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Effect of feeding maize silage on production performance in dairy cows

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ABSTRACT

Dairy farming is one of the important sectors of agriculture which is growing at faster rate and is providing food security, employment, income, and enhances the living condition of farmers and other stake holders. Silage is an alternative source of green fodder for round the year supply of roughage to dairy animals to sustain better production and reproductive performance over conventional feeding practices. The feeding trial was conducted to evaluate the effect of feeding maize silage on the production and reproduction parameters, in two phases. In first phase 59 lactating animals were fed 20 kg of maize silage daily and compared before and after feeding maize silage. In second phase 36 lactating cows were taken in three treatment groups T1, T2 and T3, having 6 high yielders and 6 low yielders in each group. A result shows that feeding maize silage to lactating animals improved milk yield, especially in high yielder cows. DMI (Dry matter intake) and reproductive performance were also improved in silage feeding group.

KEYWORDS

Silage, Milk Yield, Fat, Dry Matter Intake, Proximate Analysis

HOW TO CITE THIS ARTICLE

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Dairy production is one of the largest agricultural activities practiced in India. Synchrony between feed requirement of the animals and optimization of the available feed sources based on economics is the key to successful livestock management. Dairy plays an important role in food security, employment creation, income generation, and enhances the living condition of many dairy farmers, traders and processors and all participants in the entire milk supply chain. The contribution of forage in total animal feed is more than 75% and forage is a cheap source of nutrients (Kumar *et al*., 2014).

Regular supply of green fodder is a must for sustainable regular production and economic return from dairy farms. However, supply of green fodder throughout the year is limited due to the extreme seasonal scarcity, resulting in poor productivity of animals (Kumar et al., 2016). In the conventional daily cut and carry system adopted by famers to feed the livestock may affect the net energy balance of the animals if the green fodder is having high lignin content which increases with advancement of the age.

Also, the area under fodder crops is declining day by day due to ever increasing demand of cereal grains to feed the increasing human population and the competition from cash crops. Green fodder could be conserved to address the issue of shortage of fodder during lean periods. Further, during extreme climatic conditions like flood and drought, the conserved fodder in the form of silage can be of great help to the dairy farmers. Silage can replace the conventional fodder without any ill-effect on intake, digestibility, milk yield and its composition in dairy animals. Further, conserved fodder may be used throughout the year especially during fodder scarcity periods for regular growth and production of dairy animals (Azim *et al*., 2000; Tauqir *et al*., 2007). Silage being a partially pre-digested preserved green fodder enhances digestibility, Dry matter intake (DMI) and ultimately more Net energy (NE) will be available for production purpose.

Nutritionally maize silage is pre-digested green silage fodder and it complements well with green fodder which provides a relatively cheaper source of energy. Consistency of quality could be well managed by good management. For dairy animal high level of metabolizable energy (ME), protein and starch with low fibre are desired. Maize silage with low pH and low ammonia nitrogen and with high lactic acid content helps in better digestion. Such condition also favours long shelf life of maize silage. Further, its nutritive characteristics are largely determined by grain: stover ratio.

Keeping the above facts in mind, the present study was carried out with the aim to evaluate the effect of feeding maize silage on the milk production performance, quality of milk and reproductive performance in dairy cows.

Materials and Methods

Location of Trial

The study was conducted in Cattle farm of Animal Production Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar, India in the month of July-August, 2022. The GPS location of site is $25^0$58’48” N and $85^0$40’59”E. To evaluate the effect of feeding maize silage on the milk production performance, reproductive performance and milk quality in dairy cows, trials were conducted in two phases. In first phase milk production in 59 lactating animals were compared before and after feeding maize silage. In feeding group 20 kg of maize silage, divided in two equal doses in each cows, were given to each cows i.e. 10 kg in the morning hours and 10kg in the evening hours in addition to the normal daily ration for 14 days and the milk yield was recorded which was compared to the preceding 14 days milk yield data of the same 59 lactating animals.. Daily milk yield of all the lactating cows were recorded. Fat and SNF (solid not fat) were also recorded on weekly basis. In second phase during summer season, 36 lactating cows were randomly divided into three treatment groups T1, T2 and T3. Among each treatment groups 6 high yielders and 6 low yielders were taken as follows table 1.

Table 1. Treatment groups, number of animals were six (n=6)

Treatments	High Yielders	Medium Yielders
T1	20 kg maize silage/ day	20 kg maize silage/ day
T2	10 kg maize silage + 10 kg green fodder	10 kg maize silage + 10 kg green fodder
T3	0 kg maize silage/20kg green fodder (control)	0 kg maize silage/20kg green fodder (control)

Other feeding conditions were same for all the treatment groups as per the standard feeding procedure. Animals were given Dry matter (DM) @ 2.5 percent of their live body weight. One third of the feed requirement was met out from concentrate feed which was uniform for all the treatment groups. Rest two third of the dry matter was given as roughage ration. Daily milk yield of all the individual lactating cows were recorded.

Fat and SNF (solid not fat) were also recorded on weekly basis. To evaluate the effect of maize silage, biochemical and haematologicals parameters were also recorded. For the purpose blood samples were collected from jugular vein of the cows. Dialy DMI were also recorded by measuring the offered feed and left over feed of individul animals in each group.

Table 2. Proximate analysis of the maize silage and concentrate feed samples taken during experimental feeding trials

S. N.	Parameter (%)	First Phase	Second Phase	Concentrate Feed
1	Crude Protein	8.9	8.7	20.10
2	Crude fibre	28.8	29.6	11.80
3	Ether extract	7.1	6.9	3.00
4	NDF	48.7	50.2	24.30
5	ADF	32.7	35.1	8.15
6	Ash	10	10.6	5.9
7	Dry Matter	33.22	35.4	87.6

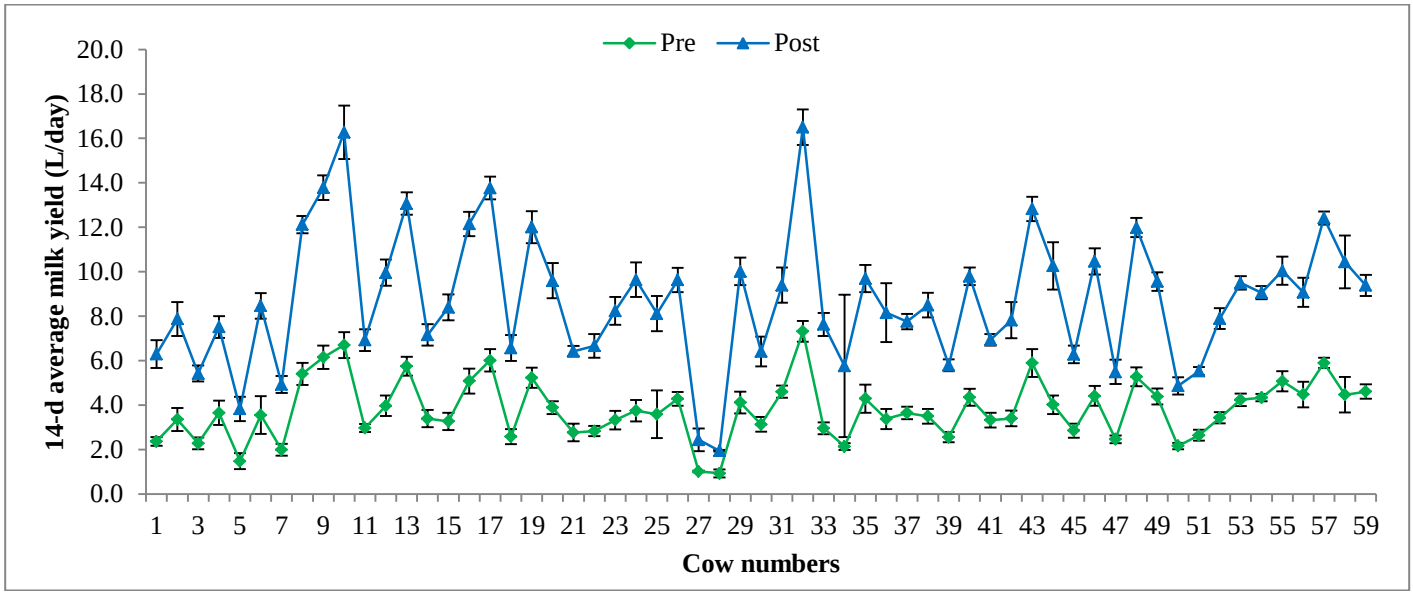

Fig 1. Variation in milk yield of 59 lactating cows for 14 days before feeding maize silage (Pre) and 14 days after feeding maize silage (Post)

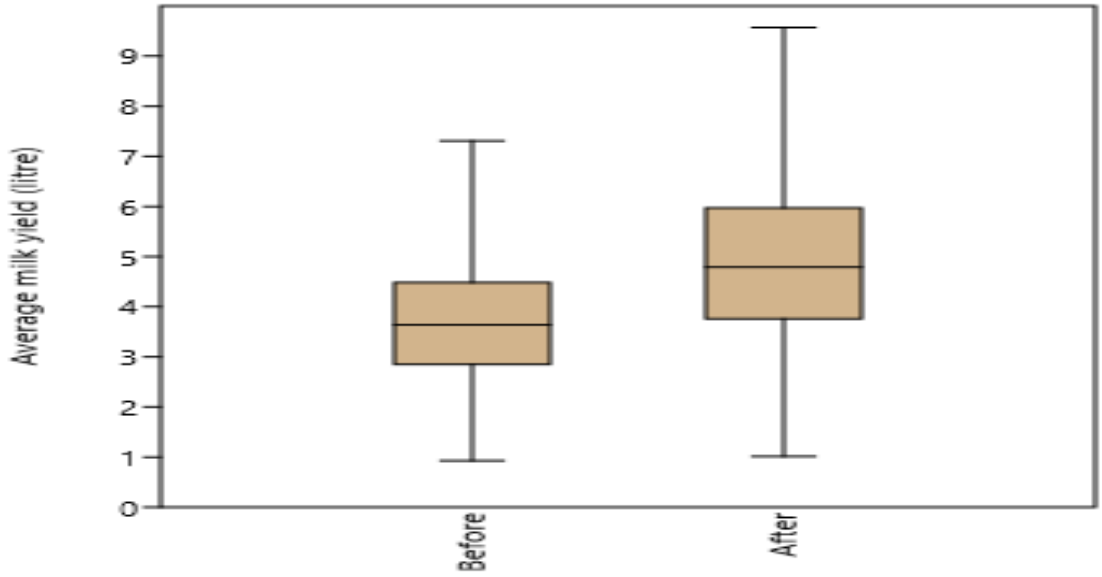

Fig 2. Box-plot showing variation in 14-d average milk yield of before and after feeding maize silage. The median values for before and after group were 3.64 and 4.79 litre, respectively.

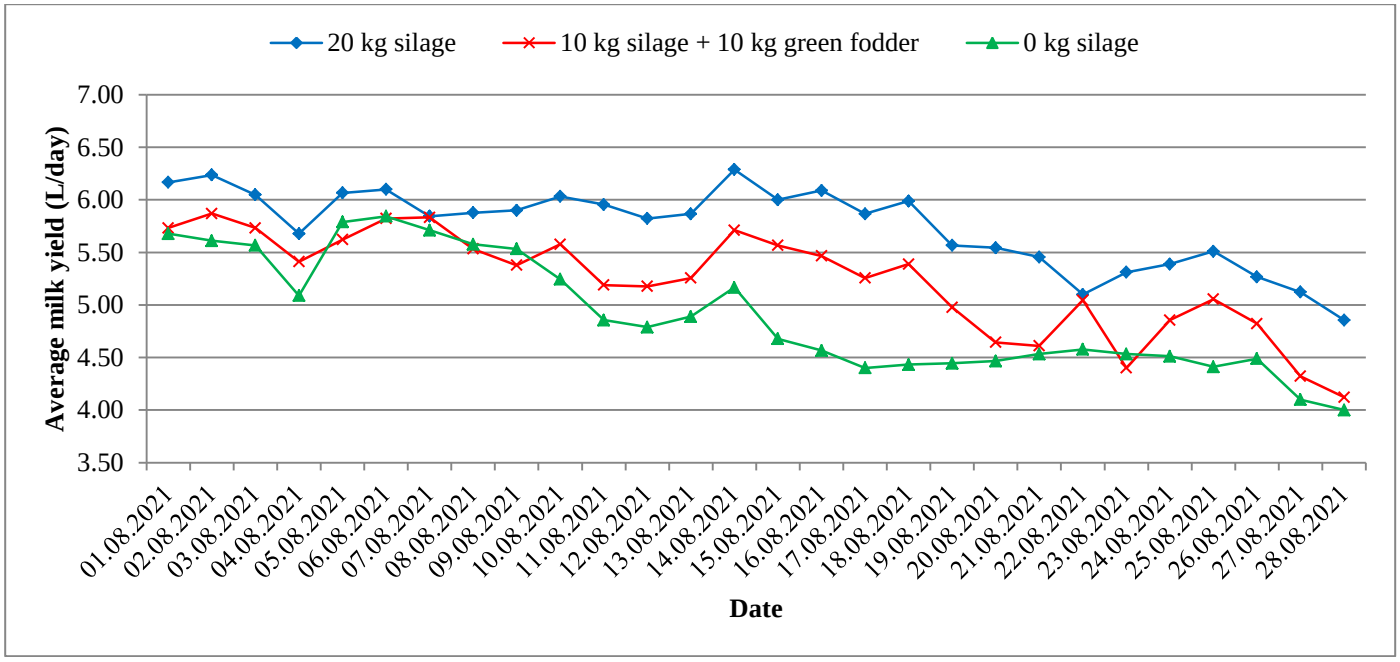

Fig 3. Effect of feeding maize silage on milk yield of high yielding lactating cows

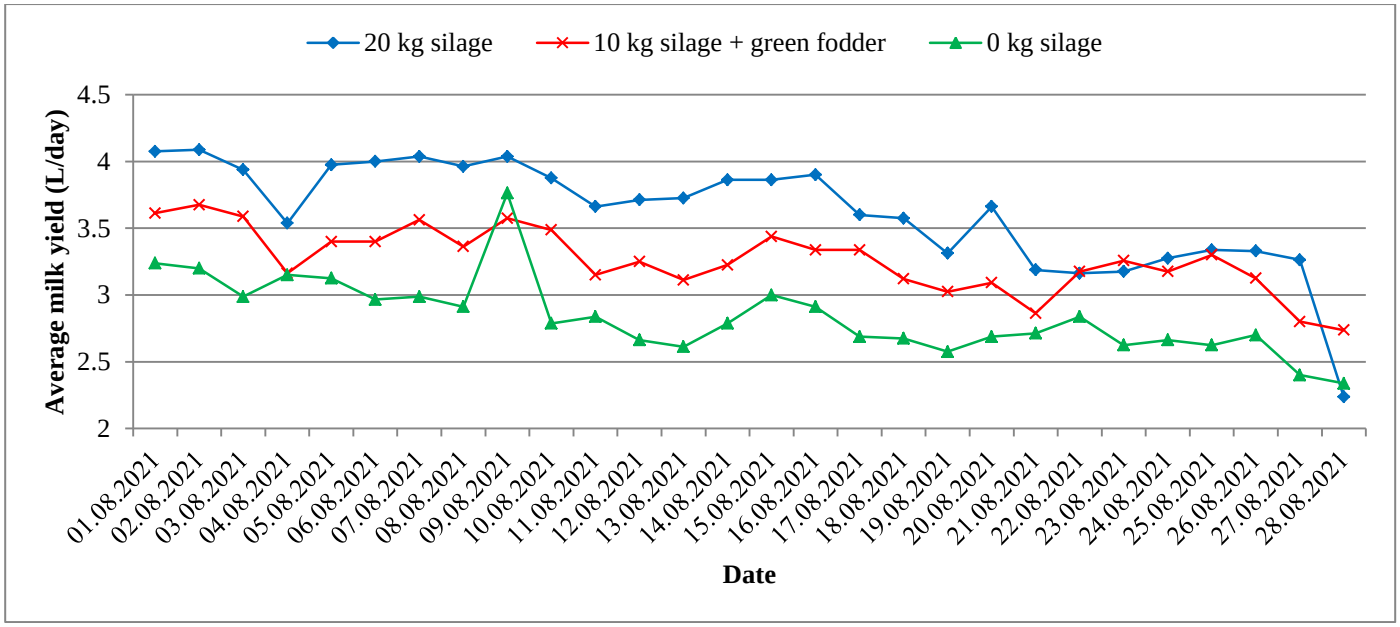

Fig 4. Effect of feeding maize silage on milk yield of low yielding lactating cows

Table 3. Effect of feeding maize silage on average milk yield (L/day) of lactating cows in high and low yielding groups

Groups	T1	T2	T3	Mean
High Yielder	5.748	5.228	4.910	5.295a
Low Yielder	3.620	3.262	2.838	3.240b
Mean	4.684a	4.245b	3.875c	
	High vs. Low Yielder	**Treatments**	**Interaction**	
SEm±	0.045	0.055	0.109	
CD (P=0.05)	0.125	0.153	NS	

Note: T1: 20 kg maize silage; T2: 10 kg maize silage + 10 kg green fodder; T3: 0 kg maize silage/20 kg green fodder (control)* Means marked with atleast a common letter are not significantly different from each other according to LSD test (P=0.05).

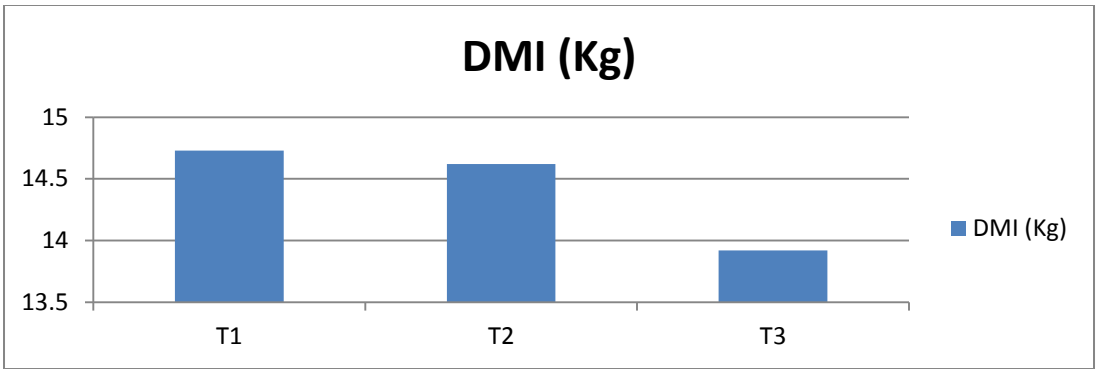

Fig 4. Effect of feeding maize silage on daily dry matter intake (Kg)

Table 4. Effect of feeding maize silage on daily dry matter intake (%)

Treatment Group	T3	T2	T1
DMI	13.92	14.62	14.73
DMI % ↑	--	5.02	5.81

Statistical Analysis

For the first phase of the experiment , data was analysed using paired t-test and for the second phase of the experiment, data wassubjected to one-way ANOVA technique.

Results and Discussion

In first phase milk production in 59 lactating animals were compared before and after feeding maize silage. In feeding group 20 kg of maize silage was given to these 59 lactating animals in addition to the normal daily ration for 14 days and the milk yield was recorded which was compared to the preceding 14 days milk yield data of the same 59 lactating animals. During the preceding 14 days and during the 14 days trial period, the daily normal ration was the same for these 59 animals. Thus pre- and post- test (paired-t test) was used for comparing the 14-d milk yield data of these two groups. The result revealed that daily milk yield varied from 0.93 L/day to 7.31 L/day in 14-d period prior to feeding maize silage with a mean value of 3.81 L/day with standard deviation (SD) of 1.35. However, milk yield varied from 1.01 L/day to 9.57 L/day in 14-d feeding period with a mean value of 4.91 L/day with SD of 1.69. Providing 20 kg maize silage in addition to the daily normal ration brought about significant increment (28.8%) in milk yield when compared to their 14-d before feeding average milk yield (fig 1). The box plot showing variation of 14-d milk yield along with median values of before and after feeding maize silage is given (fig 2). Variation of daily milk yield of three treatment groups for the 28 days of the experimentation period is given in fig 3 and 4 for high and low yielding lactating cows, respectively. In case of both high and low yielders feeding 20 kg maize silage resulted in greater average milk yield followed by feeding 10 kg maize silage + 10 kg green fodder and the least with 20 kg green fodder (fig 3 and 4) and table 3. In high yielders, average milk yield varied from 4.86 L to 6.29 L during 28 days feeding trial in 20 kg maize silage feeding group (fig 3).

Similarly, it varied from 4.12 L to 5.87 L and 4.00 L to 5.84 L in 10 kg maize silage + 10 kg green fodder group and 20 kg green fodder group, respectively (fig 3). In low yielders, average milk yield varied from 2.24 L to 4.09 L during 28 days feeding trial in 20 kg maize silage feeding group (fig 4). Similarly it varied from 2.74 L to 3.86 and 2.34 to 3.76 in 10 kg maize silage + 10 kg green fodder group and 20 kg green fodder group, respectively (fig 4). The results in table 3 showed that the average milk yield in case of high yielders (5.295 L/day) was significantly higher than low yielders (3.240 L/day) (table 3). The average milk yield of high yielders was 63.42% greater than low yielders. Feeding 20 kg maize silage resulted in average milk of 5.748 L/day whereas feeding 10 kg maize silage + 10 kg green fodder and 20 kg green fodder resulted in average milk 5.23 and 4.91 L/day, respectively in case of high yielders (table 3).

Similarly, in case of low yielders, feeding 20 kg maize silage resulted in average milk of 3.620 L/day whereas feeding 10 kg maize silage + 10 kg green fodder and 20 kg green fodder resulted in average milk yield of 3.262 and 2.838 L/day, respectively (table 3). Feeding 20 kg silage and 10 kg silage + 10 kg green fodder improved 17.11% and 6.52%, respectively in high yielders and 11.04% and 14.79%, respectively in low yielders. Non-significant increase in milk fat, milk protein, milk lactose and SNF was observed. Increase in Dry matter intake was observed as 5.81 % in 20 Kg silage group and 5.02 % in 10 Kg silage group.

Increase in dry matter intake seems to be due to high organic matter digestibility and palatability of maize silage diets offered to dairy cows during the experimental period (fig 4). The reproductive health of animals under silage feeding group was also found to improve. It was probably due to positive energy balance of the animals due to supplementation of high starch maize silage. Among haematological parameters reduction in blood urea nitrogen (<6 mg/Dl) was observed which reveals improves utilization and assimilation of amino acids in body of the silage feeding groups. Non-significant increase in Blood glucose level was observed in silage feeding group. Differential blood count level in silage feeding group and control group was found non consistent. It was probably due to difference in individual status of health, age and production level of animals under trial.

Conclusion

Crude protein and pH value of maize silage used in the experiment was 8.8 percent and 3.6 which primary indicate good silage quality. The quality of silage was found good due to its low pH and well preserved sources which help to maintain optimal digestion and avoid any fore stomach digestive disorders. The experiment revealed a significant increase in milk yields (P0.05) in the treatment groups than the control feeding group. Maize silage provides a good source of energy in the form of starch and fibre for dairy animals. Feeding maize silage alone or as supplement with green fodder helps to improve productivity and health of dairy animals.

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