Indian Journal of Animal Sciences **86** (10): 1210–1212, October 2016/Short communication
https://doi.org/10.56093/ijans.v86i10.62433

Digestibility of nutrients in crossbred heifers supplemented with hydroponically sprouted maize grains

P K NAIK[1], M KARUNAKARAN[2], E B CHAKURKAR[3], B K SWAIN[4] and N P SINGH[5]

ICAR-Central Coastal Agricultural Research Institute, Goa 403 402 India

Received: 14 March 2016; Accepted: 08 April 2016

Key words: Digestibility, Feeding, Grains, Hydroponics, Maize, Nutrients, Sprouts

The potential health benefits of sprouted grains are well known; Sprouted grains are good sources of chlorophyll and contain grass juice factor that improves the performance of the livestock (Sneath and Mclntosh 2003, Shipard 2005). Feeding of quality green fodder to dairy animals is highly essential to maintain the productivity, fertility and economical viability of the farm. The major factors responsible for the unavailability of green fodder are scarcity of land due to small land holding size, shortage of water or saline water and labour (Naik *et al.* 2013). In this scenario, supplementation of sprouted grains in the ration of dairy animals is coming up as a viable alternate technology to conventional green fodder for the livestock farmers (Naik *et al.* 2015). However, only a few reports are available on the feeding value of the sprouted maize grains to the dairy animals in India (Naik *et al*. 2012, 2014). Therefore, an experiment was conducted to find out the effect of feeding sprouted maize grains on digestibility of nutrients in heifers.

Hydroponically sprouted maize grains were produced in a hydroponics chamber measuring about 25 ft × 10 ft × 10 ft with a daily production potential of 600 kg fresh hydroponically sprouted grains (7-days) and equipped with automatic sprayer irrigation of tap water. Clean seeds of maize (*Zea mays* L.) were soaked in tap water for 4 h and distributed in green house trays with a seed rate of 7.6 kg/ m^2. Inside the green house, the plants were allowed to sprout for 7 days and on eighth day, they were fed to the animals.

Three crossbred heifers (avg. BW 271.22 kg), kept in well ventilated, clean cement floored shed were offered 2 kg standard conventional concentrate mixture (CM) containing maize grain (35), rice polish (25), soybean meal (15), cotton seed cake (22), mineral mixture (2) and common salt 1 parts by weight along with 10 kg hydroponically sprouted maize grains and *ad lib. jowar* straw to meet their nutrient requirements (Ranjhan 1998) for 30 days. The ration was offered twice daily in equally divided doses, while clean drinking water was made available *ad lib*. throughout the experiment. At the end of the feeding period, a 6–day digestion trial was conducted on all the experimental animals. During the digestion trial, the feeding schedule of the animals remained the same as earlier. The feed residues after 24 h consumption of each animal were weighed to determine the daily feed intake. Faeces were collected quantitatively from the animals immediately after defecation. The feed offered and residues left were recorded daily. The feeds and fodder offered were analyzed for proximate principles (AOAC 2000). The data were analyzed statistically for the test of significance (Snedecor and Cochran 1994).

The nutrient contents of the concentrate mixture was as per the BIS specifications of the compounded cattle feed (Table 1). The hydroponically sprouted maize grains looked like a mat of 20–30 cm height consisting of germinated seeds, roots and leaves. The increase in the fresh weight of the hydroponically sprouted maize grains than the seed weight was 5–6 folds with DM content of 18.3% (Naik *et al.* 2014). Naik and Singh (2014) reported that yields of 3.5–6.0 folds on fresh basis and DM content of 11–14% are common for hydroponics maize fodder or hydroponically sprouted maize grains. Similarly, there are reports of 3.7–4.5 times increase in the fresh weight with DM content of 19.26–19.7% in the 6–7 days hydroponics barley fodder (Dung *et al*. 2010, Fazaeli *et al.* 2011).

Table 1. Chemical composition (on % DM basis) of feeds and fodder

Parameter	Concentrate mixture	*Jowar* straw	Hydroponically sprouted maize grains
Dry matter (on fresh basis)	92.40	89.84	18.30
Crude protein	20.20	2.52	13.30
Ether extract	3.60	0.31	3.27
Crude fiber	11.51	34.90	6.37
Nitrogen free extract	58.77	54.51	75.32
Total ash	5.93	7.77	1.75
Acid insoluble ash	0.82	3.43	0.57

Present address: [1]Principal Scientist (pknaikicar@gmail.com), Animal Nutrition, [4]Principal Scientist (nbkswain@gmail.com), ICAR-CARI Regional Centre (RC), Bhubaneswar, Odisha. [2]Senior Scientist (drmkarunakaran@gmail.com), ICAR-NDRI ERS, Kalyani, West Bengal. [3]Principal Scientist (eknchakurkar @yahoo.com), [5]Director (narendraprataps@yahoo.co.in), ICAR-CCARI, Goa.

The nutrient content (13.30% CP, 3.27% EE, 6.37% CF, 75.32% NFE, 1.75% TA and 0.57% AIA) of the hydroponically sprouted maize grains observed in this experiment was parallel to the reports (13.56–13.57% CP, 2.46–3.49% EE, 8.98–14.07% CF, 66.72–73.45% NFE, 1.56–3.84% TA and 0–0.33% AIA) of the earlier workers (Naik *et al.* 2012, 2016).

The DM intake (kg) per 100 kg BW of the heifers was 2.03 and roughage:concentrate (R:C) ratio was maintained at 66:34 (Table 2). However, DM intake (kg) of 2.05 and 2.25/100 kg BW and R:C ratio of 48:52 and 73:27 was reported in lactating cows and heifers, fed 3.2 kg and 20.98 kg fresh hydroponics maize fodder, respectively (Naik *et al.* 2014, 2016). DM intake of 3.35–3.38 kg/100 kg BW was reported by Verma *et al.* (2015) in Haryana male calves fed rations supplemented with 2.5–5.0 kg hydroponics barley fodder. Hydroponically sprouted maize grains were palatable and the germinated seeds embedded in the roots are also consumed along with the leaves of the plants without any nutrient wasting. Sometimes, animals take the leafy parts of the hydroponically sprouted maize grains and the roots portions were not consumed, which could be avoided by mixing the hydroponically sprouted maize grains with the other roughage components of the ration.

The digestibility (%) of the various nutrients of the ration observed in the present study i.e. DM (61.35 vs 65.39 and 65.62), OM (65.08 vs 68.47 and 68.06), CP (67.74 vs 72.46 and 69.36), EE (72.81 vs 87.69 and 80.95), CF (51.73 vs 59.21 and 59.70) and NFE (68.23 vs 70.47 and 69.87) was lower than the nutrient digestibility (%) in lactating cows and heifers, fed 3.2 kg and 20.98 kg fresh hydroponics maize fodder per day, respectively (Naik *et al.* 2014, 2016). The difference in the digestibility of the nutrients might be due to the difference in the age or productive stage or quantity of hydroponics maize fodder fed to the experimental animals. The increase in the digestibility of the nutrients of the ration on feeding of hydroponics fodder could be attributed to the tenderness of the fodder due to its lower age. However, Verma *et al.* (2015) reported decrease in the digestibility (%) of DM (58.19–60.60), OM (62.33–64.23) and CF (42.74–43.33), and increase in the digestibility (%) of CP (77.46–79.57), EE (73.45–73.40) and NFE (70.47) in Haryana male calves fed rations supplemented with 2.5–5.0 kg hydroponics barley fodder, in comparison to the present findings. The total ration had 12.02% CP, 8.17% DCP and 63.20% TDN, which was close to the reports (CP, 12.73–13.29; DCP, 8.81–9.65; TDN, 68.71–68.52) of the earlier workers (Naik *et al.* 2014, 2016). The improvement in the nutritive values (CP, DCP and TDN%) of the hydroponics green fodder based ration may be attributed to the high digestibility of the nutrients of the ration.

Table 2. Effect of feeding hydroponically sprouted maize grains on dry matter intake, digestibility of nutrients and nutritive value in heifers

Parameter	Mean±SEM
Mean BW	271.22±13.17
Dry matter intake (kg/day)	
Concentrate mixture	1.85±0.00
Hydroponics maize fodder	1.62±0.08
Jowar straw	2.00±0.21
Total roughage	3.62±0.14
Total dry matter	5.47±0.14
Dry matter intake/100 kg BW	2.03±0.13
Roughage:concentrate ratio	66:34±0.85
Digestibility (%)	
Dry matter	61.35±2.65
Organic matter	65.08±2.35
Crude protein	67.74±2.48
Ether extract	72.81±0.99
Crude fiber	51.73±4.71
Nitrogen free extract	68.23±1.75
Nutritive value (%)	
CP	12.02±0.35
DCP	8.17±0.29
TDN	63.20±2.10

SUMMARY

A study was conducted to find out the digestibility of nutrients in heifers fed hydroponically sprouted maize grains. Hydroponically sprouted maize grains were produced in a hydroponics chamber (greenhouse) measuring about 25 ft × 10 ft × 10 ft equipped with automatic sprayer irrigation of tap water. Three crossbred heifers (avg. BW 271.22 kg) were fed individually 2 kg standard conventional concentrate mixture along with 10 kg hydroponically sprouted maize grains and *ad lib. jowar* straw daily to meet their nutrient requirements for a period of 30 days followed by a 6 days digestion trial. The hydroponically sprouted maize grains (7 days) looked like a mat of 20–30 cm height consisting of germinated seeds roots and leaves. The increase in the fresh weight of the hydroponically sprouted maize grains than the seed weight was 5–6 folds. The DM content of the hydroponically sprouted maize grains was 18.30% and the CP, EE, CF, NFE, TA and AIA content (on % DM basis) was 13.30, 3.27, 6.37, 75.32, 1.75 and 0.57, respectively. The DM intake per 100 kg BW of the heifers was 2.03 and the roughage:concentrate ratio was maintained at 66:34. The digestibility (%) of DM, OM, CP, EE, CF and NFE of the ration was 61.35, 65.08, 67.74, 72.81, 51.73 and 68.23, respectively. The total ration had 12.02% CP, 8.17% DCP and 63.20% TDN. It can be concluded that hydroponically sprouted maize grains can be supplemented in the ration of heifers in situations, where conventional fodder is not available or cannot be grown due to any adverse conditions.

ACKNOWLEDGEMENT

The authors are thankful to Indian Council of Agricultural Research (ICAR), New Delhi; Rashtriya Krishi Vikas Yojana (RKVY), Govt. of India and Goa Dairy, Curti, Ponda, Goa for providing financial support to conduct the study.

REFERENCES

AOAC. 2000. *Official Methods of Analysis*. 17th edn. Association of Official Analytical Chemists, Washington, DC.

Dung D D, Godwin I R and Nolan J V. 2010. Nutrient content and *in sacco* digestibility of barley grain and sprouted barley. *Journal of Animal and veterinary Advances* **9**(19): 2485–92.

Fazaeli H, Golmohammadi H A, Shoayee A A, Montajebi N and Mosharraf Sh. 2011. Performance of feedlot calves fed hydroponics fodder barley. *Journal of Agriculture Science and Technology,* **13**: 365–75.

Naik P K and Singh N P. 2014. Production and feeding of hydroponics green fodder. *Indian Farming* **64**(6): 42–44.

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 Journal of Animal Sciences* **84**(8): 880–83.

Naik P K, Dhuri R B, Swain B K and Singh N P. 2012. Nutrient changes with the growth of hydroponics fodder maize. *Indian Journal of Animal Nutrition* **29**: 161–63.

Naik P K, Dhuri R B, Swain B K, Karunakaran M, Chakurkar E B and Singh N P. 2013. Analysis of existing dairy farming in Goa. *Indian Journal of Animal Sciences* **83**(3): 299–303.

Naik P K, Karunakaran M, Swain B K, Chakurkar E B and Singh N P. 2016. Voluntary intake and digestibility of nutrients in heifers fed hydroponics maize (*Zea mays* L.) fodder. *Indian Journal of Animal Nutrition* **33**(2): 233–35.

Naik P K, Swain B K and Singh N P. 2015. Review-production and utilization of hydroponics fodder. *Indian Journal of Animal Nutrition* **32** (1): 1–9.

Ranjhan S K. 1998. *Nutrient Requirement of Livestock and Poultry.* 2nd revised edn. ICAR, New Delhi, India.

Shipard I. 2005. *How Can I Grow and Use Sprouts as Living Food*. Stewart Publishing.

Sneath R and Mclntosh F. 2003. *Review of Hydroponic Fodder Production for Beef Cattle*. Queensland Government, Department of Primary Industries, Dalby, Queensland.

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

Verma S, Singh A, Kalra A and Saxena M J. 2015. Effect of feeding hydroponics barley (*Hordeum vulgare*) fodder on nutrient utilization, growth, blood metabolites and cost effectiveness in Hariana male calves. *Indian Journal of Animal Nutrition* **32**(1): 10–14.