduction

Livestock rearing is one of the most important economic activities in the rural areas of the country, contributing significantly to the national economy. It provides income to households dependent on agriculture and to many landless households. The total livestock population is 536.76 million in the country, showing an increase of 4.8% over the Livestock Census-2012. The total number of cattle in the country is 193.46 million in 2019, showing an increase of 1.30% over the previous census. The exotic or crossbred and indigenous cattle population in the country is 51.36 million and 142.11 million, respectively. In the case of Gujarat, the total livestock population was reported at 2,68,70,500 during the 20th Livestock Census, whereas the cattle population was 96,10,870<sup>[1]</sup>.

Banaskantha is the country's leader in milk production and processing, having the largest milk processing plant run by the cooperative sector is a lifeline for the farmers in the operational area. Dairy development activities are increasing day by day with mechanization and the introduction of new technology, where considerable milk production can be increased. This could be possible if we have to introduce new inventions as well as farmers should adopt those inventions to produce the milk more economically.

In the present scenario of the dairy sector, input costs are increasing day to day and net return is declining, which has resulted in developing inroads in the development of this sector. Therefore, the present study was planned to know the economics of rearing heifers where commercial dairy farming is increasing day by day.

### 2. Material and Methods

#### 2.1 Demography of the study area

The study was conducted in the Banaskantha district, which is located in the northern part of Gujarat state. The district is situated between the latitudes of 23.33° and 24.45° North and the meridians of longitude of 71.03° to 73.02° East. The region falls under arid and semi-arid climatic conditions, where average minimum and maximum temperatures range from 8°C to 42°C with an annual average rainfall of 614 mm.

A multistage sampling technique was used to select the respondents from the Banaskantha district of north Gujarat, and information was collected in the predefined questionnaire from the farmers through direct interview. The district has 14 talukas and the study was conducted in two talukas were selected purposively, viz., Vadgam and Palanpur, because commercial dairy farming activities have been increasing day by day in these talukas since the last few years and this occupation of rural households is becoming a source of livelihood.

A total of six villages from each taluka, and ten respondents were selected from each village randomly, which made 120 respondents from two talukas of Banaskantha district. Respondents/dairy farmers were classified into four different categories, viz., marginal (0 to 1 ha.), small (1.01 to 2 ha.), medium (2.01 to 4 ha.) and large (above 4 ha.) on the basis of land holding of the farmers.

The cost of heifer rearing includes the total fixed cost and the total variable cost. The details of these are given below:

## 2.2 Fixed cost of heifer rearing

The expenditure borne by dairy farmers on housing, equipment, and animals was included to calculate the fixed cost, where interest and depreciation on fixed capital were calculated on an annual basis.

### 2.2.1 Interest

The annual interest on dairy animals, housing and equipment maintained by different categories of dairy farmers in the Banaskantha district of Gujarat was calculated as per the prevailing interest rate, i.e., at 6.0 per cent per annum. The interest per animal was calculated using formula (1).

$$\text{Interest per animal} = \frac{\text{Total interest on all the animals of a class}}{\text{Total Number of animals of the class}} \quad (1)$$

### 2.2.2 Depreciation

Depreciation is the cost of an asset as a result of its use, resulting in a decline in its value due to wear and tear, accidental damage, and time-obsolescence. It is worked out separately for animal sheds, machinery and equipment like tractors, chaff cutters, etc., and other items required on the dairy farms, viz., buckets, chains, ropes, etc., keeping in view the present value and useful economic life. The depreciation on these was calculated by the straight line method<sup>[2]</sup>.

**Depreciation on buildings:** The depreciation on buildings like animal sheds, store rooms, milking parlours, storage for feed and fodder, sheds for chaff cutters, etc. was included to calculate the depreciation with the help of formula (2).

$$\text{Depreciation on buildings} = \frac{\text{Cost of Building} - \text{Residual value}}{\text{Life span (25 years)}} \quad (2)$$

**Depreciation on machine or equipment:** The farmers usually have a tractor, milking machine, chaff cutter, etc. on the farm, and depreciation on machine/equipment was calculated by using formula (3).

$$\text{Depreciation on equipment} = \frac{\text{Purchase price of equipment} - \text{Residual value}}{\text{Productive life}} \quad (3)$$

## 2.3 Variable cost of heifer rearing

The variable cost includes the expenses incurred on feed and

fodder, labour, veterinary and health care services, water and electricity charges and miscellaneous costs.

### 2.3.1 Feed and fodder cost

The expenditure on green fodder, dry fodder, concentrate and mineral mixtures, etc. was worked out by multiplying quantities of feed and fodder consumed by animals with their respective prevailing prices in the study area. The green fodder and dry fodder prices in the study area were Rs. 2 to 4 per kg and Rs. 8 or 9 per kg, respectively. In the case of concentrate, farmers procure it from the Banaskantha District Cooperative Milk Producers Union Ltd. at Rs. 1000 to 1200 per 50 kg, while some of the farmers prepare it at home by purchasing different ingredients from the market, including cotton seed cake, maize cake, maize bran, jowar bran, urad barn, toor dal chunni, bajara and isabgol husk (lali) prices in the study area were Rs. 36.25, 22.50, 26.00, 19.00, 24.00, 24.00, 17.50 and 34.00 per kg, respectively.

### 2.3.2 Labour cost

It included family as well as paid labour (hired labour). The hired labour was calculated considering the type of work allotted and wages paid to them. In the present investigation, it was observed that dairy farmers paid Rs. 6000 to 8000 per month per laborer.

### 2.3.3 Treatment costs

It included the costs incurred on medicines and the charges of the veterinary doctor. But generally, treatment was given by the doctors of Banaskantha District Cooperative Milk Producers' Union Ltd. and their charge was Rs. 120 per visit, while sometimes they asked for the services of private doctors and actual payments given to them were included in the expenses of treatment of animals.

### 2.3.4 Breeding cost

It included the cost incurred on natural services and artificial insemination (A.I.) charges by AI workers. An artificial insemination charge was around Rs. 120 to 150 per insemination in the study area.

### 2.3.5 Water and electricity charges

The charges for water and electricity were calculated based on the actual expenses for them. Dairy farmers paid for a 7.5 HP motor Rs. 5000 per annum as fixed charges, while some farmers paid the bill on a month-to-month basis of Rs. 1000 to 2000 per month. These dairy farmers used the water and electricity for domestic purposes, such as drinking animals, etc. So, water and electricity charges were calculated based on the actual cost of water used for the drinking of animals and cleaning of sheds, equipment, etc.

### 2.3.6 Miscellaneous costs

The miscellaneous expenses borne by farmers include the cost of repairs of machinery, sheds or buildings like roofs, flooring, whitewashing of sheds, transportation of milk and stationery.

Overall value was calculated by the sum of the respective classes of farmers of different talukas divided by the total number of animals, and the total of Banaskantha district includes value obtained by the sum of overall and two talukas divided by the total number of CBC/buffalo heifers.

## 2.4 Statistical analysis

To achieve the objectives of the study, the data collected from

120 dairy farms was processed, summarized, scrutinized, tabulated and analyzed with the help of software, i.e., the Statistical Package for Social Sciences (SPSS).

### 3. Results and Discussion

#### 3.1 Distribution of animals

Information about the number of CBC and buffalo heifers reared by different categories of farmers was collected and presented in Table 1. The number of CBC heifers kept by different categories of dairy farmers shows that they were 2.92, 3.17, 3.20 and 2.11 per cent of marginal, small, medium, and large farmers, respectively. Similarly, buffalo heifers across different categories were 1.23, 0.88, 0.98 and 0.70 per cent on marginal, small, medium and large-sized farms respectively.

#### 3.2 Fixed cost

The expenditure borne by dairy farmers on the animals,

housing and equipment is included as a fixed cost. The details of these costs are discussed here as below, and the results are depicted in Table 2.

The interest rate on CBC and buffalo heifers was calculated at Rs. 513 and Rs. 856 per animal per year, respectively, irrespective of the class of households. It shows that the amount of interest was greater in the case of buffalo heifers as compared to CBC heifers. However, Lalrinsangpuii *et al.* (2016) [3] suggested that overall interest on fixed assets for crossbred cows kept on small, medium and large farms was Rs. 3.49, 3.69 and 3.71 per animal per day, respectively. Inderpreet and Singh (2018) [4] reported the value of animal interest as Rs. 7.61, 8.06, 11.31, and 11.83 per day per animal, respectively, for domestic, small, medium and large farms. Interest bear by different categories of farmers of Banaskantha district was almost either lower or at par with the reports of these workers.

**Table 1:** Distribution of heifers among different categories of farmers of Banaskantha district

Taluka	Category of dairy farmers	Number of dairy animals			
		CBC Heifers	Buffalo Heifers	Other <sup>#</sup>	Overall
Palanpur	Marginal (N=24)	67 (4.65)	16 (1.11)	438 (30.4)	521 (36.16)
	Small (N=19)	58 (4.02)	18 (1.25)	342 (26.23)	418 (29.00)
	Medium (N=11)	26 (1.80)	14 (0.97)	164 (11.39)	204 (14.16)
	Large (N=06)	33 (2.29)	15 (1.04)	250 (17.35)	298 (20.68)
Vadgam	Marginal (N=10)	16 (1.14)	19 (1.36)	195 (13.98)	230 (16.48)
	Small (N=12)	32 (2.29)	07 (0.50)	218 (15.61)	257 (18.40)
	Medium (N=22)	65 (4.65)	14 (1.00)	407 (29.17)	486 (34.82)
	Large (N=16)	27 (1.93)	05 (0.35)	391 (28.02)	423 (30.30)
Overall	Marginal (N=34)	83 (2.92)	35 (1.23)	633 (22.32)	751 (26.47)
	Small (N=31)	90 (3.17)	25 (0.88)	560 (19.74)	675 (23.79)
	Medium (N=33)	91 (3.20)	28 (0.98)	571 (20.14)	690 (24.32)
	Large (N=22)	60 (2.11)	20 (0.70)	641 (22.36)	721 (25.42)
Total (N=120)		324 (11.43)	108 (3.80)	2405 (84.77)	2837 (100.00)

(Note: Figures in the parenthesis indicates the percentage of animals of different class of respective talukas; N= Number of respondents of different class of respective talukas; # Other category includes milch crossbred cow and buffalo, dry crossbred cow and buffalo, bull and calf)

The interest rate on dairy farm building for CBC and buffalo heifers was calculated at Rs. 1057 and Rs. 873 per animal per year respectively for all categories of dairy farmers. It shows that the amount of interest on dairy farms was less in the case of buffalo heifers as compared to CBC heifers. Inderpreet and Singh (2018) [4] suggested interest on buildings as Rs. 2.90, 3.18, 2.45 and 2.43 per animal per day for domestic, small, medium and large farmers, respectively. Similarly, Anbukani (2018) [5] estimated interest on investment for crossbred cow herds kept on small, medium and large farms was Rs. 5.88, 4.41 and 4.01 per animal per day, respectively.

The interest rate on dairy farm equipment for CBC and Buffalo heifers was calculated at Rs. 727 and 745 per animal per year, respectively, for all categories of dairy farmers. These values are almost in the range of values reported by Kamble *et al.* (2014) [6] and Meena *et al.* (2019) [7]. The reduction in value of any item is an indirect cost borne by the owner of the enterprise. The depreciation on dairy farm buildings for CBC and buffalo heifers was calculated at Rs. 634 and 524 per animal per year, respectively, irrespective of class of households.

Depreciation on dairy farm equipment for CBC and buffalo

heifers was calculated at Rs. 969 and Rs. 994 per animal per year respectively for all categories of dairy farmers. Depreciation on dairy farm equipment for buffalo heifers was more than CBC heifers, whereas depreciation on dairy farm buildings was more for CBC heifers. The reports of Inderpreet and Singh (2018) [4] suggested that the value of depreciation on equipment was Rs. 1.25, 1.42, 0.94 and 0.52 per day per animal, respectively, for domestic, small, medium and large dairy farmers. These values are lower than our observations, while the values reported by Anbukani (2018) [5] and Meena *et al.* (2019) [7] are higher than our values. The depreciation borne by different categories of farmers in Banaskantha district was almost either lower or at par with the reports of different workers.

#### 3.2 Variable cost

The expenses incurred by farmers on rearing their animals, like feeding, breeding, labour, electricity charges, treatment, etc., are included as variable costs or operational costs of the farm. The details of these costs are discussed as below, and the results are depicted in Table 3.

**Table 2:** Fixed cost of rearing CBC and buffalo heifers kept on different categories of farms (Rs./animal/year)

Taluka	Category of dairy farmers	Interest over Investment on Animals		Interest on dairy farm buildings		Interest on dairy farm equipments		Depreciation on dairy farm buildings		Depreciation on dairy farm equipments	
		CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers
Palanpur	Marginal	331	825	1028	929	327	228	617	557	437	303
	Small	559	867	1128	951	464	445	677	571	618	593
	Medium	623	814	1371	1370	1622	1378	823	822	2163	1838
	Large	691	920	728	729	763	1280	437	437	1018	1707
Vadgam	Marginal	938	821	1204	516	489	107	722	310	651	143
	Small	413	771	1169	609	560	1051	701	365	747	1402
	Medium	489	857	1162	1033	920	974	697	620	1227	1298
	Large	467	1080	606	735	1249	1468	364	441	1666	1957
Overall	Marginal	448	823	1062	705	359	162	637	423	478	216
	Small	507	840	1142	855	498	615	685	513	664	819
	Medium	527	836	1222	1201	1121	1176	733	721	1494	1568
	Large	590	960	673	730	982	1327	404	438	1309	1769
Total		513	856	1057	873	727	745	634	524	969	994

The feeding cost of a CBC heifer was calculated at Rs. 19733 per animal per year by all categories of dairy farmers. The respective value for buffalo heifers was observed at Rs. 20376 per animal per year. It shows that the feeding cost of buffalo heifers was higher than CBC heifers. Singh *et al.* (2017) [8] suggested the feeding cost of cows kept on small, medium and large dairy farms was Rs. 55.57, 72.36 and 28.84 per animal per day, respectively. Similarly, for buffaloes, it was Rs. 67.94, Rs. 88.45 and Rs. 35.25 per animal per day, respectively.

The cost of labour for CBC and buffalo heifers was calculated at Rs. 2618 and 2178 per animal per year, respectively, for all categories of dairy farmers. Singh (2015) [9] suggested labor costs for CBC on medium and large farms as Rs. 12.08 and 10.75 per animal per day, respectively; for buffalo kept on small, medium, and large farms, it was Rs. 12.51, 12.23 and

10.75 per animal per day, respectively.

The treatment cost of a CBC heifer was calculated at Rs. 679 per animal per year by all categories of dairy farmers. The respective value for buffalo heifers was observed at Rs. 634 per animal per year.

The observations of Ghule *et al.* (2012) [10] suggested that the veterinary cost for CBC on small, medium and large farms was Rs. 3.40, 3.13 and 2.37 per animal per day, respectively; and for buffaloes on the large farm, it was Rs. 2.90 per animal per day. Inderpreet and Singh (2018) [4] reported the veterinary cost of milch buffalo on domestic, small, medium and large farms as Rs. 0.48, 0.33, 0.45 and 3.45 per animal per day, respectively. The value for treatment of buffaloes and CBC reported by Meena *et al.* (2019) [7] was Rs. 2.85 and 3.35 per animal per day, respectively.

**Table 3:** Variable cost of rearing CBC and buffalo heifers kept on different categories of farms (Rs./animal/year)

Taluka	Category of dairy farmers	Feeding cost		Labour cost		Treatment cost		Breeding cost		Water and electricity cost		Miscellaneous cost	
		CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers	CBC heifers	Buffalo heifers
Palanpur	Marginal	19419	19115	1957	1573	802	697	370	157	108	132	655	544
	Small	20666	20596	2058	2677	996	922	284	428	145	152	794	875
	Medium	19018	19916	2666	2925	1259	977	107	113	305	241	875	817
	Large	17648	19028	2345	1793	402	588	266	418	321	217	477	735
Vadgam	Marginal	22413	22919	3570	1720	544	386	185	127	78	232	612	336
	Small	20981	22232	1959	1143	472	504	251	332	150	186	417	501
	Medium	19840	19602	4286	3352	496	441	211	108	131	100	376	247
	Large	18426	18863	1948	1292	236	241	171	195	178	156	323	306
Overall	Marginal	19996	21180	2268	1653	752	528	334	141	102	186	647	431
	Small	20778	21054	2023	2247	809	805	272	401	146	161	660	771
	Medium	19605	19759	3823	3139	714	709	181	111	180	171	518	532
	Large	17998	18987	2166	1667	327	502	223	362	256	201	408	627
Total		19733	20376	2618	2178	679	634	254	234	165	179	570	572

**Table 4:** Total cost of rearing CBC heifers kept on different categories of farms

Taluka	Category of dairy farmers	Total cost of rearing milch CBC (Rs./animal/year)			Rearing cost (Rs./animal/day)
		Fixed cost	Variable cost	Total cost	
Palanpur	Marginal	2740.27	23309.79	26050.06	71.37
	Small	3444.38	24941.79	28386.17	77.77
	Medium	6601.35	24230.27	30831.62	84.47
	Large	3637.45	21458.55	25096.00	68.76
Vadgam	Marginal	4003.13	27403.38	31406.50	86.05
	Small	3589.63	24229.22	27818.84	76.22
	Medium	4495.20	25338.89	29834.09	81.74
	Large	4350.81	21283.41	25634.22	70.23

Overall	Marginal	2983.69	24098.90	27082.59	74.20
	Small	3496.01	24688.41	28184.42	77.22
	Medium	5096.96	25022.14	30119.10	82.52
	Large	3958.45	21379.70	25338.15	69.42
Total		3900.06	24018.42	27918.48	76.49

The cost of breeding dairy animals borne by different categories of dairy farmers in the Banaskantha district of Gujarat was calculated. The annual per animal breeding cost of CBC and buffalo heifers was observed at Rs. 254 and 234, respectively, for all categories of dairy farms. It is suggested that farmers should be educated properly about breeding practices to reduce the breeding cost further and to improve the productivity for a better return. a

The treatment cost of a CBC heifer was calculated at Rs. 679 per animal per year by all categories of dairy farmers. The respective value for buffalo heifers was observed at Rs. 634 per animal per year. The expenses on water and electricity borne by households for different dairy animals in the Banaskantha district of Gujarat were calculated. The overall annual cost of water and electricity for CBC and buffalo heifers was Rs. 165 and 179 per animal, respectively.

Miscellaneous expenses include the cost of repairing fixed

assets, buckets, ropes, insurance premiums, and other incidental charges for the management of all dairy animals. Miscellaneous cost for CBC and Buffalo heifers were calculated at Rs. 570 and 572 per animal per year, respectively, for all categories of dairy farmers. The observations of Anbukani (2018) [5], Lalrinsangpuii *et al.* (2016) [3] and Sunil *et al.* (2016) [11] were higher than our findings, but Inderpreet and Singh (2018) [4] estimated a lower miscellaneous cost than our observations.

### 3.3 Total cost of rearing heifers

#### 3.3.1 Total rearing cost of CBC heifers

The rearing cost of animals includes both a total fixed cost and a total variable cost. The details of the rearing cost of CBC heifers are discussed here as below, and the results are depicted in Table 4.

**Table 5:** Total cost of rearing buffalo heifers kept on different categories of farms

Taluka	Category of dairy farmers	Total cost of rearing milch CBC (Rs./animal/year)			Rearing cost (Rs./animal/day)
		Fixed cost	Variable cost	Total cost	
Palanpur	Marginal	2841.88	22218.25	25060.13	68.66
	Small	3425.67	25649.72	29075.39	79.66
	Medium	6222.14	24990.00	31212.14	85.51
	Large	5073.60	22778.33	27851.93	76.31
Vadgam	Marginal	1896.47	25719.16	27615.63	75.66
	Small	4199.00	24899.43	29098.43	79.72
	Medium	4781.86	23850.79	28632.64	78.45
	Large	5680.00	21052.40	26732.40	73.24
Overall	Marginal	2328.66	24118.74	26447.40	72.46
	Small	3642.24	25439.60	29081.84	79.68
	Medium	5502.07	24420.36	29922.43	81.98
	Large	5225.20	22346.75	27571.95	75.54
Total		3991.84	24174.55	28166.39	77.17

It was revealed from the table that the overall total cost of rearing the CBC heifers was Rs. 27918.48 per animal per year. It includes fixed and variable costs, which were Rs. 3900.06 and Rs. 24018.42 per animal per year, respectively. The overall rearing cost of a CBC heifer for all categories of dairy farmers was Rs. 76.49 per animal per day. However, it was highest for medium farmers (Rs. 82.52), followed by small (Rs. 77.22), marginal (Rs. 74.20) and large (Rs. 69.42) categories of dairy farmers.

This can be interpreted from these observations that large farmers bear fewer expenses for rearing the CBC heifers as compared to other categories of dairy farmers. It might be due to proper utilization of resources as compared to other categories of farmers.

#### 3.3.2 Total rearing cost of buffalo heifers

The details of the rearing cost of buffalo heifers are discussed here as below, and the results are depicted in Table 5. The total cost of rearing the buffalo heifers was Rs. 28166.39 per animal per year. It includes fixed and variable costs, which were Rs. 3991.84 and Rs. 24174.55 per animal per year, respectively. The overall rearing cost of a buffalo heifer was Rs. 77.17 per animal per day. However, it was highest for medium farmers (Rs. 81.98), followed by small (Rs. 79.68),

large farmers (Rs. 75.54) and marginal (Rs. 72.46) categories of dairy farmers. It demonstrates that marginal farmers incur lower costs for raising buffalo heifers than other types of dairy farmers.

### 4. Conclusions

From the results of the present investigation, it can be concluded that the rearing cost of buffalo heifers was higher than CBC heifers, where the operational cost was 85.82% in the case of buffalo heifers and 86.06% in the case of CBC heifers, and these costs may be brought down by adopting better feeding and management practices by the dairy farmers of the region.

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