



Effect of changes in milk yield and inter-calving period on profitability of commercial dairy farm

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Profitability of the dairy farm is governed by production, reproduction and genetic characteristics of the cattle. Reproductive traits are essential in determining the profitability of commercial dairy farms (Lobago *et al.* 2007). Improved fertility increases the profit of the dairy farmers by reducing the culling rate and shortening the inter-calving period. Good reproduction system is advantageous in increasing the production of milk. There are many factors which affect the milk yield of the dairy farm; inter-calving period (ICP) is one of them. ICP has economic importance as it affects total lifetime milk production and lifetime productivity of the animals hence economics of the dairy cattle rearers. The reproductive trait ICP is also influenced by various non-genetic factors like season of calving and parity, thereby affecting the milk production in a dairy farm. Profitability of a dairy farm is not only related with cost of production but also with milk production itself and breeding efficiency. Increased ICP shows that entrepreneurs received less profit. ICP of crossbred cattle was 389.98±21.36, 391.28±19.18 and 398.54±26.15 days in Haryana, Maharashtra and Odisha respectively (Kale *et al.* 2018). Short Inter-calving is important for maximizing herd profitability. If calving interval increase to 15 months from 12 months annual milk yield reduced from 4,500 to 3,372 kg and a loss of 0.94 to 3.15 USD occurs (Safiullah *et al.* 2001). Shortening of the calving interval from 14.2 to 13.0 months can increase average daily milk production by 1/2 gallon per head per day. This increase in production leads to increase the profitability of dairy farm. Milk production is maximum when inter-calving period lasts for 365 days (Krzyszewski *et al.* 2004). The inter-calving period and lactation was found to have significant effect on milk yield, fat and protein content ($P<0.01$) in the milk which determines the price of milk ultimately affects the profitability of the dairy farm (Micinski *et al.* 2008).

Keeping the important parameters in mind, simulation was done to know the effect of changes in milk yield (±20%)

and ICP (+ 4 and -2 months from baseline of 14 months) on profitability of dairy farm.

This study was based on some pre-assumed baseline parameters. Simulation was done on these parameters.

Herd size: 100 animals; milk yield, 15 litre/day and inter-calving period, 14 months.

In the present study, total milk yield is the summation of milk produced during a period of 5 years. Baseline milk productivity was considered to be 15 litre/day. Simulation exercise was done by changing milk yield by ±20% from the baseline productivity. Milk yield influence the sale proceeds and ultimately affect the different financial ratios like benefit cost ratio, internal rate of return and debt coverage ratio.

Biologically, the best (or minimum) ICP for a cow is 12 months; as animal has about 280 days of gestation period, and is served only after 60 days of calving. Theoretically, if there were no sterile /infertile cows in the herd, then with an ICP of 12 month, the annual pregnancy rate can be 100%. However, considering that about 5% of the herd would have reproductive problems the pregnancy rate for an ICP of 12 months has been taken as 95% in the present study. The pregnancy rate decreases with the increase in ICP reaching to an annual value of 0% for ICP of 21 months. Thus, from two points of ICP and pregnancy rates, i.e. (12, 95) and (21, 0) following linear relationship between pregnancy rate and ICP was built:

$$\text{Pregnancy rate} = 221.67 - (10.556 \times \text{inter-calving period})/100$$

Calving rate (the percentage of pregnant cows that finally calve) is = Pregnancy rate – Percentage of still births/abortion. Hence, ICP affects the number of animals expected to complete 300 days lactation in a year, and consequently the profitability of farms. This sequence of relationship is summarised in Fig. 1. (*number of adult females expected to complete 300 lactation days in a year).

For simulating the effect of change in ICP on financial feasibility of the project, the expected pregnancy rates for ICP of 12, 14 (baseline) and 18 months was worked out and subsequently, corresponding financial parameters were computed as explained in flow chart above.

The average milk yield was considered to be 15 litre/day and ICP was 14 months was taken for this particular study.

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Table 1. Effect of increase (+20%) and decrease (–20%) in milk yield on project profitability

Particular	Year 1	Year 2	Year 3	Year 4	Year 5
Milk production per day per animal (litre): 15 (Baseline)					
Total milk production (litre)	361500	372345	383515	395021	406871
Sale proceeds (Milk) (₹)	12241031	12999224	13803973	14658124	15564697
Financial parameter	BC ratio	1.48	IRR	54	
Milk production per day per animal (litre): 18 (+20%)					
Total milk production (litre)	433800	446814	460218	474025	488246
Sale proceeds (Milk) (₹)	14771531	15683832	16652073	17679673	18770258
Financial parameter	BC ratio	1.74	IRR	76	
Milk production per day per animal (litre): 12 (–20%)					
Total milk production (litre)	289200	297876	306812	316017	325497
Sale proceeds (Milk) (₹)	9710531	10314617	10955873	11636574	12359135
Financial parameter	BC ratio	1.22	IRR	31	

Table 2. Effect of inter-calving period on project viability

Inter-calving period (Months)	BC ratio	IRR (%)
12	1.56	62
14 (baseline)	1.48	54
18	0.68	–11

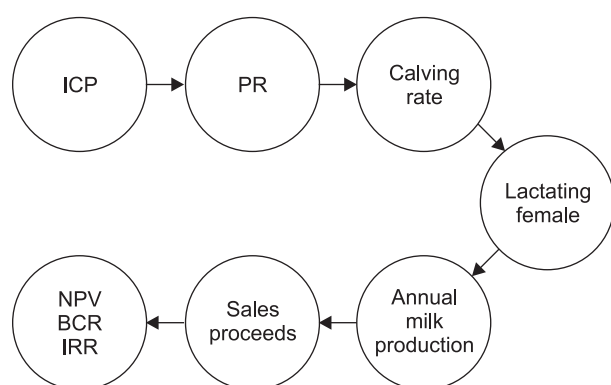


Fig. 1. Effect of Inter-calving period.

Milk yield is one of the most vital parameter influencing farm profitability. A 20% increase in milk yield from baseline increases the BC ratio to 1.74 and IRR to 76% (Table 1).

The table depicts that as the enhancement in milk yield increases the total sale of the milk, the net cash inflow on the farm goes up.

Farm is running in profit if the milk yield increases. As the milk yield decreases, it leads to decrease in net farm income. If the milk yield decreases, project is going towards the loss situation. If the milk yield drops to 12 litres/day, then IRR will be only 31%, a 23% point drop from the baseline. The BC ratio declines to 1.22 indicating a very limited margin of project viability.

An improvement in inter-calving from 14 to 12 months would have a strong positive effect on BC ratio—increasing it to 1.56 from base line, while the IRR rises to 62% that is 25 point increase from baseline.

On the other hand, an inter-calving period of 18 months on commercial farms enders them unprofitable with BC

ratio of less than 1 (0.68) and negative IRR is –11%.

SUMMARY

The present study was conducted for crossbred commercial dairy farms in India to study the effect of various reproductive parameters, viz. milk yield and inter-calving period on their profitability. The base parameters were identified under the field conditions and a base model was prepared. The milk yield and inter-caving period under field conditions were about 15 litres per day and 14 months respectively. The result indicated that profitability ratios were more sensitive to worsening ICP than decrease in milk yield. An average farm of 100 animals would continue to be profitable even if average milk yield dropped from 15 to 12 liters/day, but would not sustain if ICP increased from 14 to 18 months, thus emphasising the need to focus R&D and extension efforts on improving both, productive and reproductive traits of animals.

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