The Pharma Innovation Journal 2022; 11(12): 4945-4948

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 4945-4948

www.thepharmajournal.com
Received: 07-09-2022
Accepted: 04-11-2022

Jagjiwan Ram
Professor & Head, Dept. of Animal Science, AC, UAS, Raichur, Karnataka. India

Sreedhara JN
Assistant Professor, Dept. of Animal Science, CAE, UAS, Raichur, Karnataka, INDIA

Prahlad
Senior Scientist and Head, KVK, UAS, Raichur. Karnataka, India

Corresponding Author:
Jagjiwan Ram
Professor & Head, Dept. of Animal Science, AC, UAS, Raichur, Karnataka. India

Effect of cotton seed cake and its effect on milk yield and its composition in HF-Deoni crossbred cows

Jagjiwan Ram, Sreedhara JN and Prahlad

Abstract
The present study was conducted at Dairy unit, Main Agricultural Research Station, UAS, Raichur, Karnataka state. The objectives of this study were to determine the effect of cotton seed cake (CSC) on milk yield, milk fat and SNF, feed intake, body condition score and live weight of Holestein Friesian x Deoni crossbred cows. Twenty HF Deoni crossbred lactating cows were selected for this study based on similar age group ranged from 5 to 5.5 year and most of the animals were in stage of mid-lactation and were given feed prepared as per NRC, 2015 standards. The cows were grouped under four treatments viz. T_1 (0% cotton seed cake), T_2 (10% cotton seed cake), T_3 (20% cotton seed cake) and T_4 (30% cotton seed cake). The results revealed that dry matter intake, water intake and digestibility of nutrients were non-significant between the treatments. There was a linear increase in the digestibility of nutrients viz. DM, CP, CF, EE and NFE with increasing CSC level in the ration. The percentage of milk fat and total milk solid were significantly increased in T_3 (17.65% & 7.84%) and T_4 (21.18% & 9.41%) as against T_1 at $t_{05,}$ however milk yield was significantly increased in T_1 compared to T_3 and T_4. The results of the experiment indicate that the optimum level of CSC inclusion in the diet of dairy rations is 20% for optimum milk yield and milk composition.

Keywords: SNF, cotton seed cake, milk fat, digestibility

Introduction
Feed cost constitutes 60-70% of total expenditure on milk production therefore, concentrate feeding is important in terms of cost of feeding. The cotton seed is primarily grown for the fiber production but cotton seed cake (CSC) or cotton seed meal (CSM) obtained as a byproduct after extraction of oil from the cotton seeds. Cotton seed cake is very palatable and good source of protein for livestock in the cotton growing belt of India, with high level of natural rumen un degradable protein value (Agrawal *et al*, 2003, Ngele *et al*, 2013) [24, 25] and has been satisfactorily used as a protein supplement for growing and dairy animals (Gajera *et al*, 2013; Movaliya *et al*, 2013) [26, 27]. Cotton seed cake is an important protein supplement being used with low nutritive forages and fibrous byproducts due to its high protein digestibility which form more glucose after reaching lower tract diverting towards increase in growth rate as well as milk production in the animals (Osti and Pandey, 2006) [28].
In Northern part of Karnataka, farmers are traditionally using groundnut cake or sunflower cake as a source of vegetable protein in livestock feeding but due to inadequate supply and seasonal availability, the cost of these products has been increased. Thus, there is a need for replacing groundnut cake with some other local protein sources to release the pressure on this product. In this area Cotton seed is primarily grown for the fiber production. The availability of these seeds is very high as a source of non-conventional feed stuffs. Hence, cotton seed cake could be utilized as a source of cattle feed because; these seeds are good source of crude protein, crude fibre and other essential nutrients on affordable price (ref). Despite its high nutritional value, cottonseed cake contains gossypol, a phenolic compound which can produce intoxication, liver damage and reproductive problems in non-ruminants. Interestingly, ruminants can detoxify free gossypol by converting it into bound gossypol in the rumen, thereby impeding its absorption into the blood (Webb *et al*. 2019) [23]. Therefore, keeping in view the present study was, planned to find out the effect of CSC on feed intake, Milk yield and its composition in HF Deoni crossbred cow.

Materials and Methods
Selection of animals: Six HF Deoni crossbred lactating cows were selected for this study based on similar age group ranged from 4 to 5 years and most of them were in stage of mid-lactation.

Housing: All experimental cows were housed under ideal housing conditions for the entire experimental period. The experimental cows were tied and fed separately under same housing conditions.

Treatments: Four treatments were made viz. T_1 (0% cotton seed cake), T_2 (10% cotton seed cake), T_3 (20% cotton seed cake) and T_4 (30% cotton seed cake). The experimental period under each treatment was kept 15 days including 10 days preliminary feeding period and 5 days collection period.

Feed and water intake: Concentrate mixture was prepared by using different level of cotton seed cake (table 1) and fed to each experimental cow as per their requirement (NRC 2021) for maintenance and production @ 5 kg/day/cow. Sorghum straw was weighed on digital weighing balance and offered adlib to each experimental cow. The data of feed intake was recorded separately based on actual intake (means feed offered minus feed refused). Adlib quantity of clean drinking water was offered twice a day and was recorded separately.

Recording of milk yield: Lactating cows of each group were hand milked twice a day at about 5.30 AM and 5.30 PM by same milk man. Daily Milk yield was recorded (lit/day/cow). Calves were not allowed to suckle the milk and oxytocin was also not used for milk let down. Water soaked concentrate mixture was fed twice in a day at the time of milking.

Collection of samples: For milk analysis special plastic bottles were used to collect the milk samples, these plastic bottles were first clean with detergents and then air/sun dried. Milk samples were collected from each experimental cow in the plastic bottle. Similarly other samples were also collected separately per day per cow viz. feed intake (kg), water intake (lit) and dung excreted (kg).

Laboratory analysis: The samples were labeled and analyzed in the lab for Fat, SNF (protein, Lactose and minerals), acidity, coagulation and flavor test as per standards. Similarly proximate analysis of feed and dung was done as per AOAC (2014).

Statistical analysis: Student t-test was used to analyze the data for comparison of the treatments as per text book of Snedecor and Cochran, 2004 [20].

Results and Discussion

Table 1a: Preparation of concentrate mixture by adding different level of cotton seed cake

Sl. No.	Feed Ingredient	Diet combinations			
		T_1	T_2	T_3	T_4
1	Maize grain	35	35	35	35
2	Cotton seed cake	-	10	20	30
3	Groundnut cake	30	20	10	-
4	De oiled rice polish	20	20	20	20
5	Gram husk	05	05	05	05
6	Wheat bran	07	07	07	07
7	Mineral mixture	02	02	02	02
8	Common salt	01	01	01	01
Total		100	100	100	100
Cost (Rs) / kg feed		25.50	23.50	21.50	19.50

Table 1: Composition of diet fed to the experimental lactating cows

SL. No.	Nutrients available (%)	Treatments			
		T_1	T_2	T_3	T_4
1	Moisture%	09.55	10.05	10.15	10.25
2	Dry matter%	90.45	89.80	89.85	89.75
3	Crude Protein	21.49	20.14	18.79	17.44
4	Crude Fibre	06.51	07.74	08.97	10.20
5	Ether Extract	04.93	05.21	05.49	05.77
6	Total ash	06.77	06.66	06.55	06.44
7	Nitrogen Free Extract	50.75	50.20	50.05	49.90
8	Organic Matter	93.23	93.34	93.45	93.56
9	DCP	14.43	13.13	12.36	11.21
10	TDN	60.43	58.74	59.54	59.10

Table 2: Effect of cotton seed cake on intake and utilization of nutrients in HF Deoni crossbred lactating cows

Sl. No	Observations	Treatments			
		T_1	T_2	T_3	T_4
1	DM Intake (kg/day)	12.50±1.45	12.45±2.15	12.35±1.20	12.25±2.25
2	Water intake (lit/day)	47.50±1.45	48.40±3.85	48.35±3.42	49.45±2.15
3	Ratio between DM and water intake	1:3.80	1:3.91	1:3.88	1:4.04
4	Digestibility of DM (%)	60.45±2.10	62.35±1.25	63.50±1.10	63.65±1.35
5	Digestibility of CP (%)	64.25±2.12	65.20±2.45	65.80±2.30	67.15±2.05
6	Digestibility of CF (%)	60.45±1.85	61.10±2.10	62.54±2.20	63.25±1.35
7	Digestibility of EE (%)	58.25±1.45	59.50±1.25	60.45±2.15	61.85±1.24
8	Digestibility of NFE (%)	66.13±2.35	68.10±2.05	68.25±1.62	69.35±1.51

Table 3: Effect of cotton seed cake on quantity and quality of milk production in HF Deoni crossbred lactating cows

Sl. No	Observations	Treatments			
		T_1	T_2	T_3	T_4
1	Milk yield lit/ day	11.45±0.50	11.75±0.30	12.00±0.65	12.25±0.45
2	Fat%	4.00±0.25	4.35±0.43	5.00±0.35	5.15±0.20
3	Solid not fat (SNF) %	8.50±0.15	8.75±0.20	8.50±0.15	8.80±0.10
4	Total solid %	12.50±0.30	13.10±0.08	13.50±0.34	13.95±0.15
5	Acidity%	0.12±0.03	0.13±0.05	0.14±0.04	0.18±0.05
6	Boiling test	Normal	Normal	Normal	coagulation
7	Flavor/odor/test	Normal	Normal	Normal	Off flavor

Table 4: Effect of diet combinations on cost of milk production in HF Deoni crossbred lactating cows

Sl. No	Observations	Treatments			
		T_1	T_2	T_3	T_4
1	Cost (Rs) / kg feed	25.50	23.50	21.50	19.50
2	Total feeding cost (Rs) /day/cow	127.50	117.50	107.50	97.50
3	Milk yield lit/day/cow	11.30±0.50	11.50±0.30	12.00±0.65	12.15±0.45
4	Cost (Rs) / lit milk	40.00	40.00	40.00	40.00
5	Profit on milk (Rs)/ day/cow	452.00±6.25	460.00± 4.35	480.00±7.45	486.00±5.35
6	Net profit (Rs) /day/cow on milk	324.50±5.13	342.50± 3.25	372.50±4.50	388.50±4.32

Results and Discussion

Four experimental diets were prepared by using different level of cotton seed cakes (table 1) *viz* 0% cotton seed cake (T_1), 10% cotton seed cake (T_2), 20% cotton seed cake (T_3) and 30% cotton seed cake (T_4). The Cost of per kg feed was Rs 25.50, 23.50, 21.50 and 19.50 respectively (table 1). This significant difference was found due to incorporation of cotton seed cake in place of groundnut cake. These diets were fed to the experimental lactating HF Deoni crossbred cows to evaluate its effect on intake of feed, Milk yield and composition of milk etc. Each diet (treatment) was evaluated separately on same set of animals for a period of 15 days including 10 days preliminary feeding trial and 5 days collection period.

The results of dry matter intake, water intake and digestibility of nutrients viz. dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and nitrogen free extract (NFE) were quite similar among the treatments (table 2). These findings are against the results obtained by Hayaz Uddin *et al.*, (2013) [22], Chowdhery (2001) [7], Capper *et al*., (1989) [5] may be due to the fact that the good palatability of ground nut cake used in the control diet masking the palatability of CSC in treatment group T_1. The intake of water was noticed slightly higher in T_4 compared to T_1 but it was non-significant at t_{05}. As water intake increases the DM intake decreases in T_1, T_2, T_3 and T_4 groups. The digestibility of nutrients viz. DM, CP, CF, EE and NFE were non-significant between T_1 & T_2, T_2 & T_3 and T_3 & T_4 respectively. However, digestibility of nutrients viz. DM, CP, CF, EE and NFE were significantly higher in T_4 as compared to T_1 at t_{05}. There was a linear increase in the digestibility of nutrients viz. DM, CP, CF, EE and NFE with increasing CSC level in the ration. The increase in digestibility of nutrients might be due to low content of ether extract (4.50%) in cotton seed cake.

The results of Milk yield lit/day, fat%, solid not fat (SNF) %, Total solid %, acidity%, boiling test and flavor/odor/test are depicted in table 3. Table 3 revealed that decreased milk yield was noticed in T_3 (4.08%) and T_4 (6.50%) as against T_1. However, percentage of milk fat and total milk solid were significantly increased in T_3 (17.65% & 7.84%) and T_4 (21.18% & 9.41%) as against T1 at t_{05}. This indicates that as level of crude fibre (CF) increases in diet of lactating cow the percentage milk fat increases due to increased production of acetic acid which helps in synthesis of milk fat (Sawal *et al*., 1998) [10]. The cotton seed cake is rich in CF particularly cellulose which helps in production of acetic acid at the site of rumen as a part of volatile fatty acids by Shah (2012) [12].

The quality parameters of milk were found quite abnormal in T_4 due to high content of gossypol in diet as against T1, T2 and T_3 (table 5). The acidity of milk was recorded quite abnormal in T4 (0.18%) as against T_1, T_2 and T_3. The boiling test of milk was normal in T_1, T_2 and T_3 as against T_4. In T_4 milk was coagulated while it was just boiled due to high level of acidity (0.18%) (Brand *et al.*, 1997) [4].

The cost of per kg concentrate mixture (Rs) was higher in T_1 (25.50) followed by T_2 (23.50), T_3 (21.50) and T_4 (19.50) respectively. Similarly total feeding cost (Rs) per day per cow was found higher in T_1 (127.50) followed by T2 (117.50), T3 (107.50) and T_4 (97.50) respectively. The total profit (Rs) based on milk yield per day per cow was also found higher in T1 (367.50) followed by T_2 (360.00), T_3 (352.50) and T_4 (343.50) respectively. However, the net profit (Rs) per day per cow was higher in T4 (246.00) as against T_3 (245.00), T_2 (242.50) and T_1 (240.00) respectively. This was due to less expenditure on cost of feed even though milk yield was higher in T1 followed by T_2, T_3 and T_4 respectively.

Conclusions

The digestibility of nutrients *viz*. DM, CP, CF, EE and NFE were found significantly higher in T_4 (63.65±1.35, 67.15± 2.05, 63.25±1.35, 61.85±1.24 and 69.35±1.51) as compared to T_1 (60.45±2.10, 64.25±2.12, 60.45±1.85, 58.25±1.45 and 66.13±2.35) at t_{05}. Similarly high milk fat and total solid were recorded in milk of T4 group (17.65% & 7.84%) as against T_1 (21.18% & 9.41%) group. The quality of milk (viz. flavor, taste and acidity) was found quite normal in T_1 as compared to T_4.

The total profit (Rs) based on milk yield per day per cow was found higher in T_1 (367.50) followed by T_2 (360.00), T_3 (352.50) and T_4 (343.50) respectively. However, the net profit (Rs) per day per cow was significantly higher in T_4 group (246.00) followed by T_3 (245.00), T_2 (242.50) and T_1 (240.00) respectively due to cost of feeding.

Recommendations

The off flavor of milk was noticed with bitter and sour taste apart from coagulation of milk due to increase level of acidity (0.18%) in milk of T_4 group. The milk fat was increased with increasing CSC level in feed up to 30% but optimum level of feeding CSC is up to 20% for quality and cost of milk production in cross bred cows.

References

1. AOAC. Official methods of analysis (20th Ed). Hoerwitz, W. (Ed). Association of Analytical Chemists. Washington DC, U.S.A; c2016.
2. Ahmad I, Javed K, Mirza RH, Sattar A, Ahmad F. Effect of feeding sunflower meal as a substitute of cottonseed cake on growth and age of maturity in Holstein Friesian heifers. Pakistan Vet. J. 2004;24(2):95-97.
3. Betz FS, Hammond BG, Fuchs RL. Sa fety and advantages of Bacillus thuringiensis-protected plants to control insect pests. Reg. Toxicol. Pharmacol. 2000 Oct 1;32(2):156–173.
4. Brand A, Woodhuizen JPTM, Schukken YH. Herd Health and Production management in Dairy Practice, 2nd Edn, Newman Press, New York; c1997.
5. Capper BS, Thomson EF, Rihawi S. Voluntarily intake and digestibility of barley straw as influenced by variety and supplementation with either barley grain or cotton seed cake. Anim. Feed Sci. Technol. 1989 Oct 1;26(1-2):105:118
6. Castillo AR, Gallardo MR, Maciel M, Giordano JM, Conti GA, Gaggiotti MC, *et al*. Effects of feeding rations with genetically modified whole cottonseed to lactating dairy cows. J Dairy Sci. 2004 Jun 1;87(6):1778-1785.
7. Chowdhery SA. Effect of graded levels of cotton seed cake supplementation on intake nutrient digestibility, Microbial N yield of growing native bulls fed rice straw. Assian-Aust. J Anim. Sci. 2001;14(3):326-332.
8. Folmer J, Grant R, Beck J. Use of BT corn silage and grain by lactating dairy cattle. Dairy Report (2001-2002) University of Nebraska, Lincoln; c2001.
9. NRC. Nutrient requirements of Dairy cattle. 8th revised edition. National Academies press, Washington, DC; c2021.
10. Sawal RK, Kurar CK. Milk yield and fats content as affected by dietary factors. AJAS. 1998;11:217-233.
11. Senthil K, Singhal KK. Chemical composition and nutritional evaluation of transgenic cottonseed for ruminants. Indian J Anim. Sci. 2004;74(5):868-871
12. Shah M. Effect of different ration on blood metabolite and milk composition. MSc. Thesis Department of Livestock Management Agricultural University Peshawar Pakistan; c2012.
13. Sharma K, Dutta N, Pattanaik AK, Hasan QZ. Replacement value of decorticated sunflower meal as a supplement for milk production by crossbred cows and buffaloes in the northern plains of India. Trop. Anim. Health and Prod. 2004;35(2):131-145.
14. Sihage S, Sagar V, Yadav KR. Effect of feeding deoiled sunflower cake on milk yield and composition in crossbred cows. Indian J Dairy Sci. 1997;50(5):347-351.
15. Singh Maha, Tiwari DP, Kumar Anil. Effect of feeding transgenic cottonseed on nutrient utilization, milk production and its composition in lactating Murrah buffaloes. Buffalo J; c2002.
16. Singh Maha, Tiwari DP, Kumar A, Ravi Kumar M. Effect of feeding transgenic cottonseed vis-à-vis non-transgenic cottonseed on haemato-biochemical constituents in lactating Murrah buffaloes. Asian-Australas. J Anim. Sci. 2003 Jun 1;16(12):1011-2367.
17. Singhal KK, Senthil Kumar N, Tyagi AK, Rajput YS. Evaluation of BT cottonseed as protein supplement in the ration of lactating dairy cows. Indian J Anim. Sci. 2006a;76(7):532-537.
18. Singhal KK, Tyagi AK, Rajput YS. Effect of feeding cottonseed produced from BT cotton on feed intake, milk production and composition in lactating cows. Report submitted to Mahyco, Mumbai; c2001.
19. Singhal KK, Tyagi AK, Rajput YS, Singh M, Perez T, Hartnell GF. Effect of feeding cottonseed produced from Bollgard (BG II) cotton on feed intake, milk production and composition in lactating crossbred cows. Proc.12th AAAP Cong., Busan, South Korea; c2006. p. 757.
20. Snedecor GW, Cochran WG. Statistical methods. 8th Edn, East West Press Pvt. Ltd., New Delhi; c2004.
21. Steel RGD, Torrie JH, Dickey DA. Principles and procedures of statistics. A biochemical approach (3ed.) McGraw Hill Book Co. Inc., New York, USA; c1997.
22. Uddin H, Khan HU, Khan MI, Khan R, Naveed A. Productive and reproductive performance of Achai cattle maintained at livestock research & development station Surezai Peshawar, Pakistan. Pakistan. J Anim. Health Produc. 2014;22(1):13-19.
23. Webb NW, Bernard JK, Tao S. Production responses to diets supplemented with soybean meal, expeller soybean meal, or dry-extruded cottonseed cake by lactating dairy cows. Applied Animal Science. 2019 Dec 1;35(6):543-549.
24. Agrawal N, Dasaradhi PV, Mohmmed A, Malhotra P, Bhatnagar RK, Mukherjee SK. RNA interference: biology, mechanism, and applications. Microbiology and molecular biology reviews. 2003 Dec;67(4):657-85.
25. Ngele MB, Adegbola TA, Bogoro SE, Kalla DJ. Utilization of urea treated based rice straw: effect of intake on performance, blood and rumen metabolites in sheep. Ruminant Science. 2013;2(1):19-26.
26. Gajera H, Domadiya R, Patel S, Kapopara M, Golakiya B. Molecular mechanism of Trichoderma as bio-control agents against phytopathogen system–a review. Curr. Res. Microbiol. Biotechnol. 2013;1(4):133-42.
27. Movaliya JK, Dutta KS, Padodara RJ, Bhadaniya AR, Savsani HH. Effect of bypass methionine-lysine supplementation on hematological and blood biochemical parameters of jaffarabadi heifers. Veterinary World. 2013 Mar 1;6(3):147.
28. Osti NP, Upreti CR, Shrestha NP, Pandey SB. Review of nutrients content in fodder trees leaves, grasses and legumes available in buffalo growing areas of Nepal. InProc. Vth Asian Buffalo Congress, Nanjing, China; c2006 Apr 18. p. 366-371.