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NUTRITIVE VALUE OF SAL SEED (*Shorea robusta*)

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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*.

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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.

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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

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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

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

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

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

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

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

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 (Zombade 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.

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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 Ragi was replaced by deoiled *Shorea robusta* seed meal.

CONCLUSION

Shorea robusta seed is 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

Agarwal DK (1971). Effect of plane of nutrition on performance and carcass characteristics of large white Yorkshire pigs. Ph.D. Thesis, Agra University, Agra, India.

Ahmed AE, Smithard R and Ellis M (1991). Activities of enzymes of the pancreas, and the lumen and mucosa of the small intestine in growing broiler cockerels fed on tannin-containing diets. British Journal of Nutrition, 65: 189-197.

AOAC (2006). Official Methods of Analysis of AOAC International. Association of Official Analytical Chemists. 18th edition (Editor: William Horwitz, George W. Latimer), Gaithersburg, USA.

Appanah S and Turnbull JM (1998). Review of dipterocarps: taxonomy, ecology, and silviculture. CIFOR, Bogor, Indonesia.

CSIR (1972). The Wealth of India, Raw Materials. Dictionary of Indian Raw Materials and Industrial Products. Publication and Information Directorate, Council of Scientic and Industrial Research, New Delhi, India.

Dash PK and Misra SK (1972). Effect of sudden change of feed from normal to Sal seed supplemented ration on the ruminal activities of dairy cows and the results of stomach therapy on these animals. Indian Veterinary Journal, 49 (10): 1035-1040.

Devendra C (1985). Non conventional feed resources in Asia and the Pacific. FAO Regional Office for Asia and the Pacific, 2nd edn., Bangkok.

Evers AD, O'Brien L and Blakeney AB (1999). Cereal structure and composition. Australian Journal of Agriculture Reseach, 50: 629-650.

Garg AK, Agrawal DK and Nath K (1984). Effect of Sal (*Shorea robusta*) seed meal tannins on serum enzymes, nutrient utilization and growth in growing calves. Agricultural Wastes, 11(4): 307-317.

Gohl B (1982). Les aliments du bétail sous les tropiques. FAO, Division de Production et Santé Animale, Roma, Italy.

ICAR (1967). Report of the study group for exploring the possibility of using food byproducts as poultry feed. Indian Council of Agriculture Research, New Delhi.

Jolly MS, Sen SK and Das MG (1976). Silk from the forest. In: Unasylva 28 (4), No. 114- Employment.

Khan MY, Lal M and Krishan J (1986). Nutritional evaluation of deoiled oilseed (*Shorea robusta*) meal of goats, Indian Journal of Animal Nutrition, 3: 29-32.

Kumar GV, Subha Rao A, Sampath SH and Mudgal VD (1970). Report of studies on Sal seed meal; Workshop in Agricultural By-pro ucts and Waste Materials for economic rations for livestock, U.P.A.U., Pantnagar 21st to 23rd October, 1970.

Kurar CK and Mudgel VD (1972). Effect of feeding Sal seed meal in the utilization of feeds containing non-protein nitrogen compound in growing heifers. Indian Journal of Animal Science, 42: 393-398.

Lodhi GN, Daulat Singh and Ichhponani JS (1976). Variation in nutrient content of feeding stuffs rich in protein and reassessment of the chemical method for metabolizable energy estimation for poultry. Journal of Agricultural Science, 86(2): 293-303.

Murty VN, Joshi BC and Agarwal DK (1969). Evaluation of Sal seed meal in the ration of pigs. Scientific Annual Reports, Division of Animal Nutrition, IVRI, India.

Nagpaul PK, Verman PN and Chawla MS (1973). Some observation on the feeding of Sal seed meal (*Shorea robusta*) to the animals. Indian Veterinary Journal, 50: 352-356.

Nayak NC, Tripathi SB and Moh-anty K (1967). Use of decorticated Sal seed asa poultry feed - A preliminary trial. Indian Veterinary Journal, 40: 706.

Negi SS (1982). Tannins in Sal seed (*Shorea robusta*) and Sal seed meal limit their utilization as livestock

feeds. Animal Feed Science and Technol., 7: 161-183.

Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S (2009). Agroforestree Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya.

Panda NC, Mitro A, Kedary S and Parichha SN (1975). Sal seed and Sal oil meal as cereal substitute in starter mash. Indian Veterinary Journal, 52: 186-189.

Panda V (1970). Processings and utilization of agro-industrial by-products as livestock and poultry feed. Indian Poultry Gazettee, 54: 39.

Panda V, Jayaraman M, Ramamurty NS and Nair RS (1969). Processing and Utilization of Sal seed (*Shorea robusta*) as a source of energy in poultry feed. Indian Veterinary Journal, 46: 1075-1079.

Panda NC and Pradhan SC (1967). Chemical composition of Sal (*Shorea robusta*) fruits. Indian Veterinary Journal, 44: 62-64.

Pathak NN and Ranjhan SK (1973). Nutritional studies with Sal seed meal as a component of finisher rations in the large white Yorkshire pigs. Indian Journal of Animal Science, 43: 424-427.

Rajagopal S, Murty VN (1983). Deoiled Sal seed meal (DSSM) as an energy source in place of maize in the ratios of lactating crossbred cows. Agricultural Wastes, 5 (2): 83-94.

Rao VS and Rao KM (1986). Detaining of deoiled Sal seed (*Shorea robusta*) meal with sodium carbonate followed by washing of water. Indian Forester, 112: 253-260.

Robb J (1976). Alternatives to conventional cereals. In Feed Energy Sources for Livestock, Butterworth, London, pp. 13-28.

Santos-Buelga C and Scalbert A (2000). Proanthocyanidins and tanin-like compounds nature, occurrence, dietary intake and effects on nutrition and health. Journal of the Science of Food and Agriculture, 80: 1094-1117.

Shalini Trivedi, Mahanta SK, Kundu SS (2007). Evaluation of protein rich feed resources with different levels of tannin for their in vitro utilization. Range Management and Agroforesty, 28 (2B): 233-235.

Shukla PC and Talapada PM (1973). Studies on feeding Sal seed meal to adult animais. Indian Veterinary Journal, 50: 669-672.

Singh K and Arora SP (1981). Note on the influence of tannin of Sal seed meal on feed utilization and milk production in lactating buffaloes. Indian Journal of Animal Science, 5: 1078-1081.

Sonwane SN, Mudgal VD (1974). The utilization of Sal seed (*Shorea robusta*) meal as a feed supplement in the ration of growing heifers. Indian Journal of Dairy Science, 27: 183-187.

Tripathi AK (1975). Effect of Sal seed tannin and tannic acid on protein degradation in goats rumen (in vitro). Indian Veterinary Journal, 52: 195-200.

Verma SVS (1970). Studies on the metabolizable energy value of Sal seed (*Shorea robusta*) and Sal seed cake by chemical assay anU-biological evolution in chicks. M.V.Sc. Thesis, Agra University, India.

Zombade SS, Lodhi GN, Ichhponani JS (1979). The nutritional value of Sal seed (*Shorea robusta*) meal for growing chicks. British Poultry Science, 20 (5): 433-438.

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