



Mineral Mixture Feeding Enhances Dairy Animals Productivity: A Study of Bihar, India

Dhiraj K. Singh*, Shree P. Sahu¹ and Nils Teufel²

Tata-Cornell Institute for Agriculture and Nutrition (TCI), New Delhi, India

ABSTRACT

Dairying is not only an integral part of small-holder farming system, but it is also providing a significant source of livelihood for landless households in Bihar, India. A shift in the contribution by different sectors to the State Gross Domestic Product (SGDP) in Bihar has been observed as contribution of livestock sector has increased from 22 to 40 percent and at the same time agriculture sector contribution has decreased from 45 to 20 percent during last two decades. The per-capita milk availability in Bihar is meager (239 g/d) compared to India's average (375 g/d) in 2017-18 as productivity of animals is low due to poor feeding based on crop residue and limited concentrates. The present study was carried out on 510 dairy animals to examine the effects of mineral mixture on livestock productivity in Bihar. After introducing (50 grams) mineral mixture in the feed, average milk yield, fat and SNF content increased by 6.2%, 5.3% and 1.8%, respectively. Feeding mineral mixture to dairy animals, milk yield increased by 0.49 L/d/animal. At the same time fat content and SNF content also increased by 0.20 and 0.15 points. On average, farmers benefitted from increased net profits by ₹ 15.8/d/animal. It shows that the dairy farmers can increase their revenue from increased milk sales in terms of higher quantity (yield) and quality (fat and SNF). The mineral mixture feeding also showed positive effects on health and reproductive performance in terms of animal appearance and, timely conception and least incidence of ectoparasites.

Key words: Bihar, Dairy animals, Fat, Mineral mixture, Milk yield, SNF

INTRODUCTION

Dairying is not only an integral part of small-holder farming systems, but also source of livelihood for landless households in Bihar, India. It has been observed that there has been a shift in the contribution by different sectors to the State Gross Domestic Product (SGDP) in Bihar, as contribution of tertiary sector has increased from 22 to 40 percent and at the same time agriculture sector contribution has decreased from 45 to 20 percent during last two decades. In agriculture livestock SGDP contribution is about 40 percent and milk contribution to livestock sector is about 30 per cent (GoB 1993, 2013).

Bihar's share of milking cattle and buffaloes is about 6.8 per cent and it contributes about 5.2 per cent of the national milk production (GoI, 2018). Bihar figures ninth in milk production in the country. The milk production in the state witnessed tremendous increase in last one decade from 2.5 million tons in 2000-01 to 9.2 million tons in 2017-18 (GoI 2006, 2018).

Nevertheless, the per-capita milk availability in Bihar is meager (239 g/d) compare to India average (375 g/d) in 2017-18 as productivity is low and no increase in productivity of animals except indigenous cows, main reason behind it is feeding is mainly depends on crop residues with some green fodder and limited concentrates. Constraints to improving these feeding practices include limited farm resources, weak support services and inadequate knowledge on nutrient requirements and contents are central issues in improving livestock productivity in Bihar.

The present study examines the effects of mineral mixture on livestock productivity in comparison to non-feeding of mineral mixture. Farmers feeds residues with either individual concentrate components or commercial feed. But animals also need other micro-nutrients which is not adequately available in crop residues, green fodder and concentrates fed to animals. Mineral deficiency in dairy animals results into reduced growth, deficiency diseases, decreased milk production,

*Corresponding author : Dhiraj K. Singh, Email: dks97@cornell.edu; dhiraj.in@gmail.com; Phone: +91 9818885595; ¹Bihar Animal Sciences University (BASU), Bihar, India; ²International Livestock Research Institute (ILRI), Nairobi, Kenya

reproductive disorders and decreased immunity. During the past decade, significant advances have been made in understanding the effects of trace-element supplements on the milk production of dairy cows (Bhausahab *et al.*, 2014).

MATERIALS AND METHODS

The data for this study is collected from 510 dairy farmers feeding the mineral mixture to their 510 dairy animals (396 cows and 114 buffaloes). The experimental trials were conducted among the households with dairy animals who are members of self-help groups (SHGs) and Kisan club and in some cases not attached to any group. One animal from each household was selected. The experimental trials were conducted in six districts of Bihar (Begusarai, Bhojpur, Muzaffarpur, Patna, Samastipur and Vaishali) during 2014-15. A structured questionnaire was used to collect the data from all farmers, which consisted of the 3 days control (farmer's feeding practices) and 6 days experimental data on mineral mixture, milk yield, fat content and SNF content following the standards management practices of ILRI-CSISA project.

The feeding trials consisted of the following feeding practices: the dairy farmers use crop residues with commercial cattle feed supplemented with individual concentrate components such as crushed maize or/and oil cakes. But animals also required other micro-nutrients in their regular diets to help enhancing metabolic functions and lead to improved milk

production and reproduction efficiency in dairy animals. Supplementation of bio-available minerals through mineral mixture is of paramount importance as the minerals are not synthesized in the animal's body. Keeping this in view, mineral mixture trials were conducted to see the effect on animals in comparison to non-feeding of mineral mixture. For this a quality chelated mineral mixture is used to feed animals per day 50 g/animal. The mineral mixture was introduced through a combination of participatory trainings on nutrition and feeding and farm-based trials.

RESULTS AND DISCUSSION

It was observed that the dairy farmers were not feeding mineral mixture before the trials (Table 1). After introducing the mineral mixture at 50 grams per day in feed, average milk yield, fat content and SNF content increased ($P < 0.05$) by 6.2%, 5.3% and 1.8% respectively. The results showed that dairy farmers could increase their revenue from increased milk sales in terms of higher quantity (yield) and quality (fat and SNF contents). The mineral mixture feeding also showed positive effects on health and reproductive performance in terms of animal appearance and, early timely conception and least incidence of ectoparasites.

The results presented in Table 2 shows that farmers have introduced mineral mixture feeding by 55 g/d/animal and milk yield increased ($P < 0.05$) by 0.49 L/d/animal, fat content by 0.20 points, and SNF content by 0.15 point (Table 2). The highest milk yield increase

Table 1. Input and output of control and experimental animals

District	Milk yield (L)		Fat (%)		SNF (%)	
	C	E	C	E	C	E
Begusarai	9.72 ^a ±0.45	10.35 ^a ±0.45	3.96 ^a ±0.10	4.12 ^a ±0.09	8.50 ^a ±0.02	8.60 ^a ±0.03
Bhojpur	6.88 ^{bc} ±0.36	7.20 ^{bc} ±0.36	5.88 ^b ±0.36	6.09 ^b ±0.35	8.02 ^b ±0.29	8.14 ^b ±0.28
Muzaffarpur	6.15 ^b ±0.32	6.80 ^b ±0.32	3.55 ^c ±0.04	3.82 ^a ±0.08	8.45 ^a ±0.03	8.64 ^a ±0.03
Patna	8.24 ^c ±0.43	8.50 ^{cd} ±0.44	4.75 ^d ±0.01	4.92 ^c ±0.01	8.26 ^{ab} ±0.00	8.37 ^{ab} ±0.01
Samastipur	7.15 ^{bd} ±0.36	7.72 ^{bc} ±0.37	3.41 ^c ±0.06	3.68 ^a ±0.08	8.28 ^{ab} ±0.03	8.52 ^a ±0.04
Vaishali	9.02 ^a ±0.47	9.56 ^{ad} ±0.47	3.63 ^{ac} ±0.06	3.76 ^a ±0.06	8.50 ^a ±0.02	8.61 ^a ±0.02
All	7.86±0.17	8.35±0.18	3.81±0.05	4.01±0.06	8.42±0.02	8.57±0.02

^{a,b,c,d} Values bearing different superscripts in a column differ significantly ($P < 0.05$); C: control/farmer's feeding and E: experimental feeding trial

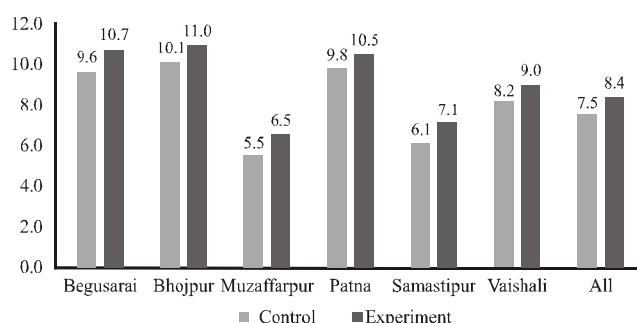
Table 2. Changes in output of experiment animals

District	Milk yield (L/d)	Fat (%)	SNF (%)
Begusarai	0.63 ^a ±0.04	0.16 ^a ±0.02	0.11 ^a ±0.01
Bhojpur	0.32 ^b ±0.03	0.21 ^a ±0.09	0.11 ^{ab} ±0.06
Muzaffarpur	0.64 ^a ±0.03	0.26 ^a ±0.06	0.19 ^{bc} ±0.01
Patna	0.26 ^b ±0.08	0.17 ^a ±0.01	0.11 ^{ab} ±0.01
Samastipur	0.57 ^a ±0.02	0.27 ^a ±0.03	0.24 ^c ±0.02
Vaishali	0.53 ^a ±0.03	0.14 ^a ±0.01	0.10 ^a ±0.01
All	0.49±0.02	0.20±0.02	0.15±0.01

a,b,c,d Values bearing different superscripts in a column differ significantly (P<0.05)

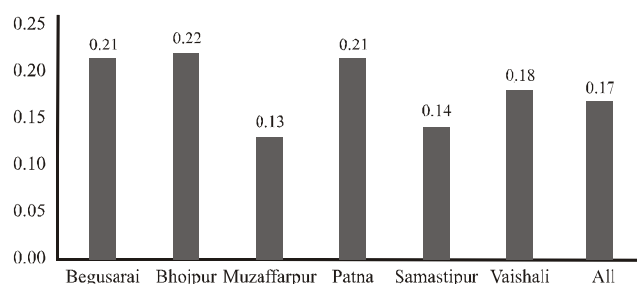
(0.64 L/d/animal) was reported by Muzaffarpur farmers in comparison to other districts. Fat and SNF content increase were higher in Samastipur compared to other districts.

On an average, FCM yield increased by 0.9 L/d/animal (Fig. 1). The lowest FCM yield increase was

**Fig. 1. Fat correct milk (FCM) yield per experiment animal across districts**

reported by Patna farmers (0.7 L/d/animal) and the highest in Begusarai farmers (1.05 L/d/animal).

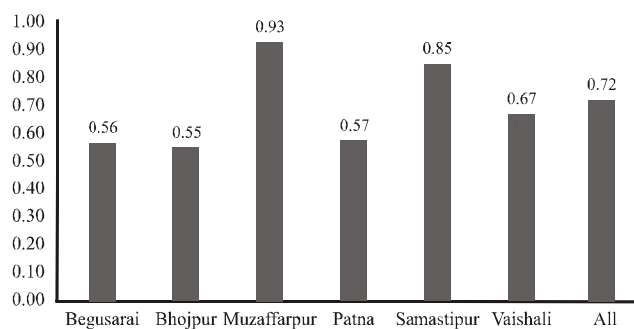
On an average 150 grams of FCM milk yield increased by feeding 50 grams of mineral mixture. The

**Fig. 2. Fat corrected milk (FCM) yield (L/d) per 50 grams of mineral mixture**

highest FCM yield was observed in Bhojpur and lowest in Samastipur district. The cost of mineral mixture/L milk produced was (₹ 0.72). Muzaffarpur district showed the highest price gap (₹ 0.93) in cost of mineral mixture/L of milk produced while Bhojpur district showed the lowest cost (₹ 0.55) (Fig. 3).

Figure 4 provides the economics of the experimental feeding trial using mineral mixture in feed. The results show that on an average farmers gained from the new feeding practice, *i.e.*, achieved positive net profits estimated at ₹ 15.8/d/animal.

Similar to the present findings, Noeek *et al.* (2006), Singh *et al.* (2008), Hackbart *et al.* (2010), Somkuwar *et al.* (2011), Tiwari *et al.* (2013), Mohsina *et al.* (2014), Singh *et al.* (2016) and Gupta *et al.* (2017) reported significant increase in milk yield in mineral supplemented animals as compared to un-supplemented group of dairy animals. Garcia-Lopez *et al.* (1988) observed increased fat percent in milk of mineral supplemented cows as compared to un-supplemented cows.

**Fig. 3. Cost of mineral mixture per litre of fat correct milk (FCM) yield**

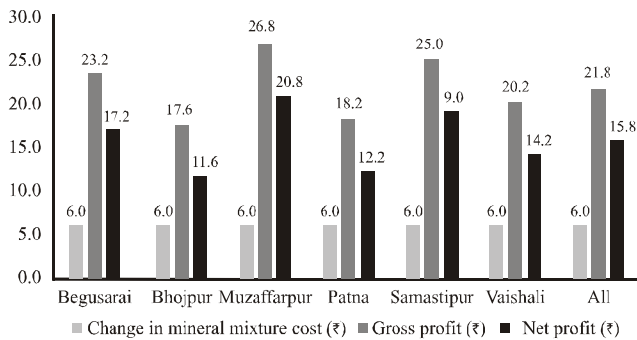


Fig. 4. Economics of feeding mineral mixture (per day/animal)

However, Wu *et al.* (2000), Sharma *et al.* (2002), Rabiee *et al.* (2010), Begum *et al.* (2010), Pandey *et al.* (2018), found no significant difference in the milk yield and milk components of cows due to either commercial or area specific mineral mixture supplementation from that of un-supplemented group of dairy animals.

The observed variability in levels of benefits is likely due to the variability in the levels of animal health and production stages during the feeding trials. The lowest benefit was reported in Bhojpur district and the per animal/d benefit was ₹ 11.6 only, the highest observed benefit was in Muzaffarpur district at ₹ 20.8, which is higher than other five districts. There is need to explore the methods to promote mineral mixture feeding on regular basis to the larger section of farmers in the state.

CONCLUSIONS

Mineral mixture feeding trial shows that introducing the 50 grams mineral mixture per day in feed enhances the dairy animal's milk yield by 0.49 L/d/animal. At the same time fat and SNF content also increased by 0.20 and 0.15 points, respectively. On an average, farmers benefitted from increased income by ₹ 15.8/d/animal. It shows that mineral mixture feeding on regular basis to animals are beneficial for farmers, though the other benefits gained by feeding mineral mixture is not measured. Farmers gains instantly by feeding mineral mixture in terms of milk yield, fat and SNF increase apart from other benefits which farmers generally do not consider while feeding animals.

Keeping in view the economic benefit of feeding

mineral mixture, there is a need to promote feeding mineral mixture among farmers. Some farmers consider that it is costly, so one could provide the mineral mixture preparation techniques to farmers to reduce the mineral mixture feeding cost by preparing mineral mixture at their own. However, the government and non-government institutions should make effort to popularize the mineral mixture feeding amongst the larger section of dairy farmers through demonstration, mass communication, print media.

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