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ECONOMICAL ANALYSIS OF FEEDING HYDROPONICS MAIZE FODDER WITH AND WITHOUT SUPPLEMENTATION OF PROBIOTIC (*SACCHAROMYCES CEREVISAE*) IN GIR CALVES

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Abstract: Technology advancement has introduced hydroponic technology for green fodder production. Hydroponic technology may become an alternative not only for the green fodder but also some part of concentrate in farm animals. In present investigation, total 36 male Gir calves were selected randomly and distributed equally in nine groups. The cost of production of hydroponics maize fodder was Rs. 4.97 per kg. There were statistically significant variations in average cost of feed (Rs./day/calf) and average cost of feed per kg weight gain among different treatment groups. The average cost of feed was highest in group T_9 (100% CP of concentrate mixture replaced by hydroponics maize green fodder with *Saccharomyces cerevisae*) and the lowest in control group (basal feed alongwith concentrate without hydroponics fodder). The average cost of feed per kg weight gain was lowest in group T_8 i.e. 75% CP of concentrate mixture replaced by hydroponics maize green fodder with *Saccharomyces cerevisae* and the highest in control group. It was concluded that cost of feed was increased with replacement of 25%, 50%, 75% and 100% CP of concentrate mixture through hydroponics maize green fodder but cost of feed per kg weight gain in calves fed hydroponics maize green fodder with *Saccharomyces cerevisae* was lower than control animals.

Keywords: Economics, hydroponics, maize, fodder, probiotic.

Introduction

India ranks first in milk production, achieving an annual output of 146.3 MT during 2014-15. To achieve higher targets in milk production, dairy animals must be fed quality feed stuffs. The land availability for cultivation of green fodder is limited to only 5% of the gross cropped area. Currently the requirement of green fodder in the country is 800 million tons and its shortage is to an extent of about 28 per cent (Gorti *et al*., 2012). Shortage of land, long growth time, labour, fertilizer and manure requirements for cultivation, unavailability of same quality throughout the year, lack of irrigation facilities, water scarcity and natural calamities are the major obstacles for conventional green fodder and grain production.

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Technology advancement has introduced hydroponic technology for green fodder production. The hydroponics green fodder could be a novel way of feeding dairy animals to improve productivity. Hydroponic technology may become an alternative not only for the green fodder but also some part of concentrate in farm animals. Chemical and structural changes take place within the cereal grain through the hydroponic growing process. Activation of enzymes in the grains leads to hydrolysis of proteins, carbohydrates and lipids into their simpler components (Dung *et al*., 2010). This hydrolysis increases the concentration of amino acids, soluble sugars and fatty acids within the grain and resulting shoot (Chavan and Kadam, 1989). Further, use of probiotics in cattle ration has immense importance for improvement in nutrient utilization as well as growth and production.

Limited research has been conducted on economics of production and feeding of hydroponics maize fodder and the results were also not consistent. Present investigation was undertaken to study the economics of feeding of hydroponics maize fodder with and without supplementation of probiotic (*Saccharomyces cerevisae*) in Gir calves.

Materials and Methods

Total 36 male Gir calves of almost same age group were selected randomly and distributed equally in nine groups. All the animals were offered basal feed *ad lib.* Calves in group T_1 were treated as control and were fed basal feed and concentrate mixture as per requirement. For calves in T_2, T_3, T_4 and T_5 groups, 25%, 50%, 75% and 100% of CP supplied through concentrate mixture was replaced by hydroponics maize fodder, respectively. Whereas in T_6, T_7, T_8, T_9 groups, 25% 50%, 75% and 100% of CP supplied through concentrate mixture was replaced by hydroponics maize fodder alongwith probiotics (*Saccharomyces cerevisae*), respectively. Daily allowance of concentrate and / or hydroponics maize fodder and roughage were offered to meet their nutrient requirements (ICAR, 2013).

The production of hydroponics maize was done in a hydroponics chamber of Ayurvet Progreen Machine having the potential of producing 240 kg fresh hydroponics maize fodder on daily basis. Inside the growth chamber, the plants were allowed to grow for duration of 7 days and were harvested on 8^{th} day and fed to calves.

During the experiment, daily consumption of experimental feeds was assessed in different treatment groups. Body weights (kg) of all the calves were recorded fortnightly. Cost of inputs (maize grain, nutrient solutions, electricity, labour and other miscellaneous expenses) were recorded to calculate the economics of feeding hydroponics maize fodder in terms of cost of feed in calves as well as cost per kg body weight gain.

Results and Discussion

The cost of production of hydroponics maize fodder was Rs. 4.97 per kg. The economics of feeding of hydroponics maize fodder in calves in different treatment groups have been shown in Table 1.

The average cost of feed was Rs. 43.67, 47.42, 51.17, 54.92, 58.67, 47.53, 51.28, 55.03 and 58.78 (in Rupees/day/calf) in group T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8 and T_9, respectively. The average cost of feed (Rs./day/calf) was highest in group T_9 (100% CP of concentrate mixture replaced by hydroponics maize green fodder with *Saccharomyces cerevisae*), followed by T_5 (100% CP of concentrate mixture replaced by hydroponics maize green fodder without *Saccharomyces cerevisae*) and the lowest in group T_1 i.e. control (Table 1). The statistical analysis of data revealed highly significant ($P<0.01$) variations in average cost of feed in terms of Rs./day/calf among different treatment groups (Table 2). It was revealed that there was significant increase in the average cost of feed on replacement of 25%, 50%, 75% and 100% CP of concentrate mixture through hydroponics maize green fodder but there was non-significant effect of supplementation with probiotic (*Saccharomyces cerevisiae*) on cost of feed.

The average cost of feed per kg weight gain was Rs. 155.95, 144.61, 139.77, 129.70, 151.00, 144.72, 137.20, 128.88 and 146.89 in group T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8 and T_9, respectively. The average cost of feed per kg weight gain was lowest in group T_8 i.e. 75% CP of concentrate mixture replaced by hydroponics maize green fodder with *Saccharomyces cerevisae*, followed by T_4 (75% CP of concentrate mixture replaced by hydroponics maize green fodder without *Saccharomyces cerevisae*) and the highest in group T_1 i.e. control (Table 1). The statistical analysis of data revealed highly significant ($P<0.01$) variations in average cost of feed per kg weight gain among different treatment groups (Table 2). It was revealed that there was comparatively less average cost of feed per kg weight gain in calves fed hydroponics maize green fodder with *Saccharomyces cerevisae* as compared to control due to higher body weight gain.

Thus, it was concluded that cost of feed (in Rupees per day per calf) was increased with replacement of 25%, 50%, 75% and 100% CP of concentrate mixture through hydroponics maize green fodder but cost of feed per kg weight gain in calves fed hydroponics maize green fodder with *Saccharomyces cerevisae* was lower than control animals. It was in fact due to higher body weight gain in calves fed hydroponics maize fodder with probiotics. Feeding of hydroponics maize fodder at a level of 75% CP of concentrate mixture replaced by

hydroponics maize fodder alongwith *Saccharomyces cerevisae* was more economical than any other level of feeding and control. Therefore, it was concluded that feeding of hydroponic maize fodder for calves was economically valid.

The results of present investigation are in agreement with that of Naik *et al.* (2014); Verma *et al*. (2015); Gebremedhin (2015); and Swati *et al*. (2015). Hydroponic sprouts may have profitable application in intensive, small-scale livestock situations with high value outputs, where land and alternative feed costs are high, and where the quality changes due to sprouting are advantageous to the particular livestock (Sneath and McIntosh, 2003).

Hydroponically grown fodder may be an alternative feeds to "achieve better than normal farm production, immune to natural weather variations, guaranteed supply of fresh fodder, 365 days a year, as well as offering an organic and more nutritive solution." Fodder success will depend upon economics of the system (Douglas and Curran, 2013). The cost of feeding may vary with the production capacity of the machine and various fixed and variable expenditures incurred in the production of hydroponics fodder. A lot of advantages are also associated with hydroponics green fodder as it is a viable alternative technology for the farmers having no grazing lands or water scarcity. It can be produced as per the daily requirement and there are no post-harvest losses. Round the year consistent high quality green fodder can be obtained for the farm animals. It is free from pesticides, herbicides and hormones etc. This technology may be especially important in regions where forage production is limited (Buston *et al*., 2000). Above all, it may be used in organic production systems.

Hydroponic fodder production systems are extremely water efficient. As the fodder is grown within a chamber, there are zero losses of water due to evaporation. Animals consume the majority of the water used, along with the feed. There is zero leeching of nutrients during growth of the fodder, unlike traditional feed crops. Hydroponic fodder has higher feed quality, rich with proteins, fibres, vitamins and minerals with therapeutic effects on animals (Boue *et al*., 2003). It has high amount of fatty acids. It has high metabolizable energy, crude protein and digestibility (El-Morsy *et al*., 2013). All these special features of hydroponic culture make it one of the most important agricultural techniques for green fodder production in many countries especially in arid and semi arid regions (Al-Karaki, 2011).

Table 1 Economics of Feeding of Hydroponic Maize Fodder in Calves in Different Treatment Groups

Treatments / Attributes	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean	SEm±
Cost of feed (Rs/day/calf)	43.67^{a}	47.42^{b}	51.17^{c}	54.92^{d}	58.67^{e}	47.53^{b}	51.28^{c}	55.03^{d}	58.78^{e}	52.05	1.6816
Cost/kg b. wt. gain (Rs.)	155.95^{d}	144.61^{bc}	139.77^{b}	129.70^{a}	151.0^{d}	144.72^{c}	137.20^{b}	128.88^{a}	146.89^{c}	142.08	4.8715

Rows and columns with different superscript differ significantly

Table 2 ANOVA of Economics of Feeding of Hydroponic Maize Fodder in Gir Calves

Attribute	Source of Variance	d.f.	mss	F Value	Level of Sig.
Cost of feed (Rs/day/calf)	Treatment	8	109.9	9.711	**
	Error	27	11.3		
Cost / kg b. wt. gain (Rs.)	Treatment	8	332.6	3.504	**
	Error	27	94.9		

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