*Indian J. Anim. Nutr.* 2020. 37 (1): 39-43
doi: 10.5958/2231-6744.2020.00007.9

Indian Journal of Animal Nutrition

# Effect of Feeding of Hydroponics Maize Green Fodder with and without Supplementation of Probiotics (*Saccharomyces cerevisiae*) on Feed Consumption in Gir Calves

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## ABSTRACT

Present investigation was undertaken to determine the chemical composition and assessment of feed consumption of hydroponics maize fodder with and without supplementation of probiotic (*Saccharomyces cerevisiae*) in Gir calves. Total 36 male Gir calves of almost same age group were distributed equally by completely randomized block design in nine groups. 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 crude protein (CP) supplied through concentrate mixture was replaced by hydroponics maize fodder, respectively, whereas in $T_6$, $T_7$, $T_8$ and $T_9$ groups, 25% 50%, 75% and 100% of CP supplied through concentrate mixture was replaced by hydroponics maize fodder alongwith probiotics (*Saccharomyces cerevisae*), respectively. The results indicated that hydroponics maize fodder had shown good nutrient profile such as crude protein, ether extract and nitrogen free extract in present experiment whereas yeast was found to be richer source of calcium and phosphorus. There was highly significant effect ($P<0.01$) of treatments and periods (15 days to 120 days) on dry matter intake (DMI) and organic matter intake. It was revealed that the DMI was found to be decreased with feeding of the hydroponics maize fodder in Gir calves but incorporation of probiotic (*Saccharomyces cerevisiae*) improved DMI.

**Key words:** Chemical composition, Dry matter intake, Gir calves, Hydroponics maize fodder, Organic matter intake

## INTRODUCTION

Green fodder and concentrate are the quintessential for optimum health, growth, productive and reproductive performance in dairy animals. For sustainable dairy farming, quality green fodder should be fed regularly to dairy animals (Naik *et al.,* 2012). The health, growth and production of dairy animals are adversely affected due to unavailability of good quality green fodder and concentrate. Continuous production of green fodder in sufficient quantities is a challenging task. Traditional production of green grasses not only requires large land area, plenty of water, labour, fertilizers and a lot of management problems but it also has low nutritional value. Faster industrialization has squeezed area under pasture land, adversely affecting the grazing based production systems. Shortage of land, long growth time (50-65 days), labour, fertilizer and manure requirements for cultivation, unavailability of same quality throughout the year, lack of irrigation facilities, water scarcity and natural calamities due to climate change are the major obstacles for conventional green fodder and grain production. Technology advancement in industry and farming systems has introduced hydroponics technology for green fodder production. In the prevailing dairy farming system, where quality and quantity of grazing is continuously decreasing, the hydroponics grown green fodder could be a novel way of feeding dairy animals to improve productivity. Due to many constraints in the conventional green fodder cultivation, hydroponics technology may become an alternative not only for the green fodder but may also replace some part of concentrate in farm animals (Naik *et al.,* 2012).

Further, use of natural feed additives in dairy cattle ration has potential for improvement in growth and production. There is a strong need for natural feed additives acceptable for consumers interested in organic

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food. However, there is no information on the effects of probiotics along with hydroponically grown maize fodder in cattle. Chemical composition and feed intake are usually considered as a preliminary index for the assessment of quality of feed. Hence, the present investigation was undertaken to determine the chemical composition and assess the feed consumption of hydroponics maize fodder with and without supplementation of probiotic (*Saccharomyces cerevisiae*) in Gir calves.

## MATERIALS AND METHODS

The per cent chemical composition of hydroponics maize green fodder, yeast (*Saccharomyces cerevisiae*),concentrate mixture and basal roughage was determined. The production of hydroponics maize was done in a hydroponics chamber of Ayurvet Progreen Machine. Clean maize seeds were soaked with tap water in gunny bags for 24 hours and thereafter were distributed in trays @ 2 kg per tray in 1.5-2.0 cm layer thickness. Harvesting of hydroponics fodder was done on day 8$^{th}$ after planting. Around 11 -14 kg hydroponics maize fodder was harvested daily from each tray on the 8$^{th}$ day and was fed to the animals as per experimental protocol. Total of 36 male Gir calves of almost similar age group (add age= and BW=) were selected randomly and distributed equally by completely randomized block design 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 $T_6$, $T_7$, $T_8$ and $T_9$ groups, 25% 50%, 75% and 100% of CP supplied through concentrate mixture was replaced by hydroponics maize fodder along with probiotics (*Saccharomyces cerevisae*), respectively. Daily allowance of concentrate and / or hydroponics maize fodder and roughage were offered to meet their nutrient requirements. Dry matter intake (DMI) and organic matter intake (OMI) was calculated at fortnight intervals as g/d, kg/100kg b. wt. and g/kg $W^{0.75}$ in different treatment groups.

The data obtained in the experiment were analyzed using statistical procedures as described by Snedecor and Cochran (1994) and significance of mean differences were tested by Duncan's New Multiple Range Test (DNMRT) as modified by Kramer (1957).

## RESULTS AND DISCUSSION

The per cent chemical composition of hydroponics maize green fodder, yeast (*Saccharomyces cerevisiae*), concentrate mixture and basal roughage are presented in Table 1. The chemical composition of hydroponics maize fodder in the present investigation was in close agreement with that of Thadchanamoorthy *et al.* (2012). Hydroponics maize fodder had shown good nutrient profile in terms of content of CP, EE and NFE in the present experiment. Yeast was found to be comparatively richer source of calcium and phosphorus. The chemical composition of yeast was also in accordance to the earlier reports of El-Ghani (2004) and Rekha *et al.* (2005). The chemical

**Table 1. Chemical composition of experimental feed (% DM basis)**

| Attributes | DM | On % DM basis | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OM | CP | EE | CF | NFE | TA | NDF | ADF | HC | Ca | P |
| Hydroponics maize fodder | 18.25 | 96.99 | 18.68 | 3.56 | 8.62 | 66.13 | 3.01 | 34.76 | 15.96 | 18.80 | 0.27 | 0.42 |
| Probiotic (*S.cerevisiae*) | 99.39 | 93.64 | 39.56 | 2.74 | 3.63 | 47.71 | 6.36 | - | - | - | 1.83 | 0.76 |
| Concentrate mixture | 89.73 | 88.66 | 20.06 | 3.35 | 10.00 | 55.25 | 11.34 | 38.49 | 20.67 | 17.82 | 1.34 | 0.56 |
| Wheat straw | 91.18 | 89.01 | 3.14 | 1.09 | 39.05 | 45.73 | 10.99 | 75.01 | 52.39 | 22.21 | 0.30 | 0.10 |

composition of hydroponics maize fodder was almost same as that of concentrate mixture except total ash, calcium and phosphorus. These findings corroborate with the reports of earlier workers (Banerjee, 1988; Verma *et al.,* 2015).

The mean values of dry matter intake expressed as kg/100kg BW. ranged between 2.83 to 3.12 whereas mean values of dry matter intake in terms of g/kg $W^{0.75}$ ranged from 94.89 to 103.12 in different treatment groups (Table 2). Data pertaining to dry matter intake in terms of g/d, kg/100kg b. wt. and g/kg $W^{0.75}$ at fortnights are presented in Table 3. he results of statistical analysis of data (Table 4) revealed highly significant effect ($P<0.01$) of treatments ($T_1$ to $T_9$) (*i.e.* hydroponics maize fodder with and without *Saccharomyces cerevisiae*) and periods (15 d to 120 d) on DMI in terms of g/d, kg/100 kg b. wt. and g/Kg $W^{0.75}$. Further, comparison of mean values of DMI revealed significant variations among the groups with highest DMI in group $T_1$ and lowest in group $T_5$. While comparing the treatment groups with respect to supplementation of probiotic, it was observed that there was significantly higher mean DMI in group $T_6$, $T_7$, $T_8$ and $T_9$ as compared to groups $T_2$, $T_3$, $T_4$ and $T_5$, thus showing positive effect of supplementation of probiotic on DMI (Table 2).It was revealed that the dry matter intake was found to be decreased with feeding of the hydroponics maize fodder in Gir calves but incorporation of probiotic (*Saccharomyces cerevisiae*) improved dry matter intake.

Highly significant effect of period was recorded on dry matter intake in terms of g/d, kg/100kg b. wt. and g/Kg $W^{0.75}$. Dry matter intake was found to be increased with advancement of age. It could be attributed to increase in dry matter intake with the growing age of calves irrespective of treatment groups (Table 3 and 4). There was significant effect of feeding of hydroponics maize fodder without and with *Saccharomyces cerevisiae* on dry matter intake in Gir calves. Similar findings were also reported by Verma *et al.* (2015) in calves, Nugrohoa *et al.* (2015) in cows, Gebremedhin (2015) in goats and Ata (2016) in lambs; fed hydroponics barley fodder or hydroponics maize fodder. Improvement in DMI in calves fed yeast culture diets were also reported by Wohlt *et al.* (1991); Erasmus *et al.* (1992); Cole *et al.* (1992); Putnam *et al.* (1997); Heinrich (2004) and Lesmister *et al.* (2004).

In contrast, few workers observed no significant difference in DMI in animals fed with artificially grown fodder *viz.* Rule *et al.* (1986) and Reddy *et al.* (1988) in cows; and Rajendra *et al.* (1998) and Saidi and Omar (2015) in sheep. However, none of them used hydroponics maize fodder in calves. Singh *et al.* (1998) and Titi *et al.* (2008) reported reduced dry matter intake in calves with addition of yeast culture in the diet. DM intake was a limiting factor for sole feeding of hydroponics fodder in cows (Pandey and Pathak, 1991). Supplementation of yeast culture in the diet increased digestion, particularly fibre fraction of the diet, leading to improved feed intake (Hassan *et al.,* 2016).

**Table 2. Average feed consumption (DMI and OMI) in different treatment groups in Gir calves**

| Unit | Treatment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ |
| **Dry matter intake** | | | | | | | | | |
| g/d | $3710.84^{a}$ | $3650.03^{cd}$ | $3624.74^{d}$ | $3595.2^{e}$ | $3555.08^{f}$ | $3687.52^{ab}$ | $3654.53^{c}$ | $3626.00^{d}$ | $3586.27^{e}$ |
| kg/100 kg b.wt. | $3.12^{a}$ | $3.03^{ab}$ | $2.96^{bc}$ | $2.83^{d}$ | $2.85^{d}$ | $3.03^{ab}$ | $2.93^{c}$ | $2.84^{d}$ | $2.88^{cd}$ |
| g/kg $W^{0.75}$ | $103.12^{a}$ | $100.39^{b}$ | $98.52b^{c}$ | $94.89^{c}$ | $95.25^{c}$ | $100.86^{ab}$ | $98.29^{c}$ | $95.52^{c}$ | $96.19^{c}$ |
| **Organic matter intake** | | | | | | | | | |
| g/d | $3307.46^{c}$ | $3287.57^{d}$ | $3302.86^{cd}$ | $3309.34^{c}$ | $3311.50^{c}$ | $3339.78^{ab}$ | $3340.82^{a}$ | $3354.07^{a}$ | $3358.51^{a}$ |
| kg/100 kg b.wt. | $2.78^{b}$ | $2.80^{ab}$ | $2.72^{c}$ | $2.72^{c}$ | $2.73^{c}$ | $2.83^{a}$ | $2.71^{c}$ | $2.70^{c}$ | $2.70^{c}$ |
| g/kg $W^{0.75}$ | $91.83^{c}$ | $93.79^{ab}$ | $92.50^{bc}$ | $90.32^{d}$ | $91.20^{cd}$ | $94.12^{a}$ | $90.34^{d}$ | $90.81^{d}$ | $90.38^{d}$ |

Rows with different superscript differ significantly

**Table 3. Average feed consumption (DMI and OMI) at fortnight intervals in Gir calves**

| Period (days) | Dry matter intake | | | Organic matter intake | | |
|---|---|---|---|---|---|---|
| | g/d | kg/100 kg b.wt. | g/kg $W^{0.75}$ | g/d | kg/100 kg b.wt. | g/kg $W^{0.75}$ |
| 15 | 3046.57$^{h}$ | 2.94$^{b}$ | 93.97$^{d}$ | 2787.15$^{h}$ | 2.55$^{g}$ | 81.60$^{h}$ |
| 30 | 3075.04$^{g}$ | 2.81$^{c}$ | 91.12$^{e}$ | 2813.20$^{g}$ | 2.61$^{f}$ | 84.62$^{g}$ |
| 45 | 3233.08$^{f}$ | 2.81$^{c}$ | 92.66$^{d}$ | 2958.55$^{f}$ | 2.66$^{e}$ | 87.52$^{f}$ |
| 60 | 3459.24$^{e}$ | 2.87$^{c}$ | 95.35$^{c}$ | 3165.44$^{e}$ | 2.71$^{d}$ | 90.36$^{e}$ |
| 75 | 3665.73$^{d}$ | 2.91$^{bc}$ | 97.52$^{c}$ | 3354.60$^{d}$ | 2.78$^{c}$ | 92.65$^{d}$ |
| 90 | 3849.60$^{c}$ | 2.92$^{b}$ | 99.15$^{b}$ | 3520.35$^{c}$ | 2.84$^{b}$ | 96.93$^{c}$ |
| 105 | 4258.76$^{b}$ | 3.10$^{ab}$ | 106.43$^{a}$ | 3898.22$^{b}$ | 2.90$^{a}$ | 99.71$^{ab}$ |
| 120 | 4469.95$^{a}$ | 3.14$^{a}$ | 108.73$^{a}$ | 4090.86$^{a}$ | 2.88$^{ab}$ | 100.18$^{a}$ |

Columns with different superscript differ significantly

The mean values of organic matter intake in terms of g/d; kg/100 kg b. wt.; and g/kg $W^{0.75}$ ranged between 3287.57 and 3358.51; 2.70 and 2.83; and 90.32 and 94.12, respectively (Table 2).

The results of statistical analysis of data (Table 4) revealed highly significant ($P<0.01$) effect of treatments *i.e.* feeding of hydroponics maize fodder with and without supplementation of *Saccharomyces cerevisiae* on organic matter intake in terms of g/d, kg/100 kg b. wt. and g/kg $W^{0.75}$. Likewise, effect of period was also observed as highly significant in terms of g/d, kg/100 kg b. wt. and g/kg $W^{0.75}$.

Further, comparison of mean values of organic matter intake in different treatment groups in terms of g/d showed significant variations among the groups with significantly high organic matter intake in groups fed supplemental Saccharomyces *cerevisiae.* The lowest organic matter intake was seen in group $T_2$ *i.e.* 25% CP of concentrate mixture replaced through hydroponics maize green fodder without supplementation of *Saccharomyces cerevisiae* (Table 2). There was significant effect of hydroponics maize fodder without and with supplementation of probiotic (*Saccharomyces cerevisiae*) on organic matter intake in Gir calves. Similar findings have also been reported by Naik *et al.* (2014) in lactating cows, Verma *et al.* (2015) in Haryana male calves, Naik *et al.* (2015) in cows and Gebremedhin (2015) in goats fed hydroponics fodder. Pal *et al.* (2010), Reena Kamal *et al.* (2013) and Yirga (2015) reported significant effects of supplementation of yeast on feed consumption.

## CONCLUSION

Dry matter intake was found to be decreased with feeding of the hydroponics maize fodder in Gir calves but incorporation of probiotic (*Saccharomyces cerevisiae*) improved dry matter intake. Dry and organic matter intake was found to be increased with advancement of age.

## REFERENCES

Ata, M. 2016. Effect of hydroponic barley fodder on Awassi lambs performance. *J. Biol. Agric. Healthcare.* 6: 60-64.

Banerjee, G.C.1988. Feeds and Principles of Animal Nutrition. Oxford and IBH Publishing Company, pp 152.

Cole, N.A., Purdy, C.W. and Hutchesont, D.P. 1992. Influence of yeast culture on feeder calves and lambs. *J. Anim. Sci.* 70: 1682-1690.

El-Ghani, A.A.A. 2004. Influence of diet supplementation with yeast culture (*Saccharomyces cerevisiae*) on performance of zaraibl goats. *Small Rumin. Res.* 52: 233-229.

Erasmus, L.J., Botha, P.M. and Kistner, A. 1992. Effect of yeast culture supplement on production, rumen fermentation, and duodenal nitrogen flow in dairy cows. *J. Dairy Sci.* 75: 3056-3065.

Gebremedhin, W. K. 2015. Nutritional benefit and economic value of feeding hydroponically grown maize and barley fodder for Konkan Kanyal goats. *J. Agric. Vet. Sci.* 8: 24-30.

Hassan, A.A., Salem, A.Z.M., Kholif, A.E., Samir, M., Yacout, M.H., Abu Hafsa, S.H., Mendoza, G.D., Elghadour, M.M.Y., Ayala, M. and Lopez, S. 2016. Performance of crossbred dairy Friesian cows fed two levels of *Saccharomyces cerevisiae*: Intake, digestion, ruminal fermentation, blood parameters and faecal pathogenic

bacteria. *J. Agric Sci.* 154: 1488-1498.

Heinrich, J. 2004. Yeast culture may affect rumen development. *Feed Stuffs* 76: 11-14.

Kramer, C.Y. 1957. Extension of multiple range tests to group correlated adjusted means. *Biometrics* 13: 13-17.

Lesmeister, K. E., Heinrichs, A. J. and Gabler, M.T. 2004. Effects of supplemental yeast (*Saccharomyces cerevisiae*) culture on rumen development, growth characteristics, and blood parameters in neonatal dairy calves. *J. Dairy Sci*. 87: 1832-1839.

Naik, P.K., Swain, B. K., Chakurkar, E. B. and Singh, N.P. 2012. Performance of dairy cows on green fodder maize based ration in coastal hot and humid climate. *Anim. Nutr. Feed Technol.*12: 265-270.

Naik, P.K., Dhuri, R.B., Karunakaran, M., Swain, B.K. and Singh N.P. 2014. Effect of feeding hydroponics maize fodder on digestibility of nutrients and milk production in lactating cows. *Indian J. Anim. Sci.* 84: 880-883.

Naik, P.K., Swain, B.K. and Singh, N.P. 2015. Review: Production and utilisation of hydroponics fodder. *Indian J. Anim. Nutr.* 32: 1-9.

Nugrohoa, H.D., Permanab, I.G. and Despal. 2015. Utilization of Bio-slurry on maize hydroponic fodder as a corn silage supplement on nutrient digestibility and milk production of dairy cows. *Media Peternakan* 38: 70-76.

Pal, K., Paul, S.K., Bhunia, T., Pakhira, M.C., Biswas, P. and Patra A.K. 2010. Responses of addition of yeast (*Saccharomyces cerevisiae*) from rice distillers grains with soluble with or without trace minerals on the performance of Black Bengal kids. *Small Rumin. Res*. 94: 45-52.

Pandey, H. N. and Pathak, N. 1991. Nutritional evaluation of artificially grown barley fodder in lactating crossbred cows. *Indian J. Anim. Nutr.* 8: 7778.

Putnam, D.E., Schwab, C.G., Socha, M.T., Whitehouse, N.I., Kierstead, N.A. and Garthwaite, B.D. 1997. Effect of yeast culture in the diets of early lactation dairy cows on ruminal fermentation and passage of nitrogen fractions and amino acids to small intestine. *J. Dairy Sci.* 80: 374-384.

Rajendra Prasad, Seghal, J.P., Patnayak, B. C. and Beniwal R.K. 1998. Utilization of artificially grown barley fodder by sheep. *Indian J. Small Rumin.* 4: 63-68.

Reddy, G.V.N., Reddy, M. R. and Reddy K.K. 1988. Nutrient utilization by milch cattle fed on rations containing artificially grown fodder. *Indian J. Anim. Nutr.* 5: 19-22.

Reena Kamal, Dutt, T., Singh, M., Kamra, D. N., Patel, M., Choudhary, L.C., Agarwal, N., Kumar, S. and Islam, M. 2013. Effect of live *Saccharomyces cerevisiae* (NCDC-49) supplementation on growth performance and rumen fermentation pattern in local goat. *J. Appl. Anim. Res.* 41: 285-288.

Rekha, N.A., Prasad, J.R. and Ramana, J.V. 2005. Evaluation of ground nut haulms supplemented with yeast culture in sheep. *Indian J. Anim. Nutr*. 22: 198-200.

Rule, D.C., Preston, R.L., Koes, R.M. and McReynolds, W.E. 1986. Feeding value of sprouted wheat (*Triticum aestivum*) for beef cattle finishing diets. *Anim. Feed Sci. Technol.* 15: 113-121.

Saidi Rahim Abd., M.A. and Omar, J.A. 2015. The Biological and economical feasibility of feeding barley green fodder to lactating Awassi ewes. *Open J. Anim. Sci.* 5: 55249.

Singh, R., Chowdhary, L.C., Kamara, D.N. and Pathak, N.N. 1998. Effect of dietary supplementation with yeast cell suspension (*Saccharomyces cerevisiae*) on nutrient utilization and growth response in crossbred calves. *Asian-Australas. J. Anim. Sci.* 11: 268-271.

Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods* 8th edn. Oxford and IBH Publishing Co., New Delhi, India.

Thadchanamoorth., S., Jayawardena, V.P. and Pramalal, C.G.C. 2012. Evaluation of hydroponically grown maize as a feed source for Rabbits. *Proceedings of 22nd Annual Students Research Session*, Department of Animal Science. November 30, 2012, pp 5 (Abstr).

Titi, H.H., Abdullah, A.Y., Lubbadeh and Obeidat, B.S. 2008. Growth and carcass characteristics of male dairy calves on a yeast culture supplemented diet. *South African J. Anim. Sci.* 38: 174-183.

Verma, S., Singh, A. Kalra, A. and Saxena, M. 2015. Effect of feeding hydroponics barley fodder on nutrient utilization, growth, blood metabolites and cost effectiveness in Hariana male calves. *Indian J. Anim. Nutr.* 32: 10-14.

Wohlt, J.E., Finkelstein, A.D. and Chung, C.H. 1991. Yeast culture to improve intake, nutrient digestibility and performance by dairy cattle during early lactation. *J. Dairy Sci.* 74: 1395-1400.

Yirga, H. 2015. The Use of probiotics in animal nutrition. *J. Prob. Health.* 3: 132.

Received on 04-06-2020 and accepted on 25-06-2020