

Development of feeding system based on Azolla (*Azolla pinnata*) and Sheanut Cake (*Vitellaria paradoxa*) for Nellore sheep reared in different production systems

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Introduction

Since protein sources such as ground nut cake and soya bean are too expensive to feed as supplements to livestock in India, steps have been taken to reduce cost by utilizing alternative feedstuffs to replace the traditional sources in ration formulation (Parashuramuluri *et al.* 2013). Azolla which is a free-floating nitrogen fixing water fern has a potential to be used as a protein supplement for ruminants (Ahirwar and Leela, 2012). Sheanut cake (*Vitellaria paradoxa*) which is produced after extraction of fats use in cosmetics and as a cocoa butter substitute in chocolate making, is also a rich in carbohydrates and protein, but the presence of anti-nutritional factors (*e.g.* theobromine and tannins) may limit its use as animal feed supplement (Odoeye *et al.* 2012). Both Azolla and Sheanut cake have been used as protein and energy supplement for sheep in India (Reddy *et al.* 2011), but further research is needed to formulate suitable rations for sheep.

The experiments reported here were conducted to assess: (1) The effect of diets based on Azolla (*Azolla pinnata*) and Sheanut Cake (*Vitellaria paradoxa*) on growth performance, DMI and nutrient utilization by Nellore weaners; (2) The influence of Azolla and Sheanut cake diets on blood biochemical profiles, liver function tests, haematocrit values and carcass traits of the Nellore weaners; and (3) The influence of diets on nutrient utilization of adult sheep. Both intensive and semi-intensive systems were compared in all the experiments.

Materials and Methods

The experimental diets consist of:

- Diet T₁, the control diet comprising concentrate mixture [ground nut concentrate (GNC) and rice bran (RB)] + Hybrid Napier in intensive system and concentrate mixture + grazing allowance in semi intensive system.
- Diet T₂ replacing 30 parts of GNC with Azolla.
- Diet T₃ replacing 16 parts of RB with Sheanut cake and
- Diet T₄ replacing 30 parts of GNC with Azolla + 16 parts of RB bran with Sheanut cake from control diet. These diets were fed to both Nellore weaners and adult

sheep in separate Complete Randomized Design with 6 replications (animals). Chemical composition and nutritive value were measured using standard methods.

Results

The chemical composition and amino acid profile of Azolla were superior to Sheanut cake. The essential and non-essential amino acids were in optimum proportions in both Azolla and Sheanut cake whereas sulphur containing amino acids were marginally lower in both. Hence, supplementation of these amino acids along with the diets was recommended.

In an experiment with Nellore weaners, higher ($P < 0.05$) dry matter intake (DMI)/day and higher ($P < 0.01$) DMI/100 kg body weight were recorded for T₃ and T₄ diets in the intensive system with the same trend observed for DMI/100 kg body weight in semi intensive system. Higher ($P < 0.01$) total body weight gain (WG) (kg) and average daily gain (ADG) (g) were observed for all test diets than the control in both systems. The feed conversion ratio (FCR) was higher ($P < 0.01$) higher for all test diets than control in both management systems. The cost of feed/kg WG was reduced by ~50% in experimental diets over control diet. DMI and cost of feed/kg WG were higher ($P < 0.01$) in the semi intensive system, whereas total body weight gain, ADG and FCR were ($P < 0.01$) higher in the intensive system.

Higher ($P < 0.01$) digestibility coefficients (%) were observed for DM, crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE), neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose and cellulose in intensive system and for DM, OM, CP, CF, EE, ADF and cellulose in semi intensive system for experimental diets over control diet. There was a significant ($P < 0.01$) difference in DM, OM, CP, NFE, NDF, hemicellulose and cellulose digestibility coefficients between systems where intensive system had higher values.

The digestible crude protein (DCP) content was significantly higher in T₄ and T₂ diets in intensive system at $P < 0.01$ and T₂ and T₃ in semi intensive system at $P < 0.05$. The TDN content was significantly ($P < 0.01$) higher in diet T₄ of intensive system and all test diets in semi intensive system than control diet. DCP and total digestible nutrient (TDN) content of test diets were higher than the recom-

mended values of NRC (1985). The protein:energy ratios were wider in all the diets of both systems indicating protein dilution. The digestibility coefficients (%) of DM, OM, CP, EE, NDF, ADF, hemicellulose and cellulose were higher ($P<0.01$) higher for all the experimental diets than the control in both systems of management whereas CF and NFE digestibility coefficients were higher in intensive system.

In the digestibility experiment with adult sheep, higher ($P<0.01$) digestibility coefficients (%) were recorded for DM, OM, CP, CF, hemicellulose and cellulose in intensive system and for NFE in semi intensive system. DCP and TDN values were comparable among all test diets and control and the values were also higher than recommendations of NRC (1985). The protein:energy ratios were wider in all the experimental diets confirming protein dilution.

In vitro dry matter digestibility (IVDMD) of *Azolla pinnata* and sheanut cake were 64.3 and 57.6, respectively, with higher ($P<0.01$) IVDMD observed for experimental diet T₄ over other test diets and control diet. *In sacco* DM disappearance and CP degradability (%), protein degradation (PD) and energy degradation (ED) were higher in test diets over control diet.

Blood biochemical profiles showed that serum albumin level of weaners were higher for T₂ diet in the intensive ($P<0.05$) and semi intensive ($P<0.01$) systems. Total protein, blood glucose, total cholesterol, BUN and creatinine values were not significant among the test diets and systems. The calcium and phosphorus levels among the experimental diets groups were higher ($P<0.01$) in semi intensive system whereas no significant difference was observed in intensive system for phosphorous levels. The values of blood biochemical profiles of the experimental groups were within the normal range.

Serum glutamic oxaloacetic transaminase and Serum glutamic pyruvate transaminase levels among the test groups and systems were comparable and within the normal range. Haematological values Hb, RBC, WBC and PCV showed non significant difference among the test diets and control. All the haematological values for the experimental

diets and systems fell within normal range.

For the intensive system higher ($P<0.01$) dressing percent on empty live weight basis was recorded for T₂ than other test diets, whereas, dressing percentage on pre-slaughter weight basis and hot carcass weight values were higher ($P<0.01$) in test diets over control diet. All the test diets fell within the normal range of dressing percentage for Nellore sheep (FAO, 1982)

Conclusion

The results of the study indicate that *Azolla* and Sheanut can be substituted up to 30 parts and 16 parts for GNC and RB, respectively, to improve feed utilization and sheep performance. Diets containing 30 parts of *Azolla* + 16 parts of Sheanut cake could profitably maintain the normal growth rate of Nellore weaners and adult sheep. Hence, all the experimental diets were recommended for the development of feeding systems of Nellore sheep raised under an intensive management system.

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