SHORT COMMUNICATION

Effect of Incorporation of De-Oiled Distillers Dried Grain with Solubles in the Concentrate Mixture on Growth Performance of Murrah Buffalo Calves

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Abstract

This experiment was aimed to assess the impact of inclusion of de-oiled DDGS (dDDGS) as source of protein to replace cotton seed cake protein (CSC) in the concentrate mixture on growth, nutrient digestibility and cost economics. In a 90 days growth trial, 18 buffalo calves in the age range of 6-9 months old and 79-84 kg BW were randomly divided into three groups and allotted to one of the dietary treatments. In the experimental feeds CSC (on CP basis) was substituted with de-oiled DDGS at 0% (T_1), 50% (T_2) and 100% (T_3) levels. The findings suggested that BW, ADG and FCR had significantly ($p<0.01$) increased in the T_3 group compared to control group. Digestibilities of DM, CP, CF ($p<0.01$), OM and cellulose ($p<0.05$) were significantly increased in T_3 group. The cost of feed/kg BW gain decreased by Rs. 35 in T_3 and Rs. 15 in T_2 group when compared to control group. DCP and TDN contents expressed either as intake (kg/d) or as % in diet consumed increased significantly ($p<0.01$). The DCP intake expressed as g/kg $W^{0.75}$ was significantly ($p<0.01$) improved in T_3 group. The DM, DCP and TDN intakes expressed as g/kg $W^{0.75}$ and ME intake (M cal/kg $W^{0.75}$) were similar among the treatments. It is concluded that de-oiled DDGS is an alternative to CSC for reduction of cost/kg live weight gain.

Key words: Buffalo calves, Cost economics, Cottonseed cake, De-oiled DDGS, Digestibility, Growth performance.

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Introduction

In livestock production, feeding accounts for 70% of total cost. Increase in the prices of traditional protein sources of livestock feeds has warranted exploration of newer ingredients with lesser cost and good protein content. With the advent of grain based bio-ethanol production a new product Distillers Dried Grains with Soluble with better protein content emerged. This product is well established as a promising protein source by a number of studies (Etman *et al*., 2010; Omer *et al*., 2015; Dey *et al*., 2019). This product after further oil extraction is available for feeding livestock. The de-oiled DDGS is one such agro-industrial byproduct from corn based ethanol producing industry, which is less explored for its nutritional value. De-oiled DDGS is similar to CSC in terms of protein content. In future, there would be more such grain-based products available to the feed industry, because the government is encouraging ethanol production. De-oiled DDGS does not contain any anti-nutritional factors and can be included in the diet of the animals. Thus, the main objective of the current experiment was to study the effect of de-oiled DDGS as a replacement of cottonseed cake protein on growth performance, nutrient digestibility and cost economics in feeding buffalo calves.

Materials and Methods

The growth trial was carried out at Livestock Farm Complex, Gannavaram, Krishna district, Andhra Pradesh (India). Experimental animals were Murrah buffalo calves (n=18) in the body weight range of 79 kg to 84 kg and age range of 6-9 months. The animals were randomly divided into three groups and allotted to one of the dietary treatments. The control group (T_1) received feed with CSC as source of protein, the T_2 and T_3 group received feed with mixture of CSC in which 50 and 100% level of protein was replaced with de-oiled DDGS, respectively, for a trial period of 90 days. Hybrid Napier was offered as a source of green fodder. The rations were formulated as per ICAR (2013, Table 1) where

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concentrate mixtures were fed in equal quantities in all the groups and the green fodder was fed at *ad-libitum*. Besides initial and final body weight animals were weighed at fortnightly intervals. Based on the prevailing market prices the cost of live weight gain was calculated.

A 7 day digestibility trial was conducted before the end of the growth trial to assess the nutrient utilization. Feed and fecal samples were analyzed for proximate composition as per AOAC (2007) and, fiber fractions (Van Soest *et al*., 1991) and calcium and phosphorus (Table 2). The three iso-nitrogenous concentrate mixtures prepared differed slightly in their ingredient composition. The maize content decreased from 34% in the control feed to 27% in the feed of T_3 where cotton seed cake was completely replaced. The DORB content increased as the De-oiled DDGS was included in higher proportion. In terms of chemical composition, the ether extract decreased with inclusion of de-oiled DDGS and there was an increase in hemicellulose, calcium and phosphorus.

Table 1: Ingredient composition of concentrate mixture (kg/100 kg)

Ingredient	T_1	T_2	T_3
Maize	34.00	30.50	27.00
DORB	42.00	43.50	45.00
Cotton seed cake	20.00	10.00	0.00
De-oiled DDGS	0.00	12.00	24.00
Urea	1.00	1.00	1.00
Mineral mixture	2.00	2.00	2.00
Salt	1.00	1.00	1.00
Sub total	100	100	100

Table 2: Chemical composition (% on DM basis) of formulated concentrate mixtures

Nutrient	T_1	T_2	T_3
Dry matter	91.13	92.28	91.75
Organic matter	91.60	91.16	90.39
Crude protein	22.10 (20.22)	21.72 (20.05)	22.00 (20.19)
Ether extract	3.16	2.83	2.39
Crude fiber	14.17	14.70	13.55
Nitrogen free extract	50.16	45.86	46.01
Total ash	8.40	8.83	9.61
Neutral detergent fiber	37.74	39.99	42.54
Acid detergent fiber	21.36	20.30	20.53
Hemi-cellulose	16.38	19.69	22.01
Cellulose	14.04	13.00	13.27
Acid detergent lignin	6.41	6.46	6.51
Calcium (%)	0.53	1.00	1.05
Phosphorus (%)	0.90	1.15	1.18

The data was subjected to statistical analysis as per Snedecor and Cochran (1994) using SPSS 2019. Homogenous subsets were separated by using Duncan's multiple range test.

Results and Discussion

Growth Performance and Economic Evaluation of the Experimental Groups

The trial results (Table 3) indicated that the final body weight (kg) was significantly ($p<0.05$) increased in the T_3 group. Total weight gain, average daily gain and feed conversion ratio, all were improved significantly ($p<0.01$) with 100 % de-oiled DDGS (T_3) compared to control. These findings were in agreement with Omer *et al*. (2015), who concluded that replacement of cotton seed cake with corn DDGS resulted in significant improvement ($p<0.05$) in the total body weight gain, average daily gain and FCR in male crossbred calves compared to the control diet. Rice DDGS was found as suitable replacer for soyabean meal by Dey *et al*. (2019) at 100% level in the concentrate mixture for increased ($p<0.05$) body weight gain and average daily gain in Jersey crossbred calves. DDGS was also found as a suitable source of protein by Etman *et al*. (2010) in male Friesian calves for improved feed efficiency. In contrast, Ale *et al*. (2022) reported that replacement of soybean meal and corn with reduced fat DDGS at 10, 20 and 30% levels on N basis in the concentrate mixture had no significant ($p>0.05$) effect on body weight gains, average daily gain and FCR in crossbred goats as compared to the control.

Nutrient Digestibility Coefficients and Nutritive Value

Results of the digestibility trial (Table 4) indicated significant ($p<0.01$) improvement of digestibility of DM, CP, CF in 100% de-oiled DDGS (T_3) group. The digestibility of OM and cellulose was also significantly ($p<0.05$) increased in T_3 group. All other nutrients' digestibility was similar among all the treatments. The overall DCP and TDN contents (Table 5) of the T_3 ration were also improved significantly ($p<0.01$). Similar effect of DDGS on nutrient digestibility was reported by Tomaz *et al*. (2021), who found significantly ($p<0.05$) improved digestibility of CP and NDF. Etman *et al*. (2010) too reported significantly improved digestibility coefficient of DM, CP with inclusion of DDGS. Omer *et al*. (2015) inferred that the replacement of cotton seed cake with corn DDGS at 25 and 50% levels had resulted in increased ($p<0.05$) DM, OM, CP, EE and NFE digestibility in crossbred calves. Reddy *et al*. (2017) also reported improved nutritive value of DCP by inclusion of DDGS in the rations.

In contradiction to the present study, Natalia *et al*. (2021) did not observe significant ($p>0.05$) effect on digestibility of OM, CP, EE and NDF by replacement of cotton seed meal at 50 and 100% level with DDGS in the concentrate mixture of male Nellore cattle. Similarly, Obeidat (2018) reported that partial replacement of soybean meal and barley grain with corn DDGS had no significant ($p>0.05$) difference on DM, CP, NDF and ADF digestibility in Awassi lambs. Singh *et al*. (2018) stated that by substitution of oil seed cakes (GNC and mustard oil cake) with RDDGS (on CP basis) in the concentrate

mixture of Murrah heifers had no effect (p>0.05) on NDF, ADF and hemi-cellulose digestibility as compared to the control.

The costs were based on average values for feeds and live body weights as shown in Table 3. Inclusion of de-oiled DDGS at 100% level in the rations of calves caused slight increase in the total daily feeding costs of experimental rations. Feed cost/kg b.wt. gain was significantly (p<0.01) decreased by Rs. 35 in T_3 and Rs. 15 in T_2 groups when compared to control. In agreement to the present findings, Omer *et al*. (2015) also inferred that the feed cost/kg b.wt. gain in the crossbred calves decreased by Rs. 6 and Rs. 5 at 25 and 50 % replacement of cotton seed cake with corn DDGS, respectively. Similarly, Sihag *et al*. (2017) reported a net saving of Rs. 8.9 and Rs. 9.6 per kg gain when soyabean meal was replaced by DDGS at 50 and 75% levels, respectively, in the growing goats. Obeidat (2018) also concluded the same findings that there was a decrease in cost/kg gain (p<0.05) with increase in the inclusion of corn DDGS by substituting soybean meal in lambs. The decreased feed cost in T_3 group was attributed to the decreased cost of feed consumed and improved feed efficiency with increasing levels of de-oiled DDGS (Table 5).

Table 3: Growth performance and cost economics of buffalo calves fed diets containing de-oiled DDGS at varying levels in the concentrate mixture

Parameter	T_1 (control)	T_2	T_3
Initial body weight (kg)	83.23 ±1.16	84.10 ±1.91	83.06 ±1.65
Final body weight (kg)*	122.56^{b} ±0.90	126.26^{b} ±1.71	133.70^{a} ±2.60
Total weight gain (kg)**	39.33^{b} ±0.78	42.16^{b} ±0.52	50.63^{a} ±1.36
Average daily gain (g/d)**	437.03^{b} ±8.71	468.51^{b} ±5.83	562.59^{a} ±8.20
Total DMI (kg/d)	4.74 ±0.09	4.61 ±0.19	5.00 ±0.01
FCR (kg feed/kg gain)**	11.28^{a} ±0.37	10.24^{ab} ±0.44	9.19^{b} ±0.23
Cost of feed/kg gain** (₹/kg gain)	156.70^{a} ±4.36	141.52^{b} ±3.99	121.51^{c} ±3.16

*p<0.05, **p<0.01, Means bearing different superscripts within the row differ significantly at p<0.05.

Table 4: Apparent digestibility (%) of gross nutrients and cell wall constituents in buffalo calves fed diets containing de-oiled DDGS at varying levels in the concentrate mixture

Nutrient	T_1	T_2	T_3
Dry matter**	60.40^{c} ±0.96	63.63^{b} ±1.02	67.92^{a} ±1.04
Organic matter*	63.12^{c} ±0.95	65.79^{ab} ±1.11	67.83^{a} ±1.15
Crude protein**	66.71^{b} ±0.87	69.38^{b} ±1.80	73.89^{a} ±1.35
Ether extract	69.80 ±1.26	70.66 ±1.19	69.44 ±1.29
Crude fiber**	45.15^{b} ±0.89	47.26^{b} ±0.86	51.16^{a} ±1.69
Nitrogen free extract	75.33 ±1.62	79.00 ±1.56	79.83 ±1.37
Neutral detergent fiber	54.21 ±0.79	55.83 ±0.99	57.55 ±2.01
Acid detergent fiber	53.68 ±1.57	54.43 ±2.14	57.94 ±2.48
Cellulose*	52.56^{b} ±0.71	54.97^{b} ±0.73	56.73^{a} ±2.53
Hemicellulose	61.40 ±3.29	62.97 ±1.57	62.76 ±4.14

*p<0.05, **p<0.01, Means bearing different superscripts within the row differ significantly at p<0.05.

Table 5: Plane of nutrition in buffalo calves fed diets containing de-oiled DDGS at varying levels in the concentrate mixture

Treatment	Body weight	DMI* (kg/d)	DCP % in diet consumed	TDN % in diet consumed	DCP Intake/ unit kg $W^{0.75}$	TDN Intake/ unit kg $W^{0.75}$	DCP/ME
T1	118.77	4.74^{b} ±0.91	7.57^{b} ±0.11	62.01^{b} ±1.03	9.98^{b} ±0.16	81.87 ±2.57	33.81
T2	122.20	4.61^{ab} ±0.19	7.96^{ab}±0.29	63.54^{ab} ±0.87	9.95^{b} ±0.22	79.76 ±2.84	34.71
T3	128.78	5.00^{a} ±0.13	8.25^{a} ±0.14	66.21^{a} ±0.76	10.83^{a} ±0.34	86.87 ±1.90	34.47
ICAR 2013	200	5.2	--	--	7.15	53.97	36.67

*p<0.05, Means bearing different superscripts within the column differ significantly at p<0.05.

Conclusion

It could be concluded that up to 100% de-oiled DDGS can be included by replacing cottonseed cake protein in the concentrate mixture as it improved the growth performance, FCR, nutrient digestibility and also decreased the cost of feed/kg b.wt. gain in the buffalo calves.

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