EFFECT OF PELLET MILL AND BINDER ON QUALITY AND ACCEPTABILITY OF CASSAVA-GLIRICIDIA PELLETS FED TO ZEBU COWS

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ABSTRACT
The challenge of inadequate nutrition and inability to meet the energy-protein requirement of cattle especially during the dry season has limited their productivity. In Nigeria, Cassava and Gliricidia are valuable feed resources that can fill the gap in feed supply if adequately harnessed, and this is dependent on methods of processing and preservation. This could be through pelleting of feedstuffs. This study was carried out to assess the effect of pellet mill and binder on quality characteristics of Cassava-Gliricidia pellets and its acceptability by cattle. Two flat die pellet mills (vertical and horizontal designs) at 2 levels of starch inclusion (0 and 5%) were adopted for the pellet feed production. Four Zebu cows were used for the preference assessment in a cafeteria study which lasted for 30min daily and a total period of eight days. The effect of pellet mill and starch level was significant on the assessed quality parameters. The crude protein content of pellets ranged from 17.65 to 19.45%. Physical quality was measured in terms of durability. Pellet Durability Index values show that pellets compressed by vertical design flat die mill with 5% starch are the most durable. Pellet preference considered in terms of intake rate showed that Zebu cows preferred Cassava-Gliricidia pellets compressed by vertical design flat die mill without starch (0%) to other pellets used in this study. It is concluded that cassava root meal and gliricidia leaves possess the potential of solving the problem of limiting feed resources of ruminant animals in Nigeria.

Keywords: *Cassava; Gliricidia; pellet mill; Zebu cows; PDI: Pellet Durability Index*

INTRODUCTION

The trends in livestock production in developing countries as well as in the world show a more rapid growth in production of pig and poultry meat in comparison with that of ruminant (Upton, 2004). The unavailability of sufficient pasture forage during the dry season in tropical and subtropical regions is a major problem in ruminant livestock production (Olorunnisomo, 2011). During this period, grazing ruminants lose weight and in extreme cases some deaths do occur. The feeding of supplemental protein diets is one of the means of minimizing weight loss during this period. Thus a sustainable strategy will entail developing means capable of optimizing the use of our common feed resources such as cassava and gliricidia. In Nigeria, cassava production is well-developed as an organized agricultural crop. It has well-established multiplication and processing techniques for food products and cattle feed. Cassava production in other African countries appears small in comparison to Nigeria's substantial output (FAO, 2004a). Ruminants can be fed on cassava tuberous root, foliage, peel and residue obtained after processing cassava. Also as part of global efforts to improve animal nutrition during the dry period of the year, attention is being shifted to the evaluation of indigenous multi-purpose tree (MPT) species. These indigenous MPT are well distributed and adapted to the hot tropical climate (Anele *et al*., 2006). Among the MPT is Gliricidia which is a browse tree of nutritional importance in ruminant feeding system. One of the means of preserving excess forage to ensure a steady supply of quality feeds for livestock during the dry season is to make the leaf meal into pellets. These pellets can be improved nutritionally by mixing leaf meal with other feed ingredients such as wheat bran, cassava tubers, palm kernel cake, brewers' dry grain, and etc. The voluntary intake of feed is a major determinant of feed quality and is quite well accepted as an indicator of potential animal performance (Coleman and Moore, 2003). Furthermore, the utilization of any feed resource is influenced by the preference and acceptability of the feed, which is related to the animal's behavioral pattern (Mtenga *et al*., 1992; Kalio *et al*., 2006).

MATERIALS AND METHODS

The experiment was conducted at the Dairy Unit of the Teaching and Research Farm (TRF), University of Ibadan, Ibadan, Nigeria (3º45´E, 7º27´N; at 220m above sea level).

FORAGE MATERIALS

Gliricidia leaves were harvested from the existing plantations at the TRF. The leaves were seperated and air dried to a constant moisture level and thereafter bagged. It was then ground into the meal form at the feedmill of the Teaching and Research farm. Cassava roots was purchased from Ikire in Osun state. It was washed and crushed. It was thereafter pressed, dried and finally milled into flour. Other ingredients were purchased from the feedmill.

PELLET MILL

Two different pellet mills were used in pelleting the feed ingredients. Treatments 1 and 2 were pelletised by a flat die pellet mill while treatments 3 and 4 were pelletised on a locally fabricated ring die pellet mill.

PREFERENCE AND ACCEPTABILITY TRIAL

Four Zebu cows were used for the acceptability study. The method used is the cafeteria method of feeding as described by Larbi *et al.* (1993). Large feeders were used to enable the four (4) cattle feed simultaneously in a convenient situation. Each animal had free access to each of the alternative feed resources in the feeding troughs. The order of placement of the test feed in the parlor was randomized every day to avoid adaptation of the animal to a particular diet. The animals were served 2kg each of the treatments and were replicated twice. Feeding was allowed for a period of 30 minutes daily and the trial was carried out for eight days. The feed consumed was determined by deducting the feed refusal from the quantity offered.

PROXIMATE ANALYSIS

Feed sample (Pellets) were analysed for Dry Matter (DM) and Crude Protein (CP) according to AOAC (2005). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined according to the procedure of Goering and Van Soest (1985).

DURABILITY MEASUREMENT

The durability of the pellets was evaluated by using a durability tester. 100g of each sample was placed in a tumbling box having 60 rpm (revolution per minute) and was allowed to run for 5 minutes. The samples were recovered and the fines were separated from the pellets.

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS

A 2 x 2 factorial arrangement in a completely randomized design consisting of 2 pellet mills (a flat die pellet mill and a locally fabricated ring die mill) and 2 levels of starch (0 and 5%) of starch inclusion in the diets was adopted for the pellet feed production.

The data collected were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of MINITAB (2002-2003). Significant differences among means were separated using the Duncan's Multiple Range Test (DMRT) of the same software.

RESULTS AND DISCUSSION

Table 1: Proximate Composition (%) of Pellets

	DM	CP	EE	ASH	CF	NFE	NDF	ADF	ADL
T1	85.72	19.45^{a}	0.75^{a}	8.25^{c}	20.55^{d}	39.45^{a}	46.00^{b}	20.50^{b}	11.50^{b}
T2	85.42	18.85^{b}	0.85^{a}	8.35^{c}	21.25^{c}	38.65^{b}	41.50^{c}	17.00^{c}	10.25^{bc}
T3	85.46	18.35^{c}	0.85^{a}	9.75^{a}	21.85^{b}	36.85^{c}	49.50^{a}	27.50^{a}	14.50^{a}
T4	85.53	17.65^{d}	0.75^{a}	9.25^{b}	22.05^{a}	38.45^{b}	45.50^{b}	15.50^{c}	9.25^{c}
SEM	0.13	0.05	0.05	0.05	0.05	0.09	0.66	0.66	0.395

$^{a-d}$ Means in the same row with different superscripts are significantly different ($p < 0.05$)

T1: Pellets compressed by flat die mill + 0% starch; T2: Pellets compressed by flat die mill + 5% binder

T3: Pellets compressed by ring die mill + 0% binder; T4: Pellets compressed ring die mill + 5% binder

The CP content of pellets ranged from 17.65 to 19.45%. All these values are well above 8% suggested by Norton (1994) for effective ruminal function. This is an indication that pellets of this composition can serve as a protein supplements for cattle, especially during the period of drought.

PELLET DURABILITY INDEX

Table 2: Effect of pellet mill and starch on PDI of cassava-gliricidia pellets

Pellet mill	
M1	93.75^{a}
M2	89.25^{b}

$^{a-b}$ Means in the same column with different superscripts are significantly different ($p < 0.05$)

M1: Flat die pellet mill; M2: Locally fabricated ring die pellet mill

Table 3: Effect of Starch Inclusion on Durability Index

Starch level	
0%	90.25^{b}
5%	92.75^{a}

The effect of pellet mill on the PDI value was pronounced with pellets compressed by flat die having lesser fines after agitation compared to pellets from ring die. The difference may be due to the quantity of steam generated by the individual pellet mill. Skoch *et al*. (1981) indicated that steam

conditioning improved pellet durability. The addition of starch binder (5%) made the pellets to be more durable. PDI values for pellets having binder were significantly ($P < 0.05$) higher than pellet without binder. This emphasised the importance of binder in the production of durable pellets. Pellets without binder compressed by flat die mill were more durable than pellets from ring die mill irrespective of binder inclusion. Sonthi and Nitipong (2013) studied the potential of cassava root to serve as pellet fuel and found out that all pellets had little amount of fines. This result agrees with the above assertions and show that pellets of cassava roots are of good durability. In addition, the durability of such pellets can be influenced by pellet mill.

ACCEPTABILITY

Table 4: Effect of pellet mill type and starch on acceptability of cassava-gliricidia pellets by Zebu cows

Pellet mill	
M1	1.17[a]
M2	0.83[b]

[a-b] Means in the same row with different superscripts are significantly different ($p < 0.05$)

M1: Flat die pellet mill; M2: Locally fabricated ring die pellet mill

Table 5: Effect of starch on acceptability of cassava-gliricidia pellets by zebu cows

Starch level	
0%	1.09[a]
5%	0.91[b]

[a-b] Means in the same row with different superscripts are significantly different ($p < 0.05$)

STARCH: CASSAVA STARCH

The Coefficient of Preference is a measure of acceptability of forages by ruminants and is determined as the ratio of individual forage intake to the mean intake of all the forages. The results are presented in Tables 4 & 5. Based on this, the effect of machine was significant on the acceptability of pellets by cattle. Pellets compressed by flat die mill are considered to be acceptable while pellets from the ring die mill are not acceptable. West (1998) reported that a major factor which could enhance intake of forages by cattle is to simply lower the cell wall content. Thus, result of statistical analysis of pellets' chemical quality showed that pellets compressed by flat die mill had comparatively lower NDF content than pellets from ring die mill. This could be one of the reasons that made pellets compressed by flat die mill acceptable to the cattle. The effect of starch binder inclusion in the diet is also noticeable in the preference of cattle for pellets made by either mill. The result revealed that the addition of starch binder (at 5%) to the diet reduced the intake of pellets by the animals. According to Matthews (1983), palatability of a feed is interchangeable with preference for the feed. It is determined by the taste, smell, appearance, temperature and texture of the feed. It could then be argued that the inclusion of pregelatinised starch as binder in the production of pellets has a way of altering those dietary characteristics that stimulates a selective response by the animals.

CONCLUSION AND RECOMMENDATION

It is concluded that pellets made from cassava root meal and gliricidia leaves possess the potential of solving the problem of limiting feed resources in Nigeria. However, the efficiency of pellet mill must be carefully considered for optimum maximization of these resources. It is recommended that binder inclusion in cassava-gliricidia pellets should not exceed 5% of the feed.

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