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Performance Of Lactating Cross Bred Cow Fed With Calcium And Phosphorus Supplemented Ration Under Farmers Managed Condition In Morang District

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Abstract
An action research based on field situation analysis was conducted based on key researchable issues identified by SLA works at Jhorahat VDC in Morang district from November 14, 2009 to March 13. The objective of the study was to find out the performance of lactating cross bred cow fed with calcium and phosphorus supplemented ration under farmers managed condition. An experiment was conducted using 20 milch cows at Jhorahat, in order to assess the milk production, milk fat and SNF content, feed intake, feed conversion efficiency, first post parturient estrus, serum calcium and phosphorus level, and benefit cost analysis of milk production. The experiment was conducted using Randomized Complete Block Design with 5 treatments and 4 replications. The treatments were diet without calcium and phosphorus (T_1), diet with 7.5 gm calcium and phosphorus (T_2), diet with 10 gm calcium and phosphorus (T_3), with 15 gm calcium and phosphorus (T_4), and diet with 20 gm calcium and phosphorus (T_5). The results of the study revealed that the daily mean milk yield was significantly ($p<0.05$) higher in T_4 (3.57 liters). Although non-significant ($p>0.05$) highest percent milk fat was observed in T_5 (4.90 percent) cattle fed with 15 gram calcium and phosphorus. The daily mean feed intake was significantly ($p<0.01$) higher in T_4 (8.37 kg). Similarly feed conversion efficiency was better in T_5 (2.49). A short post parturient estrus (60 days) was observed in T_5. The serum calcium (10.02 mg/dl) and phosphorus level (5.60 mg/dl) showed non-significant ($p<0.05$) increase in T_5. The net profit from increment of milk production was (NRs 9145.5) in T_4 with higher benefit cost ratio (6.3:1). The result showed that the supplementation of calcium and phosphorus with 15 gm /day positively affected the daily production.

Key Words: *System learning approach, lactating cross bred cow, farmers managed condition, performance*

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I. Introduction

Agriculture plays an important role in Nepalese economy by contributing 39.4 percent of share to the gross domestic products (GDP) and Livestock share 31 percent of the national agricultural products (CBS, 2005). Among the agricultural commodities, livestock plays an important role in agricultural development and economic upliftment of the country. Cow raising has been an integral component of the Nepalese farming system throughout the known history. They have been traditionally raised for milk, urine , manure, draft power and also the reserve capital for the farm families. Dairy cow plays a crucial role in household economy of the Nepalese farmer's which ranks second among the livestock species for milk production and share the second highest proportion on livestock gross domestic products of the country. Nepal has currently a population of 7.04 million cattle distributed throughout the country's agro ecological zones and provide 327115 Mt milk annually. The dairy cattle accounts for 39.11 percent of total milk production (MOAC, 2006 and Statistical year book 2007). Dairy cows alone contribute 16 percent of the livestock share in the national GDP (APP, 1995).

The eastern region has 2.74 million milking cow providing 128936 Mt of milk annually. The dairy cattle accounts for 39.41 percent of total milk production (MOAC, 2006 and Statistical year book 2007).

Morang is eastern terai district of Nepal where cattle are kept for various purposes like milk, manure, cash income, and for traditional values. Low milk production and infertility in cow's accounts for major economic losses in small holder dairy farms of Morang.

The major constraints of the dairy cattle producing milk in Morang district is feed deficit in both the quantity and the nutritional quality. There is a feed deficit of 39% in Morang district. Agricultural land provides about 64% of total annual feed supply mainly in the form of low-quality crop residues while 36% comes from forest and grazing land. Feeding practices of dairy cattle includes paddy straw, wheat bhoosa and limited green fodder along with no or limited concentrates (DLSO Annual report, 2008). Paddy straw and wheat bhoosa which are the by product available after harvesting the grains from the main bulk of the roughages contain very

little digestible crud protein and are also poor sources of energy, mineral and vitamins. Factors like high lignin content reduced palatability dustiness and high oxalic acid limit their extensive uses as cattle feed (Ranjhan 2003).

Calcium and phosphorus are minerals needed in dairy cattle ration in relatively large quantities because of their role in enhancing milk production as well as maintaining reproductive cycle (Schmidt and Vanvleck.1982). Deficiency of these minerals results in decreased milk production and failure of reproduction. For proper absorption of nutrients, maintenance of growth rate and feed utilization, calcium and phosphorus contents in the diet should be within certain proportions. The requirement of calcium and phosphorus contents in the diet should be within certain proportions. The requirement of calcium and phosphorus in growing, reproducing and milk producing animals is fairly high, as milk drains out a lot of calcium and phosphorus. Deficiency of these minerals results in retardation of growth, loss of appetite and deranged reproduction (Rangeker, 1990). Series of surveys and DLSO have reported the deficiency of calcium and phosphorus as one of the major constraint in performance of milch cows. Hence, the present study was designed to evaluate the performance of cross bred dairy cattle fed with calcium and phosphorus supplemented ration under farmers managed conditions of Morang district with the following general and specific objectives.

II. Materials And Methods

An action research based on field situation analysis was conducted based on Key researchable issues identified by SLA works at Jhorahat VDC in Morang district from November 14,2009 to March 13,2010. The objective of the study was to find out the performance of lactating cross bred cow fed with calcium and phosphorus supplemented ration under farmers managed condition. An experiment was conducted using 20 milch cows with close lactation of about 30 to 60 days from 120 cross bred cows were selected considering one cow from each household in order to reduce the heterogenecity in feeding , milk yield, breeding, management and health status and in order to assess the milk production, milk fat and SNF content, feed intake, feed conversion efficiency, first post parturient estrus, serum calcium and phosphorus level, and benefit cost analysis of milk production of cross bred lactating cattle fed with calcium and phosphorus supplemented diet under farmers managed conditions. The experiment was conducted using Randomized Complete Block Design with 5 treatments and 4 replications. The treatments were diet without calcium and phosphorus (T_1), diet with 7.5 gm calcium and phosphorus (T_2), diet with 10 gm calcium and phosphorus (T_3), with 15 gm calcium and phosphorus (T_4), and diet with 20 gm calcium and phosphorus (T_5). All farmers were provided two days training on cow management, especially not to change their usual nutritional management during experiment. Roughages were fed ad libtum which included the seasonal grasses and crop residues. The farmers were provided with tricalcium phosphate (I.P.) powder which contains calcium and phosphorus at the ratio of 2:1 (Ca-38% & P-19%). Farmers were taught to feed experimental animals with a little concentrates daily for the period of four months. Fecal and blood serum samples were collected and examined 7 days prior to the start of research. All animals were drenched with Oxyclosanide 3 percent w/v and Tetramisole 3 percent w/v i.e. Oxyzan-T liquid @ 0.3 ml/kg body weight. The data were first tabulated in Microsoft Excel and statistically analyzed in Randomized Complete Block Design (RCBD) using MSTAT-C computer software packages. Means were separated by using Least Significant Difference (LSD) at 5% level of significance.

III. Results And Discussion

Table 1. The daily mean of experimental cows fed with different levels of calcium and phosphorus supplemented diets under farmers managed condition, Jhorahat, Morang, 2009/2010

Treatment	Feed intake (Kg)	Milk yield (Liters)	FCE
T_1 Normal feeding without calcium and phosphorus supplementation	5.19^{c}	2.22^{c}	2.57
T_2 Normal feeding with 7.5 gm calcium and phosphorus supplementation	6.68^{bc}	3.30^{ab}	2.63
T_3 Normal feeding with 10 gm calcium and phosphorus supplementation	6.30^{bc}	3.04^{ab}	2.37
T_4 Normal feeding with 15 gm calcium and phosphorus supplementation	8.37^{a}	3.57^{a}	2.57
T_5 Normal feeding with 20 gm calcium and phosphorus supplementation	6.82^{ab}	2.76^{bc}	2.80
F-value	6.70**	9.72 **	0.68
Probability	<0.01	<0.01	>0.05
CV %	13.26	11.11	14.52
LSD	1.57	0.71	-

* Significantly at 5%, ** Significant at 1% and means in column with same superscript is not significantly different.

The overall mean calculated from (Table 1) revealed that the average daily feed intake (kg) of cross bred lactating cattle during experimental periods was highest (8.37 kg) in T_4 which was significantly ($p<0.01$) different with all the treatment except control (5.19 kg) in which it was significantly lower than the T_4 and T_5. The present findings is similar to the works of Call *et al., (1986), Kincaid et al., (1981), Prabu (2006), WU et al., (2000), Legel (1970), Schmidt (1982), Underwood (1981), Morron (2005), Long et al., (1957), Mc Dowel (1985), Nair (1984),* who reported that the daily feed intake significantly increased with calcium and phosphorus supplementation in diet. However, *William et al.,* (1983) and *Harris* (2003) conducted similar trials and their results were not in agreement with present findings. They reported that the daily feed intake did not significantly increase with calcium and phosphorus supplementation in diet. The general trend showed that feed intake increased with increase in calcium and phosphorus supplementation in ration. This increase in feed intake was due to increase in milk production which demanded more energy and consequently ate more feeds in order to make up the demand for energy.

Similarly, table 1 also revealed that significantly ($p<0.01$) maximum average daily milk yield (3.57 liters) was obtained from normal feeding with 15 gm calcium and phosphorus supplementation which was significantly different from normal feeding with 10, 20, and 7.5 gm calcium and phosphorus supplementation. The average daily milk yield (3.04 liters) from normal feeding with 7.5 gm calcium and phosphorus was significantly different from normal feeding with 20 gm calcium and phosphorus. However, minimum average daily milk yield (2.22 liters) was recorded from normal feeding with calcium and phosphorus supplementation (control) which was significantly different from normal feeding with 7.5 gm calcium and phosphorus supplementation. The results agree with the findings of *Banerjee (1998), Schmedit (1982), McDowell et al. (1986), Steevens et al. (2003), Underwood and Suttle (1999(, Boold and Radostits (1989), Steevens et al. (2003), Danier et al., (1990) and Block (1984)* who reported that feeding calcium and phosphorus in diets increased milk production. *Kncaid et al., (1981)* in at experiment supplemented calcium and phosphorus ration in 40 cows from parturition to 10 months post partum. He found lower milk yields in cows fed low calcium and phosphorus diets and increased milk production with calcium and phosphorus supplementation in diets. Similarly, *Prabu (2006)* found that cows fed diets low in phosphorus had lower milk yield and poorer efficiencies of milk production. WU *et al.,* (2000) also found reduced milk production when phosphorus was not supplemented in ration. Similarly, Call *et al.,* (1986) found a drastic change in milk production with incorporation of calcium and phosphorus in diets of cross bred lactating cow. So, feeding calcium and phosphorus supplemented ration to cross bred lactating cows significantly ($p<0.01$) increased average milk production as compared to control ones. This increase in milk production might be due to better utilization of nutrients. The milk production (liter/day) increased with the increase in the level of calcium and phosphorus in diets.

Table 2. The mean of experimental cows fed with different levels of calcium and phosphorus supplemented diets under farmers managed condition, Jhorahat, Morang, 2009/2010

Treatment	Initial		After	
	calcium	phosphorus	calcium	phosphorus
T_1 Normal feeding without calcium and phosphorus supplementation	6.67	4.35	8.55	4.80
T_2 Normal feeding with 7.5 gm calcium and phosphorus supplementation	5.65	4.20	9.57	4.80
T_3 Normal feeding with 10 gm calcium and phosphorus supplementation	7.67	4.00	9.70	4.90
T_4 Normal feeding with 15 gm calcium and phosphorus supplementation	7.05	4.32	9.72	5.05
T_5 Normal feeding with 20 gm calcium and phosphorus supplementation	6.77	4.37	10.02	5.60
F-value	2.08	0.17	1.93	0.24
Probability	>0.05	>0.05	>0.05	>0.05
CV %	15.06	17.86	8.54	27.34
LSD	-	-	-	-

* Significantly at 5%, ** Significant at 1% and means in column with same superscript is not significantly different.

No significant differences were seen in initial serum calcium levels of cross bred lactating cattle as it was in almost the same range in all groups of experimental cattle. None significantly ($p>0.05$) maximum average serum calcium level (10.02 mg/dl) after 120 days of experiment was obtained from normal feeding with 20 gm of calcium and phosphorus supplementation, which was not significantly different from normal feeding with 15 gm calcium and phosphorus supplementation. However, minimum average serum calcium level (8.55 mg/dl) was recorded from normal feeding without calcium and phosphorus supplementation. The serum calcium value (8.55 mg/dl) of normal feeding without calcium and phosphorus supplementation was not

significantly ($p>0.05$) lower than all other groups of experimental cattle which were fed 7.5, 10, and 15 gm of calcium and phosphorus in diets. As the levels of calcium increased in diets, the blood serum calcium levels also increased. None significantly higher level of calcium was seen in blood at level of 20 gm of calcium and phosphorus feeding in diets of experimental cattle.

Biswas and Samanta (2001) studied serum calcium and the relation with low performance of cows. He found low calcium in plasma of milch cattle which indicated that calcium supply was inadequate during lactation. Godwa *et al.,* (2001) found that 44% of animals exhibited low plasma calcium than normal and concluded that low calcium level in blood plasma might have resulted reproductive problems. Daniel *et al.,* (1990) found that cows with depleted blood calcium near calving showed negative effects on milk production and reproduction. Bahga (2003) reported that the lower levels of serum calcium may be one of the several causes of infertility in cattle and buffalo bulls. Similar observations were reported by Chandrahar *et al.,* (2003) in repeat breeding cows and Balkrishan and Balagopal (1994) in repeat breeding buffaloes. Sunder *et al.,* (2000) observed low level of calcium in blood which was responsible for reproductive problems and infertility. Prasad and Maurya (2002) also reported higher conception rate in cows fed calcium in diet than those which had lower levels of calcium in blood. Arosh *et al.,* (1998) reported significantly ($p<0.01$) lower values of calcium in an estrous cows in comparison to normal cycling animals. Verma and Paul Gupta (1984) reported that calcium and phosphorus deficiency occurs in cows when their level falls below 8 and 3.8 mg/dl respectively. Umesh *et al.,* (1995) concluded that serum calcium of anestrous ones was higher than that of that of estrous ones. Rajora and Pachauri (1997) and Singh *et al.,* (2005) found that serum calcium was significantly lower in lactating cows. Sahoo *et al.,* (2007) concluded that average serum calcium level of poor productive milk cattle was 6.90 ± 0.094 mg/ dl. Similar findings have also been reported by steevens *et al.,* (2003), Sundar *et al.,* (2007), Bansal *et al.,* (1978), and Katsuya (2003). However, the findings of Jaya Chandran *et al.,* (2000). Awasthi and Kharche (1987) are different. They studied biochemical profile in buffaloes and found that serum calcium level did not show any variation in all the animals and values ranged from 4.1 mg to 7.5 mg/dl. Raja Kumar and Srivastava (2008) also found no significant difference in calcium level between cyclic and acyclic cows. Similar findings were also observed by Tandle *et al.,* (1997) and Ramakrishna (1997).

Similarly, none significantly maximum average serum phosphorus level (5.60 mg/dl) after 120 days of experiment was obtained from normal feeding with 20 gm calcium and phosphorus supplementation, which was not significantly different from normal feeding with 15 gm calcium and phosphorus supplementation. However, minimum average serum phosphorus level (4.8 mg/dl) was recorded with normal feeding with no calcium and phosphorus supplementation (control) which was not significantly different from normal feeding with 7.5 and 10 gm calcium and phosphorus supplementation. Results showed that average serum phosphorus levels did not significantly increase with different levels of inclusion of calcium and phosphorus in diets compared to those group of experimental cow which were not fed with calcium and phosphorus.

The average serum phosphorus level (mg/dl) initially was lower in experimental cows than normal value (3-9 mg/dl) but at end of experiment the mean serum phosphorus value of experimental cows showed an increasing trend following the increasing level of calcium and phosphorus in diets. Results are in agreement with the findings of Bishwas and Samanta (2001), who reported increased serum phosphorus levels in cows, fed phosphorus supplemented diets. Gowda *et al.,* (2000) also found low serum phosphorus level in cows and concluded that low phosphorus level in blood plasma might have resulted reproductive problems. Bahga (2003) reported higher phosphorus in fertile cattle and buffalo bulls than infertile ones and concluded that a lower level of phosphorus in blood was the cause of infertility. Awasthi and Kharche (1987) reported similar findings in repeat breeding cows. Similar observations were reported by Chandrahar *et al.,* (2003) in repeat breeding cows and Balakrishna and Balagopal, (1994) in repeat breeding buffaloes. Raja Kumar and Srivastava (2008) reported significantly lower phosphorus in anoestrus cows than estrus one. Similar findings were also observed by Tandle *et al.,* (1997), Ramakrishna (1997), Das *et al.,* (2002), and Yadav *et al.,* (2004). Similarly, Prasad and Maurya (2002) reported higher level of phosphorus in cows who were pregnant than those who were not. Arosh et al., (1998) reported significantly ($P<0.01$) lower values of phosphorus in anestrous cows in comparison to normal cycling animals. Verma and Paul Gupta (1984) reported that phosphorus deficiency occurs in buffaloes when their level fall 3.8mg/dl. Umesh *et al.,* (1995) found lower serum phosphorus in rural buffaloes which were anoestrus than those which were in estrus. Rajora and Pachauri (1997) found that serum phosphorus was significantly lower in lactating cows. Singh *et al.,* (2005) found lower serum phosphorus in infertile and repeat breading buffaloes than those which were fertile and regular breeders. Bansal *et al.,* (1978) also found that the anoestrus animals possessed low level of serum phosphorus and this leads to imbalance of calcium and phosphorus ratio resulting in the lower fertility rate. The serum phosphorus level in regular breeding animals ranged from 5 mg/dl to 7.35 mg/dl whereas it was 3.82 mg/dl to 5.29 mg/dl in repeat breeding animals. Thus, serum phosphorus level was significantly ($P<0.01$) reduced in breeding buffaloes than regular breeding animals as studied by Chandrahar *et al.,* (2002), Balakrishna and Balagopal (1994), and Morrow (1969) found reduced fertility rate and a greater number of services per conception in phosphorus deficient heifers. Steevens *et al.,*

(2003) and Katsuya Kida (2003) also found that there is increase in serum phosphorus level with increase in dietary level of phosphorus in dairy cows.

Table 3. The mean post parturient estrus (days) of experimental cows fed with different levels of calcium and phosphorus supplemented diets under farmers managed condition, Jhorahat, Morang 2009-2010

Treatment	Days after calving
T_1 Normal feeding without calcium and phosphorus supplementation	105^a
T_2Normal feeding with 7.5gm calcium and phosphorus supplementation	90^b
T_3 Normal feeding with 10gm calcium and phosphorus supplementation	85^b
T_4 Normal feeding with 15gm calcium and phosphorus supplementation	80^b
T_5 Normal feeding with 20gm calcium and phosphorus supplementation	60^c
F-value Probability	14.47 0.00**
CV%	10.24
LSD	13.25

Significant at 5%, ** Significant at 1% and means in column with same superscript is not significant different.

Average first post parturient heat of experimental cow fed with calcium and phosphorus supplemented ration under farmers managed condition is presented in Table 3. Accordingly, overall maximum average first post parturient heat (105 days) was seen with normal feeding without calcium and phosphorus supplementation, which was significantly different form normal feeding with 7.5, 10 and 15 gm calcium and phosphorus supplementation, however minimum average first post parturient heat (60 days) was recorded with normal feeding with 20 gm calcium and phosphorus supplementation which was significantly different from all other treatments. Result also showed a decreasing trend in the number of days post parturient heat of experimental cows with inclusion of Calcium and phosphorus in diets. Cows came in heat earliest when 20 gm of calcium and phosphorus was supplemented in the diets. This probably might be due to better utilization of nutrients. This resulted in the efficient functioning of the ovaries. Results confirm the finding of Herrick (1977) who reported that deficiency of calcium and phosphorus causes low fertility. Calcium deficiency may be directly or indirectly responsible for infertility, but the disturbed calcium phosphorus ratio has a blocking action on the pituitary gland and consequently on ovarian action prolonging the interval of first ovulation. Similarly, several authors have also concluded that dietary calcium and phosphorus have significant effect on fertility of buffaloes specifically the 1st post parturient estrus. In the present experiment cows fed with 20 gm calcium and phosphorus in diets brought the cows in heat the earliest i.e. after 60 days of calving which is significantly lower than all other groups thus, reducing the calving interval. These findings are in close agreement with Kaushish *et al*., (1988) who found I[st] heat at 96±9.76 days in a study of 142 cows. Study carried out by Gupta (1977), Read et al., (1986), Dutta *et al.,* (2004), Scharp (1979), Herrick (1977), Belonje and Van der Walt (1971), Marron (2005), Arthur *et al.,* (1989), Hignett (1951), Dhoble and Gupta (1986), Parkimon (2001), Blood and Radostis (1989), Singh *et al.,* (2005), Sah and Nakao (2006) are also agreement with current findings who reported decrease in number of days to post parturient estrus of Buffaloes. But the findings of Dabas *et al.,* (1987), Jaya Chandran *et al.,* (2007), Awasthi and Karche (1987) are not in agreement with the present observation regarding the difference of level of calcium and phosphorus in cycling and anestrous animals. They reported that the level of calcium and phosphorus had no effect on first post parturient heat of buffaloes.

IV. Conclusion

Hence, it could be concluded that the milk production as well as milk composition (fat and SNF) of cross bred lactating cattle were affected by calcium and phosphorus levels in the diet. Inclusion of 15 gm calcium and phosphorus in diets resulted in the highest net profit. The optimum level of calcium and phosphorus was 15 gm/day, Hence, the cross bred lactating cattle fed diets deficient in calcium and phosphorus or grazed in poor grazing conditions without supplemental calcium and phosphorus should be fed with supplemental calcium and phosphorus in order to increase the milk production and improve the milk constituents.

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