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Intake, eating pattern, nutrients digestibility and growth of Tharparkar heifers fed inorganic and organically produced feeds

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ABSTRACT

A feeding trial was conducted for 3 months on 12 Tharparkar heifers equally distributed between inorganic (G_1) and organic dietary groups (G_2), (n,6) in each with mean body weight of 216.0±8.30 and 218.6±7.09 kg were offered *ad lib.* sorghum hay (cv PC 6) grown under inorganic and organic agronomic practices, respectively. Barley grain/oat grown inorganically and organically was used as energy sources in concentrate mixture with linseed cake as protein source to determine the intake, eating pattern, nutrients utilization, nitrogen balance and growth rate under both the feeding regimes. DMI (kg/d) was comparable in animals fed inorganic (G_1) and organically produced diets (G_2). OM and hemicellulose digestibility was significantly higher in animals of G_2 than G_1. The digestibility of fiber fractions was 3–3.5 units more in animals of G_2 than G_1. N retention was more animals fed organic diet (6.70) than inorganically produced diet (2.46%). Heifers fed organic fodder consumed more at early 2 and 4 h feeding than animals fed inorganic fodder and feed, however at later stages of eating animals offered inorganic fodder/feed, consumed relatively more. Growth rate (g/d) was identical in heifers of G_1 and G_2 dietary groups. Results revealed that nutrients digestibility and nitrogen balance is higher in animals fed organically grown fodder and feeds.

Key words: Digestibility, Growth, Inorganic sorghum, Nutrients, Organic sorghum, Tharparkar heifer

Several factors affect plant composition, viz. genetics, soil type, climate, irrigation, cultivation practices, harvest time etc. and factor of fertilization is one part of the total agriculture system that alters plant composition (Woese *et al.* 1997). Studies were carried out on the relative response of organic and inorganically produced feeds and fodder on intake, nutrients utilization and production performance mostly with monogastric and sporadically with ruminants (Vogtman 1988, Reksen *et al.* 1999). Effect of organically grown sorghum (hay) and barley grain (energy source) based concentrate was evaluated with inorganically produced fodder and feeds on intake, nutrients utilization and growth of Tharparkar heifers.

MATERIALS AND METHODS

Fodder and feeds production: Sorghum (PC 6 variety) was grown in Kharif on 1 ha area each under organic and inorganic fertilizer management and other agronomic practices, while the barley grain produced in Rabi was also grown under organic and inorganic agronomic practices. Sorghum harvested at half bloom stage was conserved as hay. Barley grain was used as energy source in concentrate mixture and fed to animals with sorghum hay.

Animals, feeds and digestion trial: Tharparkar heifers (12) were randomly distributed in G_1 and G_2 of 6 animals in each with mean body weight of 216.0±8.30and 218.6±7.09 kg, respectively. The animals were housed individually and offered chaffed sorghum hay *ad lib.* and concentrate mixture (barley, 72; linseed cake, 25; common salt, 2 and mineral mixture; 1 part) to meet their nutritional requirement.

The CP, NDF and cellulose contents varied from 5.7–5.9, 78.49–79.13 and 42.10–45.61% in both type of sorghum hay and 14.70–15.00, 35.21–37.21 and 8.64–9.94% in concentrate mixtures prepared from organic and inorganic ingredients.

Analytical techniques and statistical analysis: Dried samples of sorghum, hay, residue and faeces were ground through 2 mm sieve using electrically operated Willey mill. The CP, ash and DM contents were estimated as per AOAC (1992). The NDF, ADF, cellulose and lignin were determined according to Van Soest *et al.* (1991). Data were analyzed statistically as per Snedecor and Cochran (1968).

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RESULTS AND DISCUSSION

Feed intake and nutrients utilization: Intake of feed (kg/d) was comparable between inorganic (G_1) and organic (G_2) dietary groups (Table 1). Identical feed intake was also observed by Bystrom *et al.* (2002) during whole lactation in crossbred cows fed organic and conventional diet. However these workers found higher intake during 11–34 weeks lactation in organic (3.3) than conventional diet (3.1%) fed animals. The digestibility of DM tended to be higher in G_2 than G_1 but the differences were nonsignificant (Table 1). Unlike, the digestibility of OM and hemicellulose was significantly ($P<0.05$) higher in animals fed organic diet G_2 than inorganic diet G_1. The digestibility of fibre fractions was 3–3.5 units more in animals of G_2 than G_1. Higher digestibility of fibre fractions in G_2 may be partly attributed to low accumulation of cell wall fractions in organically produced sorghum. Higher DDM (%) of organically produced sorghum and mixed crop of sorghum-vicia than inorganic (Lanysasunya *et al*. 2006) substantiate the present findings. Further similar observations were recorded on feed intake and nutrients utilization in cattle, fed organically produced sorghum and in lambs fed cowpea hay-barley grain diet (Singh *et al*. 2008, 2010).

Table 1. Feed intake and nutrients digestibility in Tharparkar calves fed inorganic and organically produced sorghum hay

Attribute	Inorganic group (G_1)	Organic group (G_2)
Animal weight (kg)	227.40±7.78	235.00±4.42
Intake		
kg/d	4.48±0.095	4.40±0.21
% Body weight	1.97±1.56	1.85±0.072
G/kg $W^{0.75}$	75.8±1.56	72.41±1.27
Nutrients digestibility		
DM	60.48±1.67	63.40±0.64
OM*	66.03±1.43	69.71±0.67
CP	52.09±1.40	51.00±1.25
NDF	52.82±1.98	56.33±0.81
ADF	42.77±2.15	44.60±1.10
Cellulose	61.53±1.77	63.40±1.27
Hemicellulose*	65.55±1.84	71.09±0.47

* Significant at $P<0.05$.

Eating pattern and meal consumption: Heifers fed organic fodder consumed more at early 2 and 4 h feeding than animals fed inorganic fodder and feed, however at later stages of eating animals offered inorganic diet consumed relatively more (Table 2). Similarly the total meal ingestion in early 2 and 4 h of feeding was more in animals fed organic diet G_2 than G_1. Meal ingestion in 7 and 24 h of eating was comparable between animals of G_2 and G_1. Eating pattern and meal consumption is a function of feed/fodder physical and chemical properties. Balch and Campling (1962) suggested that without choice of food, taste and other sense play a major role in initiation of feeding than feed amount eaten.

Table 2. Eating pattern and meal consumption (kg) in Tharparkar calves fed inorganic and organic sorghum hay

	Eating pattern			Meal consumption	
Eating hours	(G_1)	(G_2)	Eating time (h)	(G_1)	(G_2)
1 h	2.290±0.10	2.300±0.15	1 h	2.290±0.10	2.300±0.15
2 h	0.805±0.12	0.929±0.07	2 h	3.095±0.13	3.2290.15
4 h	0.403±0.07	0.595±0.16	4 h	3.498±0.18	3.824±0.07
6 h	0.996±0.16	0.852±0.08	6 h	4.494±0.08	4.676±0.05
7 h	0.314±0.68	0.214±0.02	7 h	4.808±0.03	4.890±0.05
17 h	0.410±0.05	0.327±0.04	Total (24 h)	5.218±0.05	5.217±0.07

Nitrogen balance and growth rate: Nitrogen intake (g/d) was comparable between animals fed inorganic and organic diet (Table 3). Faecal losses were also identical in animals offered both type of diets. On the other hand urinary N loss was 4 units more in G_1 than G_2. Similar trend on N loss from feces and urine was reported in lambs fed organic and inorganically produced cowpea hay-barley grain diet (Singh *et al*. 2010). Per cent nitrogen retention was more in animals fed organic diet (6.70) than inorganic diet (2.46%) and this may be due to more urinary N loss in G_1.

The animals attained identical body weight gain on feeding of organic and inorganic diets. The growth rate (g/d) was identical in heifers of G_1 and G_2 dietary group (Table 3). Arnon *et al.* (1974) observed no differences in the growth of guinea pigs fed solely on grass either in soil plots having history of organic and inorganic manuring. Further Singh *et al*. (2010) also observed no significant differences in growth rate of lambs fed organic and inorganically grown cowpea hay-barley grain diets. Result indicated that heifers fed organic diet tended to have more nutrients utilization and N balance but similar growth rate.

Table 3. Nitrogen balance and growth performance in Tharparkar calves fed inorganic and organically produced sorghum hay

Attribute	Inorganic group (G_1)	Organic group (G_2)
Intake (g/d)	68.58±0.85	69.04±1.37
Faecal loss (g/d)	32.84±0.93	33.77±0.87
N retention (g/d)	35.74±1.18	35.16±1.28
Urinary loss (g/d)	32.27±1.54	28.46±4.02
N-absorbed (g/d)	2.46±1.13	6.70±4.54
% N retention	3.59	9.70
Growth rate		
Initial weight (kg)	216.0±8.30	218.6±7.09
Final weight (kg)	244.5±8.54	247.0±5.49
Weight gain (kg)	28.50	28.40
Growth rate (g/d)	317.8±25.60	315.7±32.72

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