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Nutritional evaluation of new oats variety as fodder

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ABSTRACT

Nutritional worth of new variety of green oats developed by Punjab Agricultural University, Ludhiana, was assessed. The check (OL–9) and the new (OS–342) variety of oats were cultivated at different locations in the Punjab State for 3 consecutive years. The overall average green forage and DM yield of new variety was 14.0 and 21% higher than the check variety of oats. The chemical composition of both the varieties was comparable. The *in vitro* screening revealed that the net gas production and ME availability were higher in new than check variety of oats. Adult male buffaloes (8; 465.75±3.97 kg BW) divided into 2 equal groups were offered either check variety (OL–9) or new variety (OS–342) of green oats *ad lib*, supplemented with mineral mixture and common salt for 30 days. The daily DM intake and digestibility of nutrients were slightly higher in new variety than that of the check variety but the differences were nonsignificant. The NPN concentration in the rumen liquor of animals fed new oats variety was lower than those fed check variety, but reverse trend was observed with respect to TCA-N. The blood profile, urinary excretion of purine derivatives and the microbial protein synthesized in the rumen of animals offered check or new oats variety were statistically comparable. The faecal-N excretion was lower in animal fed new variety as compared to check variety resulting in higher CP digestibility in new oats variety. The total-N excretion was comparable in both the groups, resulting in comparable N-retention and apparent biological value. It was concluded that new oats variety (OS–342) had an edge over the check variety (OL–9) with respect to yield and quality.

Key words: Buffaloes,New oats variety, Nutrient utilization, Rumen metabolites, Yield

The area under fodder production in Punjab state is only 16.6% of the net sown area (i.e. 700×10^3 ha out of 4224×10^3 ha). The cultivated fodder accounts for more than 98% of green forages. The remaining 2% is contributed by forests, fallow land (1.23%), permanent pastures and grazing land (0.1%). The availability of green fodder has increased from 55 to 57 mt in the last decade with an annual growth rate of 0.36% (Anonymous 2007). The availability/animal/day in Punjab has also increased remarkably from 10 kg (1974–75) to 21 kg (2006–07). But still there is a deficit of green forages in the state, which can be covered up to certain extent by developing high yielding fodder varieties. The present study was taken up to evaluate the new variety of oats developed by Punjab Agricultural University, Ludhiana.

MATERIALS AND METHODS

Fodder yield: The check (OL–9) and new (OS–342) varieties of green oats were cultivated and supplied in bulk for nutritional evaluation by the Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana. Both the varieties were cultivated for 3 consecutive years (2006–09) at Ludhiana and in addition in 2008–09 at PAU Research stations at Bahowal, Faridkot and Gurdaspur in order to check forage and dry matter yield.

Animals feeding: Adult male buffaloes (8; 465.75±3.97 kg BW) divided into 2 equal groups were offered either check variety (OL–9) or new variety (OS–342) of green oats *ad lib.* supplemented with 60 g mineral mixture and 30 g common salt for 30 days. The animals had free access to water twice-a-day and were exercised daily for 1 h. The animals were weighed for 3 consecutive days at 15 day interval before feeding. After adapting for 30 days on the respective diet, a 7–day metabolic trial was conducted on all the animals in each group. At the termination of the metabolism trial, blood samples were collected 4 h after feeding from each animal by jugular puncture in heparinized tubes.

Rumen studies: The effect of different varieties of oats on the biochemical changes in the rumen was assessed by offering either check or new variety supplemented with 60 g mineral mixture and 30 g common salt to 3 permanently rumen fistulated adult male buffaloes at 9.00 AM. After 30 days adaptation period, rumen contents, collected for 3

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consecutive days at 0, 2, 4, 6, 8 and 12 h post feeding were strained through 4 layers of muslin cloth. Equal quantity of strained rumen liquor (SRL) from each collection was pooled for the respective animal. A few drops of $HgCl_2$ were added in each sample of SRL to stop microbial action and refrigerated till analyzed.

Chemical and statistical analysis : Samples of feed, orts and faeces were ground to pass through 1 mm sieve and analyzed in duplicate for nitrogen and total ash (AOAC 1995), cellulose (Crampton and Maynard 1938) and other cell wall constituents (Robertson and Van Soest 1981). The urine samples were analyzed for nitrogen content only. The samples were evaluated by *in-vitro* gas production technique (Menke *et al.* 1979). The strained rumen liquor samples were analyzed for total-N, ammoniacal-N (AOAC 1995), trichloroacetic acid precipitable N (Cline *et al.* 1958) and volatile fatty acids were estimated using gas chromatograph equipped with glass column (packed with chromosorb 101) and flame ionization detector as per method described by (Cottoyn and Boucque 1968). The serum samples were analyzed for total proteins (Henry *et al*. 1974), albumin (Doumas *et al.* 1971), glucose (Trinder 1969) and urea N (Evans 1968). Globulin was calculated by difference between total protein and albumin. The urine sample (10 ml) stored in a vial containing 0.5 ml of 20% H_2SO_4 was analyzed for allantoin (Young and Conway 1942), uric acid (Trivedi *et a1*. 1978) and creatinine (Folin and Wu 1919). Purines absorbed were calculated from the daily urinary PD excreted (IAEA 1997). The data were analyzed by simple ANOVA (Snedecor and Cochran 1994) by using the software package SPSS version 12 (SPSS 1996) and differences in mean were assessed by using Tukey's b.

RESULTS AND DISCUSSION

The green fodder and dry matter yield of the new oats variety was higher (P<0.05) than the check variety cultivated in Ludhiana (2006–07 and 2008–09), Bahowal (2008–09) and Faridkot (2008–09), but comparable in Gurdaspur Research Station (Table 1). Forage yield is a quantitative trait and is highly affected by the environmental factors. Increase in forage yield in both the varieties during the third year was due to the favourable environmental factors such as temperature and soil conditions. The overall average yield (green as well as DM) was statistically comparable. The new oats variety gave 14.0 and 22.1% higher green as well as DM yield respectively, over that of check variety of oats.

Table 1. Green fodder and dry matter yield of check and new variety of oats

Year	Location	Check variety	New variety	CD
Green fodder yield, q/ha				
2006–07	Ludhiana	665.8[a]	768.4[b]	39.5
2007–08	Ludhiana	618.4	636.3	40.2
2008–09	Ludhiana	885.4[a]	1113.2[b]	35.7
2008–09	Bahowal	396.3[a]	527.5[b]	7.2
2008–09	Faridkot	611.1[a]	673.1[b]	55.0
2008–09	Gurdaspur	853.3	875.6	
	Mean	671.7	765.4	
DM yield, q/ha				
2006–07	Ludhiana	99.88[a]	125.98[b]	6.10
2007–08	Ludhiana	107.22	107.30	6.34
2008–09	Ludhiana	145.12[a]	196.80[b]	6.06
	Mean	117.21	143.36	

Figures with different superscript in a row differ significantly, P<0.05.

The proximate and cell wall composition of check and new variety of green oats was comparable (Table 2). The *in vitro* screening of the 2 varieties revealed that the net gas

Table 2. Chemical composition, *in-vitro* and *in-vivo* evaluation, and biochemical changes in the rumen of buffaloes fed check and new variety of green oats

Parameter	Check variety	New variety	Pooled SE
Total ash	10.90	10.23	
OM	89.10	89.77	
CP	16.27	15.85	
NDF	55.60	54.60	
ADF	31.70	31.15	
Cellulose	28.80	27.90	
Hemicellulose	23.90	23.45	
Lignin			
In-vitro *evaluation of check and new variety of green oats*			
NGP, ml/24 h/g DM*	216.37[a]	223.33[b]	2.04
NDFD	71.48	63.37	2.72
TOMD	82.40	77.96	1.52
ME*, MJ/g DM	9.15[a]	9.40[b]	0.07
DM intake and digestibility of nutrients in adult buffaloes, %			
Body weight	464.25	454.25	6.73
DM intake	7.92	7.56	0.07
DMI,% of BW	1.71	1.67	0.03
DM	74.27	79.99	1.60
OM	76.73	82.04	1.46
CP**	74.64[a]	83.63[b]	1.02
NDF	74.20	79.28	1.42
ADF	67.90	74.81	2.01
Cellulose	80.57	83.80	0.97
Hemicellulose	82.55	85.21	0.73
Nitrogen fractions in SRL, mg/dl			
Total-N	145.95	142.10	1.20
NPN**	65.55[b]	50.15[a]	4.48
TCA-N**	80.40[a]	91.95[b]	3.34
Ammonical-N**	13.00[a]	18.50[b]	1.60
Volatile fatty acids in SRL, mM/dl			
Total	18.60	18.13	0.22
Acetate	12.89	12.51	0.17
Propionate	3.95	3.84	0.04
Butyrate	1.66	1.69	0.02
Isovalerate*	0.06[b]	0.04[a]	0.01
Valerate	0.06	0.08	0.01

Figures with different superscript in a row differ significantly, **P<0.01; *P<0.05; NGP, net gas production; SRL, strained rumen liquor.

production and ME availability were higher (P < 0.05) in new than in check variety of green oats, indicating higher availability and efficient utilization of organic matter. The *in vitro* true OM and NDF digestibility was statistically comparable in both varieties. The animals were offered *ad lib*. green oats. Both varieties were highly palatable and resulted in similar daily DM intake. The digestibility of proximate as well as cell wall constituents was slightly higher in new variety than in check variety but the differences were nonsignificant. The rumen studies revealed that the total-N concentration in the strained rumen liquor (SRL) of animals fed 2 varieties of oats was comparable. The NPN concentration in the SRL of animals fed new variety was lower (P<0.01) than those fed check variety, but TCA-N showed reverse (P<0.01) trend. The total and individual volatile fatty acids production in the SRL was comparable except that of isovalerate which was higher (P<0.05) in animals fed check variety than those offered new variety.

The blood profile of both groups of animals was comparable (Table 3). The concentration of all the blood parameters was within normal physiological range of dairy cattle. The urinary excretion of purine derivatives (an indication of microbial protein synthesized in the rumen) and the microbial protein synthesized in the rumen of animal offered check or new green oats variety were statistically comparable. The N intake was comparable in both the groups.

Table 3. Effect of oats varieties on the blood profile, urinary excretion of purine derivatives and N-balance in buffaloes

Parameter	Check variety	New variety	Pooled SE
Blood profile, mg/dl			
Total proteins, g/dl	7.98	7.34	0.42
Albumin (A), g/dl	2.15	2.30	0.08
Globulin (G), g/dl	5.83	5.04	0.44
A/G	0.36	0.38	0.01
Blood glucose	28.75	41.14	3.51
Triglycerides	63.75	61.95	0.66
Cholesterol	45.15	47.18	2.08
Uric acid	1.89	2.03	0.08
Creatinine	1.96	1.82	0.05
Urea	28.80	33.15	1.87
Urinary excretion of purine derivatives, mM/day			
Uric acid	5.65	5.31	0.73
Allantoin	35.64	34.58	5.01
Creatinine	51.79	59.89	5.85
Purine derivatives	41.29	39.89	5.51
Microbial nitrogen,g/d	250.16	241.70	33.41
N-balance, g/day			
Intake	206.17	191.72	2.73
Faecal	44.04[b]	31.38[a]	2.52
Urinary	70.30	86.01	7.00
Total excretion	114.34	117.39	6.98
Retained	91.82	74.33	7.70
Apparaent BV	56.44	46.34	4.48

Figures with different superscript in a row differ significantly, **P<0.01; *P<0.05.

The faecal-N excretion was lower (P<0.01) in animals fed new oat variety as compared to check variety resulting in higher (P<0.01) CP digestibility in new oats variety. The total-N excretion was comparable in both the groups, resulting in comparable N-retention. The apparent biological value indicating the efficiency of N-utilization was also statistically comparable in both the groups. It was concluded that new oats variety (OS-342) had an edge over the check variety (OL–9) with respect to yield and quality.

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