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Effect of feeding a rumen modifier on cost structure of crossbred heifers

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Abstract
The goal of this study was to find a cost that will decrease input while also improving animal performance. The project was split into two halves. Phase I included a twenty-one-day pre-experimental trial to prepare the animals for the trial without a rumen modulator. Using an *in vitro* gas production test, phase II was conducted for 120 days with a mixture of rumen modifiers that included neem seed powder (*Azadirachta indica*), fennel seed (*Foeniculum vulgare*), and harad (*Terminalia chebula*) mixed in a concentrate mixture. The amount of Rumen modifier needed was determined based on the dry matter intake of heifers.
There were 21 animals in all in the trial, which was divided into three treatments. The first treatment was a control therapy without the use of a rumen modification. The second treatment used a rumen modification to increase the dry matter intake of the animals by 2%, while the third treatment used a rumen modifier to increase the dry matter intake of the animals by 4%. The treatment that included soybean straw as dry fodder, Lucerne as a green fodder, and a concentrate mixture had no significant (p>0.05) influence on the animals' body weight gain, digestibility coefficient, or dry matter intake.
Treatment two, in which seven animals were fed dry soybean straw, green lucerne, and a concentrate mixture with a herbal feed additive, rumen modifier powder, at a rate of 2% of dry matter intake, produced the greatest outcomes of all the treatments. The weight of the animals grew significantly (P0.01) by 63.45 kg, whereas the dry matter intake increased significantly (P0.01) from 6.55 to 7.15 kg. In treatment two, the digestibility coefficient shows excellent results. When compared to the control group, it increases considerably (p>0.01) by 63.45% in treatment two.
Feed cost per kg body weight gain in T_1, T_2 and T_3 were Rs. 32.96, 27.92, and 37.90, respectively which indicates the cost per kg gain of weight can be reduced by feeding rumen modifier. The cost/kg body weight gain was lowest in rumen modifier @ 2% over another concentrate feeding. However, based on the gain in body weight it can be said that there was the effect of incorporation of rumen modifier with concentrate mixture in the ration of heifer because, the total cost/kg body weight gain (Rs.) is less in T_2 followed by T_1 and T_3 group of treatments, 195.49, 230.76 and 265.32 respectively.

Keywords: Rumen modifier, cost structure, crossbred heifers

Introduction
Ruminants' rumens have a complex microbial ecosystem that allows them to bio-convert low-quality lingo cellulosic diet into important animal products such as milk and meat [1]. The polysaccharides in the feed are transformed into volatile fatty acids and microbial protein, the two main sources of energy and protein for the host animals, in the rumen, thanks to the synergistic activity of bacteria, protozoa, fungus, archaea, and bacteriophages. However, CO_2 and H_2 gases are created as by-products of feed fermentation in the rumen, and rumen methanogenic archaea convert CO_2 to methane by utilizing H_2 that is eructated out through the mouth [2].
Every day, 500-600 liters of molecular hydrogen are created in an adult bovine or buffalo, but due to methanogenesis, it never accumulates in the gaseous phase of the rumen. Methanogenesis is a necessary metabolic process in the rumen to maintain a low H_2 pressure, but it is wasteful because 2-12% of dietary energy is wasted as methane, reducing the potential conversion of dietary energy into metabolizable energy and lowering the animal's feed utilization efficiency [3].

Furthermore, because methane is a powerful greenhouse gas with a global warming potential 23 times greater than CO_2, intestinal methane production contributes significantly to global warming. As a result, dietitians have been concerned about the inhibition of methanogenesis for a long time, and it is still a problem today owing to global warming and the release of greenhouse gases [4]. The animal can be made more feed efficient and environmental pollution caused by rising levels of greenhouse gases can be decreased by reducing methane production [6].

Animal nutritionists are experimenting with newer nutritional interventions, such as chemical feed additives, to reach their goal. However, as people became more aware of the negative consequences of chemical feed additives, such as residues in animal products and bacterial resistance to antibiotics, researchers began looking for natural products to use as feed additives, and plant secondary metabolites (PSMs) emerged as a viable alternative [7].

Thus, some herbal powders which are having plant secondary metabolite contents are very expensive. Hence, it is important to calculate the cost structure of feeding crossbred heifers [8].

Materials and Methods

The current study used a randomized block design with three different treatments. A total of twenty-one crossbred heifers were chosen. Three groups of heifers were formed. For the study, each group comprised seven heifers.

Concentrate mixture, rumen modulator, green fodder, and dry roughages were employed to feed the experimental heifers. In treatment "T_1" dry fodder (Soybean straw) was mixed with green fodder (berseem) and a ready-made concentrate combination according to the requirements. In treatment "T_2," dry fodder (Soybean straw) was combined with a green fodder (berseem) concentrate mixture and a rumen modifier at a rate of 2%. In treatment "T_3", dry fodder (Soybean straw) was combined with a green fodder (berseem) concentrate mixture and a rumen modifier at a rate of 4%.

Maize grain seed, cottonseed cake, wheat bran, turchuni, mineral mixture, and common salt make up the concentrate mixture. Harad seed powder, commonly known as harad, fennel seed powder, and neem seed powder are the three constituents in the rumen modifier.

Results and Discussion

To be popular among cow owners, the feed plan must be cost-effective. As a result, the feeding economics of the several groups were as specific observations on feeding economics are provided in Table 1.

Table 1: As a result, the feeding economics of the several groups were as specific observations on feeding economics among cow owners

Feeds	Treatments					
	T_1		T_2		T_3	
	Qty (kg)	Amount (Rs)	Qty (kg)	Amount (Rs)	Qty (kg)	Amount (Rs)
Total soybean straw required @ (Rs.) 150/qtl	322.8	484.2	392.4	588.6	382.8	574.2
Total lucerne required @ (Rs.) 200/qtl	106.8	213.6	130.8	261.6	127.2	254.4
Concentrate mixture @ (Rs.) 2200/qtl	214.8	4725.6	261.6	5755.2	254.4	5596.8
Neem seed powder @ (Rs.) 2000/qtl	-	-	28.8	576	58.8	1176
Harad seed powder @ (Rs.) 10000/qtl	-	-	25.2	2520	50.4	5040
Fennel seed powder @ (Rs.) 9000/qtl	-	-	28.8	2592	58.8	5292
Labour and miscellaneous cost (Rs.) @ 263/day	2 labours	9015.64	2 labours	9015.64	2 labours	9015.64
Total cost of feeding (Rs.)	-	14439.04	-	21309.4	-	26949.04
Total BW gain in heifers (kg)	62.57	-	109	-	101.57	-
Total cost /kg BW gain	-	230.76	-	195.49	-	265.32
Total cost/kg BW gain/heifer	-	32.96	-	27.92	-	37.90

It was observed that the total quantity of soybean straw for the T_1, T_2 and T_3 groups was 322.8, 392.4 and 382.8 kg and the total quantity of green fodder was 106.8, 130.8 and 127.2 kg for T_1, T_2 and T_3 groups. The quantities of concentrate are was in T_1, T_2 and T_3 treatments 214.8, 261.6 and 254.4 kg, respectively.

The total cost of feed observed from the table indicated that it was less in the T_1 group that is Rs. 14439.04 whereas the feed cost was more in T_2 and T_3 21309.4 and 26949.04 respectively, however total cost/kg body weight gain (Rs.) was less in T_2 195.49 group compare to T_1 230.76 and T_3 265.32 group, and total cost/heifer/kg body weight gain (Rs.) is also low in T_2 followed by T_1 and T_3 group of treatments, 67.43, 59.77 and 68.44 respectively.

It was concluded that from above all discussion over experimental result the treatment T_2 feeding of rumen modifier @ 2%, shows the better and desirable result as compared to T_1 and T_3 treatments. In T_3 treatment feeding of rumen modifier @ 4% based on dry matter intake of heifers increases the cost of feeding and T_1 feeding of only concentrate mixture hence is not fulfilled to the nutrient requirement and growth of heifers but decreases the cost of feeding. Feeding cost on the daily basis was lowest observed in T_2.

Conclusion

On average Rs. 14439.04, 21309.04 and 26949.04 were incurred on the total cost of the feeding of heifers under T_1, T_2 and T_3 treatments respectively. This indicates that there was a decrease in the total feeding cost of the heifers under different concentrate-based diets.

The growth rate of heifers fed on rumen modifier @ 2% was higher than that of rumen modifier @ 4% and concentrate mixture feed. The performance in respect of weight, length, height, chest girth gain was higher in the T_2 feeding group over T_3 and T_1 treatments. It was concluded that from above all discussion over experimental results the treatment T_2 shows the better and more desirable result as compared to T_1 and T_3 treatments. Feeding cost on the daily basis was the highest observed in T_3.

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