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Economic losses due to Clinical Mastitis in Cross-Bred Cows

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Abstract

Experimental data from stock-health registers and history sheets of animals maintained at the institute for a period of twelve years (2000-2011) was used for this study. A total of 1078 lactation records comprising Karan Fries (943) and Karan Swiss cows (135) were classified according to parity viz., I, II, III, IV, V, VI & above. The average days under treatment were maximum in 1st parity (14.28) and minimum in 3rd parity (8.63). The total treatment cost was more (P<0.05) in 4th parity (Rs. 470.52) and less in 2nd parity (Rs. 250.00). The fibrosis rate of quarter was maximum in 5th parity resulting in higher loss of animal value. The parity wise result indicated highest loss in milk yield/day and the production loss in third parity (5.40kg and Rs. 1020.24) than in first parity (4.45kg and Rs. 754.80). The loss of milk yield/ day, duration of mastitis in days, production loss, average days under treatment, total cost of treatment and average number of quarter affected/mastitis infected cow were higher (P<0.01) in the year 2011 and lower in 2003. The grand total loss /cow was highest in the year 2011 (Rs. 3763.81) and lowest in 2001 (802.63). Grand total loss /cow was maximum with a THI score of 73-78 which was similar for the THI score <72 or 79-89. The overall actual loss of milk yield/day (kg) of mastitis infected cows was higher (P<0.01) in KF followed by SW, TP, KS cows and Murrah buffaloes. The various parameters of economic losses during different years was significant (P<0.01) in different breeds except for average number of quarter affected per mastitis infected animal. However, there was no effect of parity or season on mastitis infection.

Keywords: Crossbred cows; Sahiwal; Tharparkar; Mastitis; Parity; Breed; Economic loss

Introduction

Mastitis is one of the costly diseases in dairy animals and causing severe losses to the dairy industry. The losses due to mastitis are not only economic but issues like animal health and welfare, quality of milk, antibiotic usage and the image of the dairy sector are also important reasons to focus on mastitis control programme. Mastitis causes a great deal of loss or reduction of productivity to influence the quality and quantity of milk and to culling of animals at annual acceptable age [1].

Material and Methods

The experimental data was collected from stock-health registers and history sheets of animals maintained in the institute for a period of twelve years (2000-2011). The farm climateis subtropical in nature with the lowest temperature of 2 °C during winter months and the highest temperature up to 45 °C during summer season. The annual rainfall is about 760 to 960mm; however, most of the rainfall is received during the months of July and August. Relative humidity ranges from 41% to 85%. A total of 1078 lactation records comprising Karan Fries (943) and Karan Swiss (135) were classified according to parity viz., I, II, III, IV, V, VI & above. The years were divided into 2000 to 2012. The temperature humidity index was calculated on the basis of wet and dry bulb temperature during the period of study. THI was classified as < 72 (No stress), 73 to 78 (mild stress) and 79 to 89 (severe stress).The effects of non-genetic factors like parity, year and THI on economic losses due to clinical mastitis were estimated using the following formulae:

Economic loss = Production loss + Treatment loss + Loss of animal value

Production loss = Animal Mastitis days X Average loss of milk yield/day X Average price of milk/kg

Treatment loss = Average cost of treatment per day X Animal treatment days

Average cost of treatment per day = Total price of medicines used for treating mastitis /Animal treatment days

Loss of animal value = Average number of quarters infected/ animal X Fibrosis rate X Book value due to loss of each quarter

Fibrosis rate = Number of quarters resulted in fibrosis/ Number of quarters affected

The treatment cost incurred on mastitis was ascertained by considering the medicines used for treatment. The price of medicine was taken by using the wholesale price index of antibiotics with respect to the year 2011 as the base. The implied price service was used to calculate the cost of treatment based on the number of days an animal received treatment.

The loss of milk during the period of mastitis was calculated by the difference between the average milk yield potential of the dairy animals and average milk yield during disease. The milk yield potential of the dairy animals was taken as the average of 14 day's milk yield before the date of incidence of disease and 14 days after the cure of animals. The quantity of milk that reduced due to mastitis was considered as milk loss. The reduction in milk was recorded in liters.

The prevailing price of milk in 2011 was taken as milk procurement price being paid by the Haryana Milk Cooperative Federation based on fat and SNF percentage in milk. The prices of earlier years that is 2000-2010 was worked out using the wholesale price index of milk with year 2011 as the base. These prices were then multiplied by the quantity of milk losses to arrive at the production loss in value terms.

The loss of book value of an animal due to incidence of disease or defect was evaluated as per the practice followed at Livestock Research Centre at National Dairy Research Institute, Karnal. The prices of adult animals were kept same up to third lactation. Depreciation @10% was accounted for 4th and 5th lactations. The rate of depreciation was doubled beyond 6th lactation to the maximum of 80 per cent.

Mastitis: The depreciation was calculated in animals suffering from mastitis as under

I. One teat blind → 15%

II. Two teat blind → 40%

III. Three teat blind → 60%

IV. Four teat blind → 90%, if not pregnant

The depreciation was charged at the rate of 80% in case of confirmed pregnancy.

Results

The overall loss of milk yield per day was more in KF than the KS (4.90 vs 3.41kg) however average mastitis days were non-significant between the breed (16.12 vs 17.02 days). The average production loss was higher in KF than the KS (Rs 867.95 vs Rs 622.01) but days under treatment were not different (12.13 and 12.06 days). However, treatment expenditure/day (Rs. 32.13 vs 35.83) and total treatment expenditure (Rs 389.16 vs 431.98) was lower in KF cows in comparison to KS (Table 1). Fibrosis rate and average number of quarter affected/mastitis infected cows did not vary between the breed. Each fibrosed quarter led to the declining of value by Rs 2296.54 and Rs 1297.15 in KF and KS cows respectively. The loss of animal value was higher in KF than the KS cows (Rs 238.32 and 173.09) and grand total loss was Rs 1227.08 in KS cows and (Rs 1495.43) in KF cows infected with clinical mastitis.

Table 1

Effect	No.	Average loss of milk/ day (kg)	Average mastitis days	Average price / kg of milk (Rs.)	Production loss (Rs.) (6)=(3)x (4)x(5)	Average days under treatment	Treatmentexpenditure / day(Rs.)	Total treatment expenditure (Rs.) (9)=(7)x (8)	Fibrosis rate	Average number. of quarter affected / mastitis infected cow	Decrease value of each fibrosed quarter (Rs.)	Loss of value/ cow(Rs.) (13)=(10) x(11) x(12)	Grand total loss(Rs./ cow) (14)=(6) x(9) x(13)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Overall	135	3.41	17.02	10.02	622.01	12.06	35.83	431.98	0.06	1.61	1297.2	173.09	1227.1
Parity													
First	32	2.98	19.78	9.63	567.63	14.28	32.44	463.25	0.04	1.5	2136	133.5	1164.4
Second	28	3.33	15.79	9.05	475.73	10.84	23.06	250	0.04	1.7	2091	142.19	867.91
Third	19	3.23	11.58	8.9	332.86	8.63	40.09	345.95	0.04	1.38	2091	110.98	789.79
Fourth	16	3.46	16.44	8.82	501.63	10.88	43.25	470.52	0.07	1.75	1983.2	247.89	1220
Fifth	13	3.02	20.43	9.59	591.69	13.07	28.78	376.16	0.11	1.57	1639	270.87	1238.7
Sixth & above	27	3.48	13.92	10.42	504.76	9.88	36.85	364.12	0	1.73	0	0	868.88
Year													
2000	15	2.03	17.33	7.88	277.27	14.87	20.8	309.17	0.11	1.87	1976.4	395.99	982.43
2001	22	2.82	20.09	8.06	456.65	16.32	17.08	278.67	0.08	1.77	2061.8	280.72	1016
2002	13	5.33	16.77	8.37	748.11	12.46	25	311.54	0	1.92	0	0	1059.7

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2003	20	2.25	6.35	8.53	121.87	5.6	34.48	193.07	0	1.4	0	0	314.94
2004	16	2.45	14.94	8.96	327.91	10.31	39.78	410.21	0	1.31	0	0	738.12
2005	14	3.1	9.5	9	265.05	6.07	42.4	257.42	0	1.36	0	0	522.47
2006	9	6.58	31.33	9.56	1971.02	14.44	38.1	550.39	0.07	1.67	1962.9	218.54	2740
2007	4	5.28	8	10.14	428.31	7.25	32.52	235.77	0	1	0	0	664.09
2008	5	2.73	20.2	10.81	596.13	17	53.43	908.24	0.25	1	1657.3	414.32	1918.7
2009	6	2.56	18.67	12.36	590.64	10.33	40.27	416.17	0.07	2.33	1620.8	251.77	1258.6
2010	5	3.97	35.6	15.39	2175.1	25.8	47.44	1223.92	0.14	1.4	2091	418.2	3817.2
2011	6	3.28	11.67	16.86	645.18	9.33	59.22	552.68	0	2.33	0	0	1197.9
Thi Score													
< 72	51	3.17	17.16	9.58	521.13	11.71	30.16	353.14	0.06	1.84	1891.6	201.87	1076.1
73 to78	23	3.17	16.22	9	462.68	13.52	29.92	404.57	0.13	1.48	2121	408.08	1275.3
79 to89	61	3.34	15.74	9.53	500.93	10.61	37.38	396.61	0.05	1.49	1917.2	139.98	1037.5

Effect of parity on economic losses in KF and KS cows

The parity wise result indicated highest loss in milk yield/day and the production loss in third parity (5.40kg and Rs 1020.24) than in first parity (4.45kg and Rs 754.80). The days in mastitis were more in third parity (17.76 days) and were lower in 6th & above parity (15.10 days). Average price of milk / kg was more (Rs.10.79) in first parity and lower in sixth & above parities (Rs 9.74). The average days under treatment, treatment expenditure/day and the total treatment expenditure were marginally different during different parities. Fibrosis rate was maximum in 1st parity (0.09) and decreased in 6th&above parity (0.03). The average number of quarter affected/mastitis infected cow was more in 6th& above parities (1.83) and but lowest in 1st parity (1.42). The decrease in value of fibrosis quarter increased from first parity to fourth parity and therefore, declined with a value of Rs 876.67 in sixth & above parities. A similar trend in loss of value of cow was found during different parities (Table 2).

The grand total loss was more in third (Rs 1693.43) and lower in 6th&above parities (Rs 1171.06) in KF cows. In Karan Swiss cows the average loss in milk yield/day varied from 2.98kg in first parity to 3.48kg in sixth & above parity and increased with increase in parity order in KS cows. There was no trend in average number of days in mastitis which ranged from 11.58 to 20.43 in different parities. The average price of milk/kg was higher in 6th & above parity (Rs 10.42); however, milk production loss was maximum in 5th parity (Rs 591.69) and minimum in 3rd parity (Rs 332.86). The average days under treatment were maximum in 1st parity (14.28) and minimum in 3rd parity (8.63). The total treatment cost was more (P<0.05) in 4thparity (Rs 470.52) and less in 2nd parity (Rs 250.00). The fibrosis rate of quarter was maximum in 5th parity resulting in higher loss of animal value. However, number of quarters affected /cow did not exhibit any set pattern. The grand total loss/cow was higher in fifth (Rs 1238.72) and lower in sixth & above parities (Rs 868.88).

Table 2

Effect	No.	Average Loss of Milk/ day (kg)	Average Mastitis Days	Average price / kg of milk (Rs.)	Production loss (Rs.) (6)=(3)x (4)x(5)	Average days under treatment	Treatmentexpenditure / day(Rs.)	Total treatment expenditure(Rs.) (9)=(7)x (8)	Fibrosis rate	Averageno. of quarter affected / mastitis infected cow	Decrease value of each fibrosed quarter (Rs.)	Loss of value/ cow(Rs.) (13)=(10) x(11) x(12)	Grand total loss(Rs./ cow) (14)=(6) x(9)x(13)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Overall	943	4.9	16.12	10.46	867.95	12.13	32.13	389.16	0.06	1.62	2296.54	238.32	1495.43
Parity													
First	260	4.45	15.72	10.79	754.8	11.47	34.26	392.92	0.09	1.42	2294.97	308.94	1456.66
Second	176	4.66	15.73	10.76	788.73	12.64	31.87	402.84	0.06	1.61	2389.44	230.53	1422.1
Third	169	5.4	17.76	10.64	1020.24	13.22	32.69	432.33	0.05	1.71	2713.69	240.86	1693.43
Fourth	121	4.98	15.82	10.43	822.27	11.26	34.64	390.24	0.06	1.66	2827.62	303.79	1516.3
Fifth	78	5.12	16.52	9.98	844.13	12.68	29.58	375.09	0.06	1.64	2679.21	274.01	1493.23
Sixth & above	138	5.31	15.1	9.74	780.96	11.58	29.3	339.24	0.03	1.83	876.67	50.86	1171.06
Year													

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2000	84	4.48	17.9	7.88	631.91	14.12	20.57	290.45	0.13	1.31	2615.29	434.95	1357.31
2001	61	3.93	13.26	8.06	420.02	11.08	17.1	189.47	0.07	1.46	1975.83	193.15	802.63
2002	72	4.47	13.08	8.37	489.04	10.04	27.68	277.91	0.05	1.54	2348.65	162.94	929.89
2003	76	3.81	11.78	8.53	382.36	9.04	30.28	274.67	0.05	1.51	2133.4	167.86	824.89
2004	75	4.18	15.15	8.96	567.41	11.03	33.38	368.17	0.01	1.57	2316	29.15	964.73
2005	108	5.83	17.82	9	935.02	12.14	33.74	409.63	0.03	1.64	2079.09	115.17	1459.81
2006	93	5.4	15.4	9.56	795.06	10.98	44.46	488.11	0.08	1.69	2155.99	298.45	1581.63
2007	70	4.82	12.23	10.14	597.67	9.07	36.19	327.28	0.05	1.61	2067.74	176.91	1101.86
2008	69	5.12	16.7	10.81	923.64	12.41	40.94	507.86	0.04	1.67	3127.25	224.12	1655.62
2009	74	4.27	17.03	12.36	898.75	10.93	39.44	431.21	0.07	1.66	2166.03	262.82	1592.79
2010	85	5.79	18.89	15.39	1683.1	14.61	24.31	355.16	0.05	1.75	1583.1	127.65	2165.92
2011	75	6.03	22.81	16.86	2320.41	18.91	38.55	728.93	0.12	1.95	2983.92	714.47	3763.81
Thi Score													
< 72	375	5.13	17.06	10.84	948.69	12.95	32.94	426.57	0.06	1.66	2337.88	229.16	1604.42
73 to78	150	4.93	18.45	10.29	935.67	13.87	29.65	411.17	0.06	1.67	2179.47	203.42	1550.25
79 to89	417	4.7	14.26	10.25	686.98	10.68	33.06	353.08	0.07	1.56	2376.09	255.56	1295.61

Effect of year on economic losses in KF and KS cows

The loss of milk yield/day, duration of mastitis in days, production loss, average days under treatment, total cost of treatment and average number of quarter affected/mastitis infected cow were higher (P<0.01) in the year 2011 and lower in 2003. The total cost of treatment and the average number of quarter affected/mastitis infected cows were lower in 2000 and 2001. Further, the average price of milk/kg increased from 2000 to 2011 while treatment cost/day was highest (Rs 44.46) in 2006 in comparison to Rs 17.10 in 2001. The decrease in the value of each quarter was maximum in 2011 (Rs 2983.92) and minimum in 2010 (Rs 1583.10). The loss of animal value in more was 2011 (Rs 714.47) and less in 2004 (Rs 29.15). The grand total loss/cow was highest in the year 2011 (Rs 3763.81) and lowest in 2001 (802.63). In general the economic loss was almost higher during the period 2011 in Karan Fries cows (Table 2). The average loss of milk yield/day was higher in period 2006 (6.58kg) and lower in 2000 (2.03kg; Table 1). Further, average mastitis days, production loss, average days under treatment, total treatment expenditure and loss of grand total /cow were maximum value (35.60, Rs 2175.10, 25.80 days, Rs 1223.92 and Rs 3817.22) in 2010 and minimum (6.35, Rs 121.87, 5.60 days, Rs 193.07 and Rs 314.94) in the year 2003. The average price of milk/kg increased steadily in order during period 2000 (Rs 7.88) to 2011 (Rs 16.86); the treatment cost/day ranged between Rs 17.08 to Rs 59.22 in different periods of study. The data on fibrosis rate, average number of quarter affected/ mastitis infected cow, decrease in the value of each fibrosed quarter, loss of animal value was consistently different in all the periods of Karan Swiss cows.

Effect of THI on economic losses in KF and KS cows

The pooled data of THI score over the years indicated that the loss of milk yield/day was more when THI score was <72 and was similar with THI score of 73-78 and 79-89 (Table 1). However, average price of milk / kg (Rs 10.84), average production loss (Rs 948.69), total treatment expenditure (426.57), average number of quarter affected/mastitis infected cow (1.66) and grand total loss (1604.42) was more with a THI score of <72. In Karan Fries cows the average loss of milk yield/day, average mastitis days, average price of milk / kg and average production loss were marginally different with different THI score. The average days under treatment and the total treatment expenditure were higher when THI ranged between73 to 78 (13.52 days and Rs 404.57). The loss of animal value and fibrosis rate were higher in THI range of 73 to 78 (0.13 and Rs 2121.00) and was lower with a THI score < 72 (0.06 and Rs 1891) but average number of quarters affected/mastitis infected cow were higher when THI score was < 72. Grand total loss /cow was maximum with a THI score of 73-78 which was similar for the THI score <72 or 79-89.

Effect of breeds and parity: The result of different breeds revealed that the overall actual loss of milk yield/ day (kg) of mastitis infected cows was higher (P< 0.01) in KF followed by SW, TP, KS cows and Murrah buffaloes. The average days in mastitis were more (P<0.05) in SW as compared to crossbred cows. The production loss in rupees value was more (P< 0.01) in KF cows followed by SW, TP, MU and KS cows. The average number of quarter affected/mastitis infected animal was more in SW and crossbred cows (P<0.01) but least in Murrah buffaloes. The grand total economic loss was significantly more (P<0.01) in KF and SW cows than the Murrah buffaloes, TP cows but least in KS cows. The effect of parity was non- significant on any of the parameters under study in different breeds.

Effect of year and season: The various parameters of economic losses during different years was significant (P<0.01) in different breeds except for average number of quarter affected per mastitis infected animal. The interaction of breed x year was significant in the average number of quarter affected/mastitis infected animal. However, rest of the parameters were didn't differ significantly. Effect of season on economic losses was non-

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significant in different breeds. The interaction of breed X year further supported this fact.

Discussion

The total loss in indigenous SW and TP cows was more (Rs 1695.00) in this study than the crossbred (1597.64) cows and Murrah buffaloes (Rs 1498.44). Patel & Rao [2] estimated economic loss of Rs. 443.00 for Kankrej cow every year due to mastitis, out of which 12.29 percent was treatment cost. It has been found that cost per case or clinical mastitis was 54.47, 38.53 and 54.88 for amoxicillin, Cephapirin and oxytocin treatment in cattle [3]. However treatment cost/day was comparatively less in all the breeds of cows and corroborates earlier finding [4,5] Daily milk yield decline 2 to 4 weeks prior to clinical mastitis with a daily milk loss 5 kg in primiparous and 1 to 8 kg/day in multi-parous cows [6]. In this study the range was 4.45 to 5.40 kg irrespective of parity in KF cows and was more than the reported loss in milk (kg)/day in KF, KS and SW cows (2.1, 1.79, and 1.40kg) by Chand [7] and 2kg/d by Kuzomina [8] in buffaloes. The considerable variability in expenditure on treatment of mastitis was due to variation in treatment days, cost of medicine and health care of cows [8-11]. The average expenditure on drugs for treating mastitis has been reported ranging from Rs 7.81 to Rs 58/ case in different breeds of cows [9,12,13].

The incidence of mastitis in cows increased with increase in THI value of more than 72 as it initiates that stress and milk production starts declining [14]. THI value of 72-78 may cause very serious risk to milk production and requires efficient shelter and mechanical ventilation [15]. This was the reason of increased mastitis incidence in all the breeds in this study. It has been found that milk yield decreased by 0.41 kg/cow/day for each point increase in the THI values above 69 [16]. The adverse climatic condition of hot-humid and hot-dry season increases mastitis incidence in crossbred cows and the treatment cost of mastitis was Rs. 170.03 in winter, Rs 249.83 in summer, Rs 207.23 in rainy and Rs 212.35 in autumn season [17]. In summer buffalo' suffering from mastitis needs longer duration of treatment. Sharma et al. [18] observed variable milk yield losses and cost of treatment during different seasons indicating seasonal influence on mastitis as found in this study also. Considerable literature is available regarding the effect of THI and heat stress on milk production in cows and buffaloes [19] but comparative studies on mastitis incidence in different breeds is lacking. Several authors [17,18, 20] have reported incidence of mastitis during different seasons but the combined effect of temperature and humidity using THI is very scanty. In our study the lower THI value (<72) lead to more mastitis incidence in buffaloes and TP cows possibly due to being exposed to low ambient temperature during winter season in a loose housing system. Since buffaloes are more adoptive to harsh climatic condition, the incidence of clinical mastitis was less in Murrah buffaloes than the cow breeds in this study. However, non-significant effect of year on mastitis incidence was due to wide variability in climatic variable, management factors and number of observation in each year. The non-significant effect of duration of dry period on mastitis incidence indicated goodness of the prepartum health management of cows and buffaloes. The high incidence in early lactation could be due to non-adaptation to milking operation, disturbed metabolic adjustment leading to poor body condition postpartum.

The stage of lactation is also an important factor affecting how dairy cows respond to heat stress. Johnson et al. [21] observed that the mid-lactating dairy cows were most heat sensitive compared to their early and late lactating counterparts. The nutritional-metabolic conditions of dairy cows during the different lactation stages might explain the higher heat sensitivity of mid-lactating dairy cows [22]. In fact, milk yield in early lactating cows is strongly supported by tissue stores mobilization and less by feed intake, whereas milk yield in mid-lactating cows is mostly supported by feed intake, which reaches a peak in this stage.

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