NUTRITIVE VALUE OF SAL SEED (Shorea robusta)

Md. Emran HOSSAIN1, Md. Hossain KABIR2, Sabuj Manohar SARMA2 and Hillol SIKDER2

1Department of Animal Science and Nutrition, Chittagong Veterinary and Animal Sciences University, Khulshi, Chittagong-4225, Bangladesh
2UG student, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University Khulshi, Chittagong-4225, Bangladesh
*Email: emranncvasu@yahoo.com

ABSTRACT: The study was undertaken to find out the chemical composition and nutritive value of Sal seed (Shorea robusta) available in Bangladesh. Shorea robusta seeds were collected from different remote places of study areas. Chemical analyses of the samples were carried out in triplicate for dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash (TA) in the animal nutrition and poultry research and training centre (PRTC) laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh. Results indicated that, air dried corticated Shorea robusta seed contained 91.6% DM, 7.7% CP, 17.8% CF, 8.1% EE, 54.3% NFE and 3.7% TA. Similarly, air dried decorticated seed contained 88.7% DM, 8.8% CP, 7.3% CF, 10.0% EE, 58.6% NFE and 4.0% TA. Air dried seed shell contained 88.5% DM, 5.8% CP, 39.3% CF, 3.7% EE, 34.8% NFE and 4.9% TA. Metabolizable energy (ME) was 2614.2 Kcal/kg, 2933.0 Kcal/kg and 1582.9 Kcal/kg in corticated seed, decorticated seed and seed shell respectively. It could therefore be inferred that, the Shorea robusta seed seems nutritionally sound enough to be utilized as unconventional feed for ruminant especially during scarcity period.

Keywords: Chemical Composition, Nutritive Value, Metabolizable Energy, Shorea robusta.

INTRODUCTION

Sal is a dominant tall tree providing excellent quality timber. Its botanical name is Shorea robusta. Local name in Bengali is Sal. It grows well in deciduous dry and evergreen moist forests with sandy loam soil of low height plain land from 200 to 1200 meters above sea level and sensitive to frost and water logging condition (Orwa et al., 2009). It grows extensively in Northern and Central India and as far north as the outer Himalayan region. This is a native tree to Myanmar and Nepal. It is moderate to slow growing and attain heights of 30 to 35 m with a trunk diameter of up to 2-2.5 m in around 100 years under favorable conditions. The leaves are simple, shiny, reddish and glabrous about 10-25 cm long and 5-15 cm broad (Orwa et al., 2009).

Sal seed leaves are used as medium to poor quality roughage (Orwa et al., 2009). The high content of NFE suggests using it as a source of cheap metabolizable energy (ME) in livestock diets in place of cereals like maize and barley. Sal seed fat has a buttery texture with a fatty acid composition of palmitic acid (4.5%), stearic acid (44.2%), arachidic acid (6.3%), oleic acid (42.2%) and lenoleic acid (2.8%). The oil is used for cooking and lighting and is suitable as a substitute for cocoa butter in the manufacture of chocolate (CSIR, 1972). On a dry matter basis, Sal seed meal has a low content of calcium (0.18-0.29%) and phosphorus (0.16-0.18) (ICAR, 1967). The tannin content appears to be 3.5 to 4.0% (Panda, et al., 1969), 6.2 to 13.7% (Devendra, 1988) and 7.6% (Kumar et al., 1970). Verma (1970) determined ME value of 11.10MJ/kg in goats (Khan et al., 1986). Negi (1982) reviewed the use of Indian Sal seed in livestock rations and concluded that it is comparable to other poor quality roughages.
No systematic study has so far been conducted to find out the chemical composition of Sal seed available in Bangladesh. Therefore, current study aimed to collect process and determine the chemical composition and nutritive value of Bangladeshi Sal seed.

MATERIAL AND METHODS

Study area
Most of the Sal forests in Bangladesh are extended over Madhupur and very few of them in Chittagong, Rangpur, Dinajpur and Rajshahi districts. However, most of the Sal forests are degrading and encroached by industrial plantation of fuel woods along with exotic species. The Chittagong Sal forest is the largest Sal forest patch in the country. Therefore, the current study was conducted in Chittagong Sal forest.

Collection of sample
Sal fruits start falling on ground from 2nd to 3rd week of May. Strong wind and storm help in bumper fall of Sal seed towards end of May. Collection seed was done in forenoon because of apprehension for casual storm and rainfall in the afternoon. Fresh seeds were collected from Chittagong area under standard random sampling technique. Total 3.0 kg of seeds were collected directly from the Sal forest for a total period of 30 days. Production of kernel from seed was almost 2:1. Seeds were packed in airtight sacks and sent to the Animal Nutrition and PRTC laboratory, Chittagong Veterinary and Animal Sciences University for proximate analysis.

Preparation of sample
From the winged fruit, Sal seed was processed in two gradual stages. De-winging was done in two different ways. The fruit after being completely dried were beaten on plain hard ground with a wooden stick to break the brittle wings. In this process the wings were broken and round seed pods with shell and covers were separated.

Chemical Analysis
Chemical analyses of the samples were carried out in triplicate dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash (TA) in the Animal Nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong as per AOAC (2006).

Estimation of ME
All samples were subjected to proximate analysis in triplicate. Later on, ME available in all seeds, kernel and shells were estimated by using a standard mathematical formula as per Lodhi et al. (1976).

Data analysis
Data related to chemical composition and nutritive value of corticated Shorea robusta seed, decorticated Shorea robusta seed and Shorea robusta seed shell were collected, compiled and analyzed for mean values by using Microsoft Excel 2007.

RESULTS AND DISCUSSION

The average DM contents of corticated Shorea robusta seed, decorticated seed (Inner kernel) and seed shell estimated in this study were 91.6%, 88.7% and 88.5% respectively. The average CP contents of corticated seed, decorticated seed and seed shell were 7.7%, 8.7% and 5.8% respectively. The average CF contents of corticated seed, decorticated seed and seed shell were 17.8%, 7.3% and 39.3% respectively. The average NFE contents of corticated seed, decorticated seed and seed shell were 54.3%, 58.6% and 34.8% respectively. The average EE contents of corticated seed, decorticated seed and seed shell were 8.1%, 10.0% and 3.7% respectively. The average TA contents of corticated seed, decorticated seed and seed shell were 3.7%, 4.0% and 4.9% respectively. The average ME contents of corticated seed, decorticated seed and seed shell were 82614.2%, 2933.0% and 1582.9% respectively.

Shorea robusta seed has been used successfully in a wide range of studies. In cattle, up to 20% has been recommended (Gohl, 1982). Up to 30% was recommended in diets for growing heifers with or without 2% urea (Sonwane et al., 1974; Devendra, 1985). In growing calves, supplementation of 30% seed meal did not affect health, intake and performance (Garg et al., 1984). Recommendations have been made for its incorporation in poultry mashes at 5-7% level. In concentrate mixtures for growing and lactating cattle 10-20% was suggested (ICAR, 1972). In another study, deoiled seed meal replaced maize in dairy cows up to 20% (Rajagopal et al., 1983). Kurar and Mudgal (1972) included 10, 20 and 30% seed meal and 2% biuret in diets for growing heifers and found
that up to 30% of the meal and 2% biuret was optimum for growing heifers. The seed cake has a low protein and fat content and its usefulness as feedstuff has been questioned (Negi, 1982). Despite many advantages, inclusion of 40% seed in cattle diet caused indigestion (Dash et al., 1972) and bullocks receiving 100% meal lost 14.0 kg in 60 days (Shukla and Talapada, 1973). In another study, digestibility of the seed meal was negative (Robb, 1976). It was suggested that tannins may have formed complexes with proteins in the meal to give the negative result.

### Table 1 - Chemical composition (% Air DM) and nutritive value of corticated Shorea robusta seed

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit (% Air DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (DM)</td>
<td>91.6</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>7.7</td>
</tr>
<tr>
<td>Crude fiber (CF)</td>
<td>17.8</td>
</tr>
<tr>
<td>Nitrogen free Extract (NFE)</td>
<td>54.3</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>8.1</td>
</tr>
<tr>
<td>Ash</td>
<td>3.7</td>
</tr>
<tr>
<td>Metabolizable Energy (Kcal/kg)</td>
<td>2614.2</td>
</tr>
</tbody>
</table>

### Table 2 - Chemical composition (% Air DM) and nutritive value of decorticated (Inner kernel) Shorea robusta seed

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit (% Air DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (DM)</td>
<td>88.7</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>8.8</td>
</tr>
<tr>
<td>Crude fiber (CF)</td>
<td>7.3</td>
</tr>
<tr>
<td>Nitrogen free Extract (NFE)</td>
<td>58.6</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>10.0</td>
</tr>
<tr>
<td>Ash</td>
<td>4.0</td>
</tr>
<tr>
<td>Metabolizable Energy (Kcal/kg)</td>
<td>2933.0</td>
</tr>
</tbody>
</table>

### Table 3 - Chemical composition (% Air DM) and nutritive value of Shorea robusta seed shell

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit (% Air DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (DM)</td>
<td>88.5</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>5.8</td>
</tr>
<tr>
<td>Crude fiber (CF)</td>
<td>39.3</td>
</tr>
<tr>
<td>Nitrogen free Extract (NFE)</td>
<td>34.8</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>3.7</td>
</tr>
<tr>
<td>Ash</td>
<td>4.9</td>
</tr>
<tr>
<td>Metabolizable Energy (Kcal/kg)</td>
<td>1582.9</td>
</tr>
</tbody>
</table>

Tannins adversely affect the utilization of other feed proteins while attempts to remove tannins from seed meal are neither effective nor practicable (Negi, 1982). Tannins in the diet resulted in reduced weight gain and poor feed efficiencies in chicken (Ahmed et al., 1991; Santos-Buelga and Scalbertm, 2000). By virtue of its availability, the seed and seed meal have a tremendous potential for its utilization as animal feed. However, the utilization of seed and seed meal as feed for cattle, poultry, and pigs showed that tannins limited their utilization (Negi, 1982, 1990). Nutritive value of 3% untreated seed meal and 0.1% NaOH treated seed meal was compared by lactating Murrah buffaloes. It was evident that, digestibility of crude protein and production of milk were favored by alkali treatment (Singh and Arora, 1981). In another study, Rao and Rao (1986) also reported 20-71% losses in dry matter of Shorea robusta seed meal as a result of washing after soaking in sodium hydroxide and sodium carbonate, respectively.

Shorea robusta seed cake has negative effects in poultry due to high tannin content. Inclusion of 50 g seed meal/kg in the diet of chicks resulted retarded growth and poor feed efficiency (Zomade et al., 1979). Similarly, broilers and layers fed 50% seed cake showed depressed nutrient digestibility and lower pancreatic and intestinal enzyme activity and hens produced eggs with discolored, greenish-yellow eggs (Mahmood et al., 2006). In another study, Panda et al., (1975) replaced maize by Shorea robusta seed meal in chick diets at levels varying between 2.25 to 45% and found an inverse relationship between seed meal level and body weight attained by the chicks. Similarly, Mohanty et al. (1967) substituted 2.4 to 5.0% of the maize with Shorea robusta seed meal to feed chicks up to eight weeks of age. The results indicated depression in growth rate compared to the control diets.
Up to 40% Shorea robusta seed cake in pig diets replacing maize had no significant effect on pig performance (Pathak et al., 1973; Devendra, 1985). Murty et al. (1969) used 20% seed meal to replace maize and noted reduced live weight gain, N and P balance. Similarly, Agarwal (1971) reported a drastic drop in live weight gain when maize or Ragí was replaced by deoiled Shorea robusta seed meal.

CONCLUSION

Shorea robusta seed is a good source of crude protein. However, it contains tannins that can be removed either by boiling or soaking in water. Therefore, tannin in Shorea robusta seed is no more a problem. Additionally, tannin present in seed has protein binding capacity. Therefore, Shorea robusta seed cake may be used to improve forages containing highly degradable protein. Apart from seed, Shorea robusta leaves may also be used for feeding the silkworm pupa (Antheraea mylitta) for garments industry.

REFERENCES


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