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Preparation of low cost straw based densified complete feed blocks for crossbred heifers using dhanwantharam oil residue and tapioca starch waste*

H.S. Sunil Gowda[1], Sajith Purushothaman[2], K. Ally[3], Deepa Ananth[4] and Shibu Simon[5]
Department of Animal Nutrition, College of veterinary and Animal Sciences, Mannuthy- 680651, Thrissur, Kerala.

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Abstract

The study was carried out to prepare a cost effective straw based densified complete feed block (DCFB) using dhanwantharam oil residue and tapioca starch waste replacing conventional ingredients on nutrient basis. Three complete feed blocks T1 (straw based DCFB), T2 (DCFB containing 20 per cent dhanwantharam oil residue) and T3 (DCFB containing 20 per cent tapioca starch waste) were formulated according to ICAR (2013) standards. Dry matter content was similar for all the DCFB. Higher crude protein, crude fat and neutral detergent fibre values were recorded in T2 compared to T1 and T3. Higher crude fibre was observed in T3. The cost of production per kg block of T1, T2 and T3 were Rs.17.25, 13.89 and 16.42, respectively. Based on the present study, dhanwantharam oil residue and tapioca starch waste can be incorporated in DCFB at 20 per cent inclusion level replacing conventional costly feed ingredients on nutrient basis for the production of low cost DCFB for livestock feeding.

Key words: *Densified complete feed blocks, dhanwantharam oil residue, tapioca starch waste*

Livestock play a central role in the natural resource-based livelihood of the vast majority of the population living in developing countries. The major reason responsible for sub optimal livestock production is shortage or scarcity of quality feed and fodder. The shortage of feed or fodder may be due to increase in human population and urbanization. Another factor responsible for lower productivity is improper utilization of bulky and fibrous crop residues for feeding ruminants (FAO, 2012). Locally available feed resources can be utilized to reduce the cost of feed production.

In the present scenario, the concept of total mixed ration or complete feed is widely used by farmers to feed the animals. Complete feed is a nutritionally adequate feed for animals to be fed

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1. M.V.Sc scholar (Corresponding author E mail- sunilgowda17894@gmail.com Ph No- 9916710813)
2 & 4. Assistant Professor
3. Professor and head
5. Assistant Professor, Department of ARGO

as a sole ration and capable of maintaining life or promoting production without any additional substance being consumed except water (AAFCO, 2000). Feed can be further effectively utilised by using densification technology. Densification means increasing the density of the feed. Densified complete blocks are composed of forage, concentrate and other supplementary nutrients in desirable proportions capable to fulfil nutrient requirements of animal (Karangiya *et al.,* 2016).

The DCFB can be used as a balanced feed for livestock during scarcity and drought conditions. These blocks are very important to improve the productivity of animals and provides an opportunity to include crop residues, agro-industrial and ayurvedic pharmaceutical industry byproducts in the preparation of blocks. Hence the study was taken up to assess the feasibility of preparing DCFB using dhanwantharam oil residue and tapioca starch waste under Kerala conditions.

Materials and methods

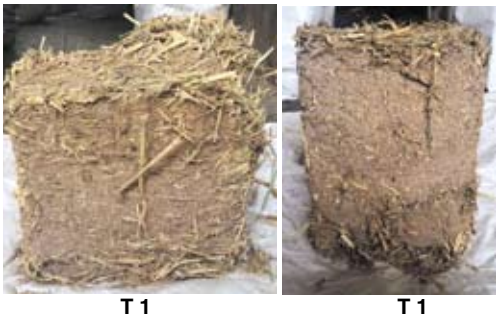
Preparation of Densified complete feed block

Three types of complete feed blocks were formulated to meet the daily nutrient requirement of heifer calves. The chemical composition of three different complete feed blocks are presented in Table.1

Feed formulation was done according to ICAR (2013) standards for heifer calves. Straw was chopped and the concentrate mixture required was also prepared with the ingredients as per the formulation and 5 per cent cornsteep liquor was added which acted as a binder for block making. The chaffed straw and cornsteep liquor added to concentrate mixture were mixed thoroughly in a horizontal mixer for about 5-10 minutes for uniform mixing. Finally this mixture was fed to the block making machine (M/s Real tech engineers, Coimbatore) and compressed to form DCFB at a pressure of 6000 psi for 30 sec. The prepared blocks were stored and used for feeding of experimental calves.

The samples were dried, ground and sieved through 1 mm sieve and used for chemical analysis. Percentage of dry matter, crude fibre, crude protein, ether extract, total ash, nitrogen free extract and acid insoluble ash were determined according to AOAC (2016). Percentage of neutral detergent fibre and acid detergent fibre were analysed as per Van Soest *et al.* (1990).

Plate 1. Densified complete feed blocking (DCFB) machine



T 1 **T 1**

Plate 2. Densified complete feed blocks (DCFB)

T 3

Plate 2. Densified complete feed blocks (DCFB) fed to different treatments

Cost of production of complete feed blocks

Cost of production of different

Table 1. Ingredient composition of straw based DCFB offered to calves maintained on three dietary treatments

Ingredient	Percentage composition of DCFB		
	T_1	T_2	T_3
Maize	32.00	31.00	26.00
Corn gluten fiber	13.00	06.00	08.00
Deoiled rice bran	23.00	14.00	15.00
Alfalfa	05.50	02.50	08.50
Straw	20.00	20.00	16.00
Dhanwantharm oil residue	-	20.00	-
Tapioca starch waste	-	-	20.00
Cornsteep liquor	05.00	05.00	05.00
Salt	00.50	00.50	00.50
Mineral mixture	01.00	01.00	01.00
Total	100.00	100.00	100.00
Vit AB_2D_3K, g/100kg*	25	25	25

*Nicomix AB_2D_3K (Nicholas Piramal India Ltd, Mumbai Agra Road Balkum Thane, Mumbai - 400 608).
Composition per gram: Vitamin A-82,500 I.U, Vitamin B_2- 50 mg, Vitamin D_3- 12,000 I.U and Vitamin K- 10 mg.

Chemical Analysis

Table 2. Chemical composition of dhanwantharam oil residue, tapioca starch waste and paddy straw, Per cent dry matter basis for items from 3-9 rows

Parameter	Dhanwatharam oil residue	Tapioca starch waste	Paddy straw
Dry matter	91.11	90.55	81.89
Crude protein	23.62	3.51	3.03
Ether extract	24.22	1.32	1.19
Crude fibre	4.94	22.53	28.97
Total ash	7.45	3.95	14.42
Nitrogen free extract	39.77	68.69	52.39
NDF	44.40	44.39	68.75
ADF	21.72	36.45	46.84

complete feed blocks was calculated using the rate contract values fixed for feed ingredients by College of Veterinary and Animal Sciences, Mannuthy, for the year 2018-19.

Results and Discussion

Chemical composition

The estimated proximate compositions of the dhanwantharam oil residue and tapioca starch waste values are in accordance with values reported by Seethal (2018) and Purushothaman(2018)

Chemical properties

The dry matter per cent of three complete feed blocks ranged from 89.55 to 90.45, these values are in accordance with values (86.61-90.55 per cent) reported by Shanthiralingam and Sinniah (2018). The crude protein (CP) per cent of complete feed blocks ranged from 15.04 to 15.61 (Table 3). Sharma *et al.* (2015) prepared a complete feed block for crossbred female calves containing 13.62 per cent of CP which was lower than CP content of complete feed blocks in present

Table 3. Chemical composition of complete feed blocks, %

Parameter[1]	Dietary treatments		
	T_1	T_2	T_3
Dry matter	90.45±0.40	89.55±0.59	90.43±0.64
Crude protein	15.08±0.25	15.61±0.25	15.04±0.33
Ether extract	3.57±0.17	6.30±0.17	3.42±0.04
Crude fibre	12.47±0.39	15.59±0.31	17.40±0.13
Total ash	9.62±0.14	10.98±0.07	9.71±0.12
Nitrogen free extract	59.26±0.56	51.51±0.42	54.43±0.44
Acid insoluble ash	3.11±0.06	4.29±0.06	3.27±0.05
Calcium	1.09±0.03	1.05±0.02	1.07±0.03
Phosphorus	0.97±0.01	0.96±0.01	0.97±0.02
Neutral detergent fibre (NDF)	44.82±1.99	49.38±0.93	46.10±0.74
Acid detergent fibre (ADF)	27.80±0.70	29.13±0.41	26.22±0.84

[1]Values expressed on DM basis, average of six values

study. Shanthiralingam and Sinniah (2018) also formulated the ration for heifers with complete feed block containing 15.73 per cent CP and 49.19 per cent of NDF which was more or less similar to the formulation in this study. Ether extract per cent of complete feed blocks ranged from 3.42 to 6.30. Similar values were reported by Seethal (2018) for dhanwantharam oil residue included compound feed and Purushothaman (2018) for tapioca starch waste included total mixed ration.

Higher crude fibre content in T3 group might be due to inclusion of tapioca starch waste. The crude fibre values are in accordance with the values reported for different complete feed blocks by Chacko (2015) and the values ranged from 10.73 to 15.01 per cent. The total ash content was higher in T2 group compared to other two groups. The ash content value of the present study was similar to the values (7 to 8 per cent) of Somarasiri *et al.* (2010). This might be due to inclusion of mineral mixture in the blocks. The NDF per cent of complete feed blocks ranged from 44.82 to 49.38. Singh *et al.* (2016) had reported a similar range of 42-76 per cent in paddy straw based complete feed blocks. Whereas Chacko (2015) observed that complete feed containing paddy straw, with 35 per cent of NDF can be recommended for lactating cattle for efficient production. The ADF per cent of complete feed blocks ranged from 26.22 to 29.13. Similarly, Singh *et al.* (2016) stated that ADF level for the complete feed block was between the range of 21 to 55 per cent. As the ADF level increases in the feed then the digestibility of the feed will decrease (NRC, 2001).

Cost of Production

The costs of complete feed blocks per kg were Rs.17.25, 13.89 and 16.42 for T1, T2 and T3 respectively. The lower cost of complete feed block observed on T2 this might be due to inclusion of ayurvedic pharmaceutical industry byproduct dhanwantharm oil residue which was obtained free of cost. In accordance with these results Seethal (2018) had earlier reported that the cost of calf feed will decrease with increased supplementation level of dhanvanthram oil residue.

Based on the present findings dhanwantharam oil residue and tapioca starch waste can be incorporated in preparation of complete feed blocks. The DCFB prepared for treatment T2 was cost effective since the dhanwantharam oil residue was obtained free of cost. Hence it can be concluded that

dhanwantharam oil residue and tapioca starch waste can be used as an ingredient in DCFB replacing costly conventional ingredients.

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