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Economic analysis of buffalo milk production in Kolhapur district

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Abstract

India is the world's largest producer and consumer of milk and has the world's largest dairy herd, comprised of water buffalo and indigenous and crossbred cattle. The superiority of buffalo over local cow in milk production has been proved beyond any doubt. Pandharpuri is native breed of Maharashtra. The breeding tract includes Solapur, Sangli and Kolhapur districts of Maharashtra. The study was carried out to estimate per liter costs and returns of buffalo milk production in Kolhapur district. The primary data were collected by visiting 54 sample milk producers from Karveer, Kagal and Panhala tahsils and analyzed by using various statistical tools. The study revealed that the average variable cost of buffalo milk production on sample farms was Rs.32622.43 and average fixed cost was Rs. 12814.57 and total cost Rs. 45437.00. The per litre cost of milk production was Rs. 38.88. The returns over variable cost were Rs. 20761.55 and total cost of milk production was Rs. 7946.98 at overall level. The maximum returns over variable cost Rs. 21621 and total cost Rs. 9567 were observed in medium size heard group. The benefit cost ratio at overall level was 1.18 which indicates that buffalo rearing is profitable business as the magnitude of B:C ratio is more than one. Sample milk producers were operating in profit zone as the break-even output 931 litres per lactation at overall level was less than the actual output i.e. 1168 litres. The factors responsible for buffalo milk yield of sample households were number of buffaloes, quantity of green fodder and concentrates fed to animal and human labour. The study suggested that milk producers may be motivated to increase the use of green fodder and concentrate for securing higher milk yield.

Keywords: Fixed cost, variable cost, Milk production, B:C ratio, break even point analysis

Introduction

India is the world's largest producer and consumer of milk and has the world's largest dairy herd, comprised of water buffalo and indigenous and crossbred cattle. The buffalo population in India was 105.3 million heads out of that 6.07 million heads were in Maharashtra, whereas 6.6 lakh in Kolhapur district. The superiority of buffalo over local cow in milk production has been proved beyond any doubt. Even the higher percentage of fat, protein and mineral especially calcium content of buffalo milk makes it richer in nutrients vis-à-vis cow milk. Pandharpuri is native breed of Maharashtra. The breeding tract includes Solapur, Sangli and Kolhapur districts of Maharashtra. These buffaloes are concentrated in Pandharpur, North Solapur, South Solapur, Barshi, Akkalkot, Sangola and Mangalvedha tehsils of Solapur district; Miraj, Walwa, Jath and Tasgaon tehsils of Sangli district; and Karveer, Shirol, Panhala, Radhanagri, Hatkanangale and Gadhinglaj tahsils of Kolhapur district. The animals have multiple milk let down capability. The buffaloes produce on an average 1700 Kg. of milk with 8% fat per lactation.

The present study was carried out to estimate per liter costs and returns of buffalo milk production in Kolhapur district. The Kolhapur district was purposively selected due to the fact that the district has more than 6.12 lakh buffalo population contributing 10.91 per cent to the total buffalo population in the state.

Methodology

Karveer (49,713), Kagal (32,212) and Panhala (30,167) tahsils were selected on the basis of maximum number of buffaloes in milk. Two villages from each tahsils i.e Wadange and Padali from Karveer tahsil, K. Sangav and Sarwade from Kagal tahsil and Kushire and Pohale from Panhala tahsil were selected randomly making total of six villages in the district. The list of buffalo milk producers was collected from cooperative milk society in the selected villages and these milk producers were categorized in three groups based on number of buffaloes viz;

Small (Upto 2 buffaloes), Medium (3 to 4 buffaloes) and large (5 and above buffaloes). The three milk producers were selected randomly from each group thus 9 buffalo milk producers from each selected village. The primary data were collected by visiting 54 sample milk producers from Karveer, Kagal and Panhala tahsils with the help of specially designed questionnaire by survey method for the year 2017-18.

The analysis was carried with simple statistical tools viz., averages and percentages. The fixed cost and variable cost concepts were used for estimating average per unit and per litre production cost of milk. Break Even Point analysis (BEP) of milk production was also worked out.

Break-even point analysis (BEP): Break-even point analysis was carried out to judge the minimum quantity of to be produced to avoid losses.

$$BEP = \frac{F}{p - v}$$

Where F= fixed cost, p= per litre price of milk and v= per litre variable cost of milk

Functional analysis: Multiple regression analysis was carried out judge factors contributing in the milk production.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + u$$

Where,

Y= Total milk production (lit)

a = Constant

bi's = Regression Coefficients

X₁= Number of buffaloes

X₂= Age (Year)

X₃= Green fodder (qtls)

X₄= Dry fodder (qtls)

X₅= Concentrates and supplements (qtls)

X₆= Veterinary expenditure (Rs.)

X₇= Human labour (hrs)

u= error term

Results

The primary data collected were analyzed with the help of various statistical tools and the results are presented aspect wise and category wise.

General Information

The information of sample milk producers on age, education status, size of family, no. earners, average size of land holding and livestock status of sample milk producer is presented in Table 1.

The average age of head of sample milk producer family was 48.66 years at overall level among that large size heard owner has minimum age (44.83 years) compare to medium and small size heard owners. Maximum numbers of heads of milk producer family were from middle aged followed by high age group and low age group. More than 55 per cent head of milk producers has completed secondary education, whereas 27.77 per cent head of milk producer's family were graduates at overall level. Maximum numbers of graduated head of family were from small group followed by medium and large heard size group. The average size of family is 4.96 at overall level. Highest numbers of family members were found in medium size group followed by small and large group. The number of earners in the sample milk producer was 2.47 at overall level. The highest number of earners noticed in large size group followed by medium and small heard size group. Farming is the main occupation and dairy is secondary occupation among all sample heard size groups. The average land owned by sample milk producers was 1.29 hectares at overall level. The maximum land owned was observed in large heard size group but irrigated land owned by medium heard size milk producer was maximum followed by small heard size milk producer. The average livestock owned at overall level was 5.68. The number of livestock and number of buffaloes owned increased as size group increased. The average numbers of buffaloes noticed were 1.52, 3.35 and 6.72 in small, medium and large size heard group, respectively.

Table 1: Information of milk producers

Sr. No.	Particulars	Small	Medium	Large	Overall
1	Number of Sample milk producers	18	18	18	54
2	Age of sample farmer of head of family	50.83	50.74	44.83	48.66
	a) Below 30 years (Low age group)	3	3	4	3
	b) 31 to 50 years (Middle age group)	10	8	12	10
	c) Above 50 years (High age group)	5	7	2	5
3	Education of head of family				
	a) Illiterate	1	1	0	1
	b) Primary	2	4	3	3
	c) Secondary	9	8	14	10
	d) Graduates	6	5	1	5
4	Size of Family	4.69	5.48	4.72	4.96
5	Number of Earners (No.)	2.34	2.48	2.67	2.47
5	Farming (No.)	1.93	1.83	2.06	1.93
7	Dairy (No.)	1.1	1.22	1.44	1.23
8	Land holding (ha.)	1.17	1.32	1.39	1.29
	a) Irrigated (ha.)	1.07	1.13	0.85	1.03
	b) Unirrigated (ha.)	0.10	0.13	0.54	0.26
11	Livestock (No.)	3.62	5.31	9.49	5.68
a	Bullock (No.)	0.17	0.09	0.11	0.13
b	Cow (No.)	0.41	0.17	0.22	0.28
c	Buffalo (No.)	1.52	3.35	6.72	3.46
d	Calf/heifer (No.)	1.52	1.7	2.44	1.82

Capital assets of sample milk producers

Land, labour and capital are the most important factors of milk production activity. The value assets such as land, farm buildings, byre, irrigation structure, machinery and tools and dairy equipments of sample milk producers is presented in Table 2.

The value of total assets was Rs. 63.60 lakh at the overall level. It was maximum in medium heard size group as the irrigated land owned by milk producers in this group was

more than other groups. The value of capital assets *viz.*, byre, livestock etc. was found to be increasing with the increased in the heard size group but the reverse trend was noticed in capital assets *viz.*; farm buildings and irrigation structure. Value of land contribute more than 90 per cent share in the value of total assets followed by value of livestock, irrigation structure, machinery and tools and value of byre. The highest value of livestock Rs. 3,24,905 was noticed in large heard size group and lowest Rs. 8,5876 in small heard size group.

Table 2: Capital assets (Rs.)

Sr. No	Particulars	Small	Medium	Large	Overall
1	Land	5180862.07	6244673.91	5775694.44	5733743.47
	%	91.90	92.03	87.95	90.58
2	Farm buildings	54137.00	25869.00	27500.00	35835.33
	%	0.96	0.38	0.42	0.57
3	Byre	76551.00	90856.00	136055.56	101154.19
	%	1.36	1.34	2.07	1.60
4	Irrigation structure	148155.00	122643.00	85166.00	118654.67
	%	2.63	1.81	1.30	1.87
5	Livestock	85786.21	170169.57	324905.04	193620.27
	%	1.52	2.51	4.95	3.06
6	Machinery and tools	83793.00	100441.52	130852.22	105028.91
	%	1.49	1.48	1.99	1.66
7	Dairy equipments	8491.00	31060.00	87178.00	42243.00
	%	0.15	0.46	1.33	0.67
8	Total assets	5637775.28	6785713.00	6567351.26	6330279.85
	%	100.00	100.00	100.00	100.00
9	Value of capital asset excluding land value	456913.21	541039.09	791656.82	596536.37
	%	8.10	7.97	12.05	9.42

(% is worked out to the value of total assets)

Cost of milk production

The details of size groupwise and itemwise cost of buffalo milk production is presented in Table 3.

The average total milk production cost at overall level was Rs. 45,437 of that the share of variable cost was 71.80 per

cent and fixed cost was 28.20 per cent. The total cost of milk production was the highest in small herd size group amounting Rs. 48,129.84 followed by large herd size group Rs. 45,034.04 and medium heard size group Rs. 42,357.03.

Table 3: Cost of milk production per buffalo (Rs.)

Sr. No.	Particulars	Small	Medium	Large	Overall
	Variable cost				
1	Green fodder	9502	9950	9691	9697.8
	%	19.74	23.49	21.52	21.34
2	Dry fodder	2216	1452	1601	1806.83
	%	4.60	3.43	3.56	3.98
3	Concentrate & supplements	10946	9920	10171	10409.6
	%	22.74	23.42	22.59	22.91
4	Veterinary Charges and other expenses	1223	2196	1503	1614.7
	%	2.54	5.18	3.34	3.55
5	Labour Charges	12140	6785	7135	9093.5
	%	25.22	16.02	15.84	20.01
	Total variable cost	36027	30303	30101	32622.43
	%	74.85	71.54	66.84	71.80
	Fixed cost				
1	Interest on value of animal	4403.35	4709.93	4491.34	4526.71
	%	9.15	11.12	9.97	9.96
2	Depreciation on cattle shed & accessories	5586.49	3106.1	3748.7	4298.93
	%	11.61	7.33	8.32	9.46
3	Heard replacement cost	2113	4238	6693	3988.93
	%	4.39	10.01	14.86	8.78
4	Total Fixed cost	12102.84	12054.03	14933.04	12814.57
	%	25.15	28.46	33.16	28.20
5	Total cost	48129.84	42357.03	45034.04	45437.00
	%	100.00	100.00	100.00	100.00
6	Total milk production	1216.00	1145.00	1121.00	1168.24
7	Per liter cost of milk production	39.58	36.99	40.17	38.88

(% is worked out to the total cost)

The variable cost includes cost on account of green fodder, dry fodder, concentrates and supplements, veterinary expenses, water & electricity expenses. The average variable cost at overall level was Rs. 32,622.43. The variable cost was observed to be the highest in small heard size group i.e. Rs. 36,027 and lowest Rs. 30,101 in large herd size group. The major contribution of variable cost was expenditure on green fodder, human labour and concentrates at overall level. Total fixed cost constitutes interest on value of animal, depreciation on cattle shed & accessories and heard replacement cost which was Rs. 12,814.57 at overall level. The highest total fixed cost (Rs. 14,933.04) was observed in large heard size group and almost same i.e. Rs. 12,000 in remaining two

groups. The per litre cost of buffalo milk production was Rs. 38.88 at overall level. It was the least i.e. Rs. 36.99. in case of medium herd size group.

Profitability of buffalo milk production

The returns from buffalo includes returns from milk sold and consumed, buffalo dung and sale of animal (Table 4). The returns from milk were calculated on the basis of the average quantity of milk yield and average price received per litre of milk. Dung is useful waste because it is used as fuel and manure. Return from dung was calculated by taking average price at which dung was sold in the study area.

Table 4: Profitability of buffalo milk production (Rs.)

Sr. No	Particulars	Small	Medium	Large	Overall
1	Total milk production	1216.00	1145.00	1121.00	1168.24
2	Av. rate of milk	42.37	41.44	40.78	41.68
3	Value of milk	51523.00	47448.00	45717.00	48691.10
	%	91.65	91.38	90.21	91.21
4	Value of offspring	1560.80	1524.98	2018.43	1666.71
	%	2.78	2.94	3.98	3.12
5	Value of dung	3136.00	2952.00	2944.00	3026.17
	%	5.58	5.69	5.81	5.67
6	Gross returns	56219.80	51924.98	50679.43	53383.98
	%	100.00	100.00	100.00	100.00
7	Total variable cost	36027.00	30303.00	30101.00	32622.43
8	Total Fixed cost	12102.84	12054.03	14933.04	12814.57
9	Total cost of milk production	48129.84	42357.03	45034.04	45437.00
10	Returns over variable cost	20192.80	21621.98	20578.43	20761.55
11	Returns over total cost	8089.96	9567.95	5645.39	7946.98
12	Benefit cost ratio	1.17	1.23	1.13	1.18

(% is worked out to the gross returns)

The annual milk production at overall level was to the tune of 1,168.24 litres and the average rate was Rs. 41.68 per litre and the value of milk was Rs. 48,691.10. The size groupwise picture shows that highest value of milk was obtained by small heard size group Rs. 51,523 followed by medium and large heard size group of milk producers. The value of milk has more than 91 per cent share in gross income from buffalo followed by value of dung 5.67 per cent and value of offspring.

The variable cost of milk was Rs. 32622.43 at overall level. The size groupwise analysis showed that it was highest in small heard size group i.e. Rs. 36027.00 and lowest i.e. Rs. 30301.00 in large heard size group. The fixed was Rs. 12814.57 at the overall level. The fixed was highest in large heard size group i.e. Rs. 14499.04 and almost same Rs. 12000 in remaining two heard size groups. The total cost of milk production was Rs. 45437.00 at the overall level. The highest

total cost was noticed in small heard size group (Rs. 48129.84) and lowest (Rs. 42357.03) in medium heard size group. The returns over variable cost were Rs. 20761.55 and total cost of milk production were Rs. 7946.98 at overall level. The maximum returns over variable cost Rs. 21621.98 and total cost Rs. 9567.95 were observed in medium size heard group. The benefit cost ratio at overall level was 1.18 which indicates that buffalo rearing is profitable business as the magnitude of B:C ratio is more than. The highest B:C ratio was observed in case of medium heard size group (1.23) followed by small (1.17) and large (1.13) heard size group.

Break even point analysis of buffalo milk production

The break-even point analysis was done to estimate minimum quantity of milk to be produced to cover the total cost of milk production and presented in Table 5.

Table 5: Break - even point (BEP) for buffalo milk production

Sr. No	Particulars	Small	Medium	Large	Overall
1	Milk yield animal per lactation (litre)	1216.00	1145.00	1121.00	1168.24
2	Fixed cost per animal (Rs.)	12102.84	12054.03	14933.04	12814.57
3	Variable cost per animal (Rs.)	36027.00	30303.00	30101.00	32622.43
4	Total cost per animal (Rs.)	48129.84	42357.03	45034.04	45437.00
5	Variable cost per liter (Rs.)	29.63	26.47	26.85	27.92
6	Price per litre of milk (Rs.)	42.37	41.44	40.78	41.68
7	Break-even point (litre)	949.73	805.01	1071.97	931.66
8	Margin of safety (litres)	266.27	339.99	49.03	236.58

The break-even output worked was 931 litres per lactation at overall level which is less than the actual output i.e. 1168.24 litres. It indicates that the sample milk producers are operating in profit zone. The highest difference in actual quantity of milk produced and break even quantity was noticed in case of medium heard size, whereas minimum difference observed in

case of large head size group. It shows the need of increasing milk production in large heard size group

Determinants of buffalo milk production

The multiple regression analysis was carried out to judge the determinant of milk production on sample households and results are presented in Table 6.

Table 6: Determinants of buffalo milk production

Sr. No	Particulars	Small	Medium	Large	Overall
1	R ²	0.7091	0.5597	0.8947	0.9270
2	F Value	7.31	2.72	12.14	112.58
3	Intercept	273.05	230.88	214.25	238.65
4	Number of buffaloes (No.)	1224.26**	960.60*	753.38*	948.23***
5	Age (Year)	-57.998*	-18.575*	-93.19**	-120.24**
6	Green Fodder (qtls)	1.72*	0.65*	0.99*	0.942***
7	Dry Fodder (qtls)	1.568	12.382 ^{NS}	17.473 ^{NS}	9.805
8	Concentrate & supplements (qtls)	11.34**	9.186*	22.14*	10.66***
9	Veterinary charges & other expenses (Rs.)	-0.0415*	0.1243*	0.054 ^{NS}	0.088*
10	Human Labour (hrs.)	0.481*	1.274*	2.848 ^{NS}	0.839**

The results of multiple regression analysis indicated that the factors responsible for buffalo milk yield of sample households were number of buffaloes, quantity of green fodder and concentrates fed to animal and human labour. These factors explained 92 percent variation in the milk production at overall level. The value of R² was lowest in medium heard size group. The results clearly indicated that the as the age of animal increase there is decline in milk yield. The veterinary expenses also showed significant impact on milk production at the overall level and medium heard size group whereas it was negatively significant for small heard size group and nonsignificant for large heard size group. The Pandharpuri buffalo milk production per buffalo per lactation of sample milk producers was 1168.24 liters which is less than average productivity of Pandharpuri buffalo i.e. 1700 liters. Multiple regression analysis indicated that increase in the quantity of green fodder and concentrates will result in increase in milk yield hence it is suggested that milk producers may be motivated to increase the use of green fodder and concentrate for securing higher milk yield.

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