

THE EFFECT OF LIVE YEAST (*Saccharomyces cerevisiae*) ON MILK YIELD OF CROSSBRED DAIRY CATTLE AT KHUMALTAR, NEPAL

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ABSTRACT

A study was carried out to assess the effect of live yeast *Saccharomyces cerevisiae* (Nutriferm™) on milk production at National Cattle Research Program Khumaltar Lalitpur from 19 March 2015 to 15 April 2015. Twenty crossbred cattle were selected randomly and divided into five treatment groups. Each group had four animals arranged in Complete Randomized Design (CRD). Among five treatment groups, treatment (T₁) was treated with 0.5 kg/MT of live yeast *Saccharomyces cerevisiae* (SC) incorporated feed, treatment (T₂) with 1 kg/MT SC, treatment (T₃) with 1.5 kg/MT SC, treatment (T₄) with 2 kg/MT SC and treatment (T₅) as control without any live yeast inclusion in feed. Supplementation of the live yeast up to seventh day of the trial had statistically non-significant (P>0.05) effect on average milk yield per cattle between the treatments. Response of the yeast on mean milk yield per cattle between the treatments was found statistically different (P<0.05) on fourteenth day and twenty-eight day of the trial. On fourteenth day mean milk yield of control group (T₅) was statistically significant with highest dose rate inclusion T₄ only but remained non-significant with the rest of the lower dose rate treatments. With further supplementation of the yeast up to 28th day of the trial results showed the statistically significant effect with lower dose rate T₂ as well with respect to control group besides T₄. Hence, the result of this experiment indicates that supplementation of live yeast for at least 14 days has role in the enhancement of milk production in crossbred dairy cattle with faster effect by dose rate of T₄ treatment.

Key Words: *Saccharomyces cerevisiae*, milk yield, crossbred cattle

INTRODUCTION

Nepal has an emerging economy and its income is primarily based on agriculture. Agriculture sector contributes about 32.61 percentages in Gross Domestic Product (GDP) and supports about 65.6 percentage of the population in our country (MOAD, 2014). Agriculture in Nepal is a way of sustaining life and multi species livestock sector plays significant role in agricultural development and economic empowerment of the country. It contributes 31 percentages in the National Agricultural Gross Domestic Product (AGDP) (CBS, 2012). Livestock sector of Nepal is broadly characterized by large number of animals with low level of productivity (TLDP, 2002). Livestock have been playing vital role in rural economy but level of income from this sector is comparatively low due to low productivity of the animals (CBS, 2002). Milk production from cattle and buffalo is one of the important sub sectors in Nepalese economy. In Nepal, the total milk production is around 18,54,247 MT per year where dairy cattle and buffalo produce around 6,43,806 and 12,10,441 MT of milk respectively (MoAD, 2015/016). Out of the total annual milk production of 18,54,247 MT, dairy cattle contribution is 34.72 percentage. The population of dairy cattle and buffalo are estimated to be 73,02,808 and 51,68,809 respectively (MOAD, 2015/16). Dairy industry contributes a big share on livestock sector but growth of milk production over last decade has been insignificant i.e. only 2.6

percentage per year (Pradhan *et al.*, 2003). Milk processing industries have spent more than 237.3 million Rupees to import dairy products only from India (MOAD, 2014).

With the purpose of enhancing milk production, scientists over the last couple of decades have been attempting to manipulate the microbial activities in ruminants. Nowadays, chemical feed additives are considered as common means to enhance milk production. The mode of action of these additives varies according to the ruminal fermentation patterns. Some other feed additives, antibiotics and ionophores have antimicrobial activities which enable them to eliminate specific harmful organisms present in the rumen. The use of feed additives like antibiotics are not safe stimulants due to the possibility of various chemicals entering the food chain of human (Chiquette, 1995) and at the same time there is high incidence of increasing residual effects of antibiotics additives including hormones. Many researchers have shown beneficial results with the inclusion of live yeast cultures in ration of lactating dairy cattle. The low manufacturing costs associated with the production of yeast cultures have enhanced their use. In contrast to chemical feed additives, yeast cultures stimulate and enhance multiplication of cellulolytic bacteria in rumen, which has resulted alternative use of yeast as a natural, safe and cost-effective feed additive (Newbold *et al.*, 1992). Yeast has been utilized successfully for many years in animal feed industries. In feed industry; antimicrobials, natural products and yeast are used as probiotics and growth promoters (Muihead, 1992).

Due to fungal origin, yeast and its derivatives have resistant property to anti-bacterial agents (Auclair, 2000). Live yeast (*Saccharomyces cerevisiae*) culture is a fermented feed additive product (Linn & Raeth-Knight, 2006). Live yeast extract improves the feed efficiency and milk yield as it is a source of naturally occurring B-vitamins and disaccharides enzymes which enhance digestion of fiber, protein, fats and minerals (Buts *et al.*, 1994). Specifically, live Yeast extract (*Saccharomyces cerevisiae*) has capability to competitively inhibit pathogenic bacteria and to promote growth of beneficial bacteria (Gedek, 1989). Therefore, this study was conducted to find out the impact of live yeast (*Saccharomyces cerevisiae*) on milk yield of crossbred cattle.

MATERIALS AND METHODS

Research design

The experiment was conducted by using Complete Randomized Design (CRD). Total of 20 crossbred cattle were randomly allocated in five different treatments with four replications each cattle representing an experimental unit. Efforts were made to group cattle with similar parity and age into a treatment group. The cattle were under study for 12 to 40 days after parturition. The five different dietary treatment groups, T₁, T₂, T₃, T₄ and T₅ are as follows.

T₁= Concentrates enriched with live yeast (*S. cerevisiae*) @ 0.5kg/MT of feed and rice straw and green oat.

T₂= Concentrates feed enriched with live yeast (*S. cerevisiae*) @ 1 kg/MT of feed and rice straw and green oat.

T₃= Concentrates feed enriched with live yeast (*S. cerevisiae*) @ 1.5 kg/MT of feed and rice straw and green oat.

T₄= Concentrates feed enriched with live yeast (*S. cerevisiae*) @ 2 kg/MT of feed and rice straw and green oat.

T₅= Normal concentrates feed and normal rice straw and green oat.

Table 1: Tag no. of cattle in experiment

Dietary treatment	Block 1	Block 2	Block 3	Block 4
T ₁	1806	1725	1681	1570
T ₂	1750	1767	1683	1644
T ₃	1808	1781	1687	1530
T ₄	1752	1763	1685	1539
T ₅	1798	1713	1629	1639

Preparation of the experimental cattle feed

Cattle feed used in this experiment was manufactured by Proboitech Industry Pvt. Ltd., Parsa Nepal and was incorporated live yeast supplement *S. cerevisiae* (Nutriferm™). These cattle ration were adequately fortified with minerals and vitamin premixes too. Major raw ingredients used to manufacture pellet cattle feed are as mentioned:

Table 2: Ingredients used for preparation of cattle feed

Ingredients	Percentage
Maize	20
Soybean Meal	5
De-oiled Rice Bran	50
De-oiled Mustard oil cake	15
Molasses	7
Vitamin and mineral premix	3
Total	100

Nutrients analysis

The proximate nutrient constituent analysis of the samples of all treatments was determined three times covering the entire experimental period. Moisture, crude protein (CP), crude fiber (CF), ether extracts (EE), total ash, sand silica, calcium and phosphorous were analyzed at Animal Nutrition Laboratory of Probiotech Industry Pvt. Ltd., Parsa using the methods described in AOAC (1997).

Table 3: Nutrients composition of cattle feed

S.N.	Parameters	T ₁	T ₂	T ₃	T ₄	T ₅
1	Moisture (%)	9.62	10.52	10.23	10.97	10.09
2	Total Ash (%)	9.38	9.37	9.42	9.42	9.47
3	Sand Silica (%)	2.44	2.43	2.38	2.53	2.55
4	Fat content (%)	2.43	2.52	2.5	2.49	2.58
5	Crude Fiber (%)	6.01	6.04	6.31	6.37	6.21
6	Crude Protein (%)	21.95	22.25	21.13	21.3	22.13
7	Calcium (%)	0.62	0.62	0.7	0.65	0.71
8	Phosphorous (%)	0.66	0.69	0.69	0.69	0.67

Daily milk yield in liter

Total data of 28 days of milk yield was collected. The daily milk yield (liter) was recorded directly in farm of National Cattle Research Program Khumaltar, Lalitpur.

Statistical analysis

The observed data was tabulated in Ms-Excel and transferred to SPSS 16 version data sheet. Test statistic for the mean differences in the milk yield for different treatments was analyzed with repeated measures Analysis of Variance (ANOVA) by General Linear Model. Bonferroni Pair wise multiple comparisons were done for the interaction effects of time with treatments groups.

RESULT AND DISCUSSION

The effects of live yeast (*Saccharomyces cerevisiae*) on milk production among different treatment groups are included in the study. The data is compared for the effects of live yeast (*Saccharomyces cerevisiae*) on milk yield among different treatment groups across different time points of feeding.

Mean milk yield per cattle per day were significantly different between treatments at $P < 0.05$ across different time points. Mean milk yield per cattle per day comparison on the first day of the trial to 7th day of the trial were statistically non-significant ($P > 0.05$) between the treatments. But the results showed significant effect ($P < 0.05$) on milk yield by the 14th day of yeast feeding with T_4 group only with respect to control (T_5) and rest of the treatments T_1 , T_2 , T_3 were insignificant with control (T_5). Also the group T_4 was statistically non-significant ($P > 0.05$) among T_1 , T_2 and T_3 on 14th day. This suggest that there is no significant effect upon milk yield up to 7th day of yeast feeding in all dose rate of the treatments with respect to control but has effect of dose rate 2 kg/ton by the 14th day of yeast feeding with highest milk yield 15.37 ± 1.79 liters per cattle per day followed by T_2 , T_3 , T_1 and T_5 as shown in the table 4 below. However, the effect was non-significant by the 21st day of yeast feeding and again there were significant effect of yeast feeding in milk production on 28th day with T_4 (15.45 ± 1.97) with respect to the control group, moreover mean milk yield (14.57 ± 2.15) of T_2 was also statistically found to be different with respect control. These suggest that lower dose rate yeast inclusion also had relatively slower effect upon enhanced milk yield than non-inclusion of yeast in feed.

Table 4: Mean \pm SEM milk yield at a week apart

Treatments	Milk yield in Kg (Mean \pm SEM)				
	1 st Day	7 th Day	14 th Day	21 st Day	28 th Day
T_1 (SC 0.5 kg/MT)	9.25 \pm 1.19a	10.97 \pm 1.72a	11.77 \pm 1.25 ^{ab}	12.23 \pm 1.76a	12.60 \pm 1.18 ^{ab}
T_2 (SC 1 kg/MT)	12.00 \pm 3.02a	12.96 \pm 2.22a	14.38 \pm 2.32 ^{ab}	13.15 \pm 2.24a	14.57 \pm 2.15 ^{ac}
T_3 (SC 1.5 kg/MT)	11.50 \pm 2.35a	11.99 \pm 2.44a	12.04 \pm 2.25 ^{ab}	12.77 \pm 2.42a	11.95 \pm 1.73 ^{ab}
T_4 (SC 2 kg/MT)	14.08 \pm 1.20a	15.31 \pm 2.01a	15.37 \pm 1.79a	14.77 \pm 1.72a	15.45 \pm 1.97 ^a
T_5 (SC 0 kg/MT)	6.90 \pm 0.54a	6.53 \pm 0.71a	6.69 \pm 0.60b	7.17 \pm 0.63a	6.07 \pm 0.39 ^b

Note: Means with different superscripts are statistically different at 0.05 level of significance

Mean milk yield was significantly different across different time points between treatments. The various results of milk yield during the experiment are compared with other similar researches which were conducted in different area in different time periods by different scientists. The results are discussed for possible interpretation, justification and analysis added by possible cause and literature support. The data are compared for the effects of live yeast (*Saccharomyces cerevisiae*) on milk production among different treatment groups.

In different researches, increased in milk production was due to the increased proportion of propionic acid in total volatile fatty acid profile which resulted into increased number of essential microbes in the rumen (Weidmeier *et al.*, 1987; Harrison *et al.*, 1988; Dawson, 1990; Newbold *et al.*, 1992; Dawson 1993). This result was in accordance with the result of Williams *et al.* (1991) who also observed increment in milk yield by 1.4 liters per day when yeast culture (*Saccharomyces cerevisiae*) was fed to dairy cattle. It was reported that supplementation with *Saccharomyces cerevisiae* in the cattle feed improved feed intake (Poppy *et al.*, 2012), milk production (Nocek *et al.*, 2011), digestion of nutrients (Miller-Miller-Webster *et al.*, 2002) and concentration of volatile fatty acids in rumen (Arcos-Garcia *et al.*, 2000).

Addition of *Saccharomyces cerevisiae* in cattle feed increased dry matter intake because of increased number of anaerobe and cellulolytic bacteria and increased digestibility of nutrients. Promkot *et al.*, (2013) also reported that the effect of *Saccharomyces cerevisiae*, which was added in cattle feed had a higher rate of milk yield and quicker result as compared to the control group. Various scientific studies proved that, supplementation of *Saccharomyces cerevisiae* in cattle feed increased milk yield (Nocek *et al.*, 2003; Nocek and Kautz, 2006; Al-Ibrahim *et al.*, 2010; Bruno *et al.*, 2009; Nocek *et al.*, 2011). According to Maamouri *et al.*, (2014) significant result of milk yield as well as milk fat and protein percentage was obtained when cattle were fed live yeast (*Saccharomyces cerevisiae*) supplemented feed. Bruno *et al.* (2009) also reported that cattle fed with supplemented live yeast (*Saccharomyces cerevisiae*) produced 1.2 kg/day more milk as compared to control and similar results were observed by Williams *et al.* (1991), Wohlt *et al.* (1991), Piva *et al.* (1993) and Dutta *et al.* (2008).

But some authors observed contradictory results that, there was non-significant response on milk yield when live yeast (*Saccharomyces cerevisiae*) was incorporated in cattle feed (Erdman and Sharma, 1989; Arambel & Kent, 1990; Swartz *et al.*, 1994). Similarly Kung *et al.* (1997) also found no any significant result in his study on milk production, milk composition and dry matter intake of cattle which were fed with live yeast (*Saccharomyces cerevisiae*) on malt extract agar in their ration. Likewise, effect of live yeast (*Saccharomyces cerevisiae*) on cattle feed had non-significant change in milk production, dry matter intake, body weight gain, milk yield and milk composition (Kamamma *et al.*, 1996). In some experiments, researchers did not find remarkable improvement on milk yield in dairy cattle when live yeast (*Saccharomyces cerevisiae*) was used in cattle feed (Adams *et al.*, 1981; Weidmeier *et al.*, 1987; Erdman & Sharma, 1989; Arambel & Kent, 1990; Chademana & Offer, 1990; Nicholasville *et al.*, 1994; Dann *et al.*, 2000; Kalmus *et al.*, 2009; Promkot *et al.*, 2013). Some other scientific studies also showed that the supplementation of *Saccharomyces cerevisiae* had no any visible effect on milk production as well as on composition of milk in dairy cattle (Dann *et al.*, 2000; Kalmus *et al.*, 2009; Al-Ibrahim *et al.*, 2010; Promkot *et al.*, 2013).

According to Putman *et al.* (1997) milk yield of dairy cattle increased with the addition of *Saccharomyces cerevisiae* only when protein content was deficient in the diet of ruminant. There was no consistency among the results of the experiments in which *Saccharomyces cerevisiae* was supplemented. This situation might have resulted due to the use of various doses in experiment, stage of lactation and animal age, composition of feed and feeding strategy. It has been stated that *Saccharomyces cerevisiae* is more effective in the diets in which nutrient content is inefficient or in high energy diets (Masek *et al.*, 2008). So, this result of study suggests that effect of live yeast is reflected on milk production by second week onwards and suggests that effect is seen in lower level of yeast inclusion after 28th day onwards only.

CONCLUSION

This experiment indicates that supplementation of live yeast for at least 14 days has role in the enhancement of milk production in crossbred dairy cattle. Farmers will enjoy the benefit of getting higher milk production of yeast feeding with faster effect of live yeast at the inclusion rate of 2 kg/MT in their concentrates whereas lower inclusion rate 1kg/ton also had slower response to enhance the milk yield per cattle per day.

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