



Evaluation of Velvet bean (*Mucuna pruriens*) for Proximate Composition, Fodder Quality and Digestibility Parameters

Arumbaka Sudheer Babu^{1*}, Chilumula Rama Krishna² and Sagi Raju¹

¹Department of Animal Nutrition, College of Veterinary Science, Hyderabad, Telangana, INDIA

²Department of Livestock Farm Complex, College of Veterinary Science, Hyderabad, Telangana, INDIA

*Corresponding author: AS Babu; E-mail: bakasudheer@gmail.com

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ABSTRACT

The study was conducted to explore the possibility of utilization of Velvet bean (*Mucuna pruriens*) whole plant foliage for application as animal feed using the proximate analysis based on AOAC analytical standard and further the fodder quality and digestibility parameters were estimated using various factorial methods. Velvet bean was harvested for testing as forage between 90-120 days after sowing from Fodder Unit, College of Veterinary Science, Hyderabad wherein the whole plant samples were pooled. Crude protein (CP) was 16.80 percent while crude fiber (CF) was 19.0. The CF recorded was higher than the conventional feeds generally used for non-ruminant livestock hence the whole plant foliage may probably suit to be fed to ruminant and pseudo-ruminants. Other results were total ash 7.8 %, moisture content 73.0 % and lipid content 2.40%. The Calcium was 1.03 % and Phosphorous 0.19%. The quality analysis of fibers was Neutral Detergent Fiber 59.00% and Acid Detergent Fiber was 40.30%. The estimated dry matter intake on dry matter basis was 2.03% and estimated digestibility parameters i.e. Relative Feed Value (RFV) was 90.67%; Relative Feed Quality (RFQ) was 98.60 %. The other results of analysis were acid detergent lignin (ADL) 9.92%, hemi cellulose (HC) 22.10%, acid insoluble ash (AIA) 0.27% and silica 0.17%. The analysis results depict potential nutritional use as animal feed which has to be further tested *in vivo* at various levels of inclusion.

HIGHLIGHTS

- Estimation of velvet beans fodder quality and digestibility parameters by factorial methods.
- Results depict potential nutritional use of Velvet bean as animal feed.

Keywords: Velvet bean, *Mucuna pruriens*, Relative Feed Quality (RFQ), Relative Feed Value (RFV)

Mucuna pruriens is a member of the Fabaceae family, composed of approximately 650 genera and 2,000 species, and is a tropical legume native to Asia and Africa having many common names, including monkey tamarind, velvet bean, Bengal velvet bean, and cowage. Velvet bean is a fast-growing, bushy or vining, annual plant that is somewhat drought tolerant. It can protect the soil through the wet monsoon season. Literature suggests that it can be used as a feed for livestock. The plant's vines and foliage can be used as pasture, hay, or silage for ruminants. Velvet bean seeds contain moderate amounts of protein (20–25 %) and smaller amounts of fat (3–5 %) which as a meal can be used as an alternative protein ingredient in poultry

feed, while pods and seeds grounded can be fed to both ruminants and monogastrics.

Velvet bean a legume has great potential as green manure as well as a weed control in plantation crops but management practices have to be developed which can minimize competition for light and moisture with plantation crops. Information is scanty with regard to the as to how they can be utilized as livestock feed and its fodder quality and digestibility. Out of the available plant

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species which can remain green late after the rainy season has passed if analyzed for possible inclusion in the feed can mitigate the shortage of fodder. The present study was taken up to assess the nutritional as well and feeding value of *Mucuna pruriens* velvet bean for livestock. A systematic evaluation can open up economical and novel utilisation and inclusion approaches in the livestock diets or rations during normal or scarcity or disaster conditions in various forms.

MATERIALS AND METHODS

Velvet bean seed was sown at a rate of 35-40 kg/ha as single crop at the beginning of the wet season, using inter row spacing of 0.9 - m and within row spacing of 30-40 cm. Velvet bean samples were harvested for testing as forage between 90-120 days after sowing when the pods are young which were further estimated for dry matter and pooled for analysis. Forage quality assessment of whole plant sample approximately 1 kg was taken and then dried in the oven for 48 hours at 60 degree Celsius and prepared for chemical analysis.

The samples were grounded with a Wiley mill to pass a 1 mm screen and analyzed for quality components. Proximate composition (AOAC, 2005) and cell wall constituents (Van Soest *et al.*, 1991) were estimated in the dried and pooled samples. Hemi-cellulose content was calculated by the difference between NDF and ADF. Ca and P content were determined by titration method (Talapatra *et al.*, 1940).

Total digestible nutrients (TDN), dry matter intake (DMI), digestible dry matter (DDM), digestible crude protein (DCP), net energy for lactation (NEL), digestible feed energy (DFE), relative feed value (RFV), relative forage quality (RFQ) and Digestible Energy DE were estimated according to the following equations adapted from NRC (2001), Lithourgidis *et al.* (2006), Lebas (2013) and Kumar *et al.* (2016) from the measured variables:

1. Total digestible nutrients (TDN, %) = $87.84 - (0.7 \times \text{ADF})$
2. Dry matter intake (DMI, % DM basis) = $120 / \text{NDF}$
3. Dry matter digestibility (DDM, %) = $88.9 - (0.779 \times \text{ADF})$

4. Digestible crude protein (DCP, %) = $(0.929 \times \text{CP}) - 3.77$
5. $\text{NE}_l (\text{M Cal/Kg}) = (1.044 - (0.0119 \times \% \text{ADF})) \times 2.205$
6. $\text{NEL} = [0.866 - (0.0077 \times \text{ADF})] \times 2.2$
7. Digestible feed energy (DFE, Mcal/kg) = $4.4 \times (\text{TDN} / 100)$
8. Relative feed value (RFV, %) = $(\text{DDM} \times \text{DMI}) / 1.29$
9. Relative feed quality (RFQ, %) = $(\text{TDN} \times \text{DMI}) / 1.23$
10. Digestible energy (DE) = $15.627 + 0.000982 (\text{CP}^2) + 0.0040 (\text{EE}^2) - 0.0114 (\text{Ash}^2) - 0.169 (\text{ADF}) \pm 1.250 \text{ MJ/kg DM}$

RESULTS AND DISCUSSION

As the evaluation results of the basic whole plant of *Mucuna pruriens* is scanty from previous research or literature the present experiment results were compared with the majority conventional ingredients or feeds and fodder and it was found that fiber level was higher than that of the majority conventional ingredients that are used for producing feeds for non-ruminant livestock species.

Table 1: Chemical composition in percent

Sl. No.	Item	Velvet bean (<i>Mucuna pruriens</i>)
1	Moisture	73.0
2	Dry Matter	27.0
3	Crude Protein	16.80
4	Crude Fat	2.40
5	Crude Fibre	19.0
6	Total Ash	7.80
7	Nitrogen free extract (NFE)	54.0
8	Neutral detergent fiber (NDF)	59.0
9	Acid detergent fiber (ADF)	40.30
10	Acid detergent lignin (ADL)	9.92
11	Cellulose	29.70
12	Hemicellulose (HC)	22.10
13	Acid insoluble ash (AIA)	0.27
14	Calcium	1.03
15	Phosphorous	0.19
16	Silica	0.17

Table 2: Estimated digestibility parameters and quality of Velvet bean (*Mucuna pruriens*)

ITEM	TDN%	DMI%	DDM%	DCP%	NEL, Mcal/kg	DFE, Mcal/kg	RFV%	RFQ%	DE, MJ/kg DM
	59.6	2.03	57.51	11.84	1.24	2.62	90.67	98.60	9.67

TDN = Total digestible nutrients; DMI = Dry matter intake; DDM = Digestible dry matter; DCP = Digestible crude protein; NEL= Net lactation for energy; DFE = Digestible feed energy; RFV = Relative feed value; RFQ = Relative forage quality; DE= Digestible energy.

Hence it can be inferred that the foliage may not be suitable to be used as feed ingredient for non-ruminant livestock species, but will probably better suit to ruminant and pseudo-ruminant.

The crude protein content of up to 16.80% is comparable to those of feed ingredients such as brans and cakes, usually used in rations of livestock indicating its potential to be used accordingly.

Relative Feed Value (RFV) presently recorded was 90.67% which was equivalent to the values of the Brome grass in late vegetative bloom 91% (Fekadu *et al.*, 2017 and Dunham, 1998). Approximate forage quality based on above comparison can be used as an indicative to include them in the future experimental *in vitro* or *in vivo* trials to know the true nutritional potential for livestock feeding. High RFV index signifies superior forage quality. The RFV index estimates the digestible dry matter (DDM) from ADF, and calculates the DM intake potential (as a percent of body weight, BW) from NDF. RFV is an accurate measure for quality over protein content alone which provides an indication of digestibility and how much forage an animal can eat.

It is to be noted that quality of roughages depends on the NDF and ADF content and the indexes relative feed value (RFV) and relative forage quality (RFQ) estimate the quality of roughages depending on their NDF and ADF content.

Out of the estimated indexes Relative forage quality (RFQ) considers NDF digestibility and the RFQ is a more developed index than the RFV index, as it better reflects the expected performance of cattle consuming roughage. The digestibility of NDF determines rumen fullness and digesta flow rate ultimately affecting the dry matter consumption. Total digestible nutrients (TDN) are used to determine the RFQ (Ball *et al.*, 2007). The RFQ index includes the differences in digestibility of the fiber fraction and can be used to more accurately guess animal performance and match animal needs.

The recorded Relative Forage Quality (RFQ) percent was 98.60. In this context it has to be noted that as per Undersander, 2003, RFQ must be from 100 to 200 in order to support Cattle Type of Heifer and 18 to 24 months dry cow. While the RFQ-based Forage Quality Grading system given by Saha *et al.* (2010) classifies the RFQ of >185 as Supreme and RFQ of <90 as Utility. Based on the above two approaches defining RFQ, the values recorded in the present study have to be interpreted cautiously while including in the future feeding or nutritional evaluation trials. The RFQ stresses upon the fiber digestibility while RFV uses DDM intake. Accordingly to some extent it can be inferred that it can only be fed as a partial replacement in the diets with due care after further *in vivo* trials.

CONCLUSION

Results of experiment appeared comparable with that of the available literature. Effects on feed intake, nutrient utilization and growth performance at various inclusion levels and forms has to be taken up based on the above proximate composition, fodder quality and digestibility parameters. Their application as animal feed has to be further tested *in vivo*.

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