# CHEMICAL EVALUATION *IN VITRO* AND *IN SACCO* OF TRADITIONAL FODDER TREE (*DELONIX ELATA GAMBLE*) IN BUFFALOS

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## ABSTRACT

Present study was undertaken in order to study *Delonix elata* (L) Gamble for its nutritive value so as to use this particular tree leaves as livestock feed. The findings shown that, *Delonix elata* (L) Gamble contained, 32.8, 90.9, 25.2, 2.4, 18.2, 9.1, and 45.1% of DM, OM, CP, EE, CF, TA and NFE, respectively. The cell wall constituents (%) were, 46.5 (NDF), 24.3 (ADF), 22.2 (hemicellulose) and 5.3 (ADL). The determination of different fraction of carbohydrates and protein as per CNCPS (Cornell Net Carbohydrate and Protein System) revealed that, carbohydrate fraction A and protein fraction $B_2$ contents were more, indicating the readily available nutrients are more in this forage. The *IVDMD* and *IVOMD* were 76.7 and 77.4%, respectively. *In sacco* DM degradability indicated readily soluble component a-14.3, insoluble but degradable component, b-68.7, rate constant at which 'b' is degraded c- 0.0586 and effective degradable dry matter (EDDM) of 55.8%. While the protein degradability study indicated a-18.3, b-60.4, c- 0.0904 and effective degradable protein (EDP) was 60.8%. The total tannin content was 4.1 g%. It can be concluded that, *Delonix elata* can be used as livestock feed.

**Keywords**: Cornell Net Carbohydrate and Protein System, *Delonix elata* (L) Gamble, forage, *IVDMD, In sacco* degradability, rumen

## INTRODUCTION

Tropical trees and shrubs are important feeds for livestock and wild animals and can be used as alternative supplements to balance the diet of livestock in terms of protein, energy, vitamins and minerals. Leguminous trees produce leaves and pods that are palatable and rich in protein, minerals and vitamins that are deficient in natural pasture and crop residues. The supplementation of animals fed low quality roughage with tree legumes either fresh or as leaf meal has been found to be effective in improving the animal performance during the dry season while at the same time lowering the cost of production. They are also used in human and veterinary medicine and also for environmental conservation.

Although the role of trees and shrubs is recognised in different livestock production systems in the tropics, appreciable work in evaluating the nutritional value of these forage material has been

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conducted on exogenous plants such as Leucaena (*Luceana lucocephala*), *Gliricidia sepium* and Mulberry (*Morus alba*) as well as some indigenous plants. However, due to agronomic requirements and climatic differences in various locations of the tropics different indigenous trees are widely distributed in these areas. As there is deficit for fodder for livestock, identifying the new species of fodder is very much required to alleviate the fodder deficit. Hence an attempt was made to increase knowledge on exploitation of trees and shrubs locally found for livestock feeding, namely *Delonix elata*, which is popular as "Chiripeti chettu", "Flame of the forest", "Gold mohur" etc., (Sumitra and Sonia, 2014) distributed in tropical and sub tropical countries. The feeding of leaves or twigs of this plant for different livestock is a common practice in Chittoor, Kadapa, Prakasham and Nellore districts of Andhra Pradesh. However scientific validation about the nutritional value is not documented, particularly different protein and carbohydrate fractions is also lacking. The cell wall constituents of plants are very important factors that affect the forage intake and digestibility (Van Soest *et al*., 1966). The different protein (non protein nitrogen, soluble peptide and soluble true protein) and carbohydrate (soluble sugar, starch, non starch polysaccharides) and the structural carbohydrate fractions are utilized by rumen microbes and animals differently and their estimation in the feedstuff elucidates more information about their availability (Nocek and Russell, 1988; Sniffen *et al*., 1992). Hence a study was conducted to evaluate the nutritive value of native leguminous browse tree, namely *Delonix elata.*

## MATERIALS AND METHODS

The plant material collected from different locations of the village, Padipeta near Tirupati, Chittoor district of Andhra Pradesh and got authenticated with Botanist at S.V. University, Tirupati, The samples were dried at 70$^{o}$C for 48h, ground to pass through 2 mm medium mesh screen and analyzed for chemical composition AOAC (1995) and forage fiber fractions (Van Soest *et al*., 1991) total tannins (AOAC, 1980) and calcium and phosphorus (Talapatra *et al*., 1940). Nitrogen solubility was measured using borate-phosphate buffer of pH 6.8 (Krishnamoorthy *et al*., 1982) and non-protein nitrogen content was estimated (Licitra *et al*., 1996). The difference between the total N and buffer insoluble N was considered as the buffer soluble N and nitrogen that is insoluble in neutral detergent (NDIN) and acid detergent (ADIN) was estimated (Van Soest *et al.*, 1991). Starch in dried samples was estimated as per Clegg (1956) method. NSC was computed directly by using the formula: 100-[(NDF-NDFIP) + crude protein + fat + ash] (Van Soest *et al*., 1966). Carbohydrate fractions were calculated according to the equations developed by Sniffen *et al.* (1992). The determination of different fraction of carbohydrates and protein were as per CNCPS (Cornell Net Carbohydrate and Protein System).

The samples were ground to pass through 2 mm medium mesh screen and 3 g of each sample was incubated in the rumen of four permanently rumen cannulated buffalos (maintained on green forage), for 12, 24, 36, 48 and 72 h by suspending in the nylon bags with cloth pore size of 25-28µm. The protein degradability was estimated by incubating 3 g of sample in the nylon bags at 3, 6, 9, 15 and 24 h. The constants a, b and c were calculated by iterative least square technique using

NEWAY programme with the help of a computer (Mc Donald, 1981). The effective degradable dry matter and effective degradable protein contents were calculated assuming an outflow rate (K) of 0.05/h. *In vitro* dry matter digestibility (*IVDMD*) was estimated using a Tilley and Terry (1963) two-stage technique, with rumen liquor from rumen cannulated buffalos. *In sacco* dry matter and protein disappearance evaluation was carried out as per the method described by Orskov *et al*., (1980) and Mc Donald (1981), using four cannulated buffalos (385±5.3 Kg) maintained on the ration containing NB-21 fodder, paddy straw and concentrate mixture. Rumen fermentation pattern in terms of pH, $NH_3N$ and TVFA was determined at 0, 1, 2, 4 and 6 h in rumen cannulated buffalos. The data was subjected for standard statistical methods described by Snedecor and Cochran (1970).

## RESULTS AND DISCUSSION

The *Delonix elata* foliage contained DM, OM, CP, EE, CF, TA and NFE of 32.8, 90.9, 25.2, 2.4, 18.2, 9.1, and 45.1%, respectively (Table 1). The NDF, ADF, cellulose, hemi-cellulose, lignin and silica contents (%) were 46.5, 24.3, 22.2, 23.7, 5.3 and 3.5, respectively. The Calcium and Phosphorus were 0.121 and 0.04%, respectively. Nutrient composition is comparable with subabul (*Luceana lucocephala*) and malbery leaves (Deva Sena *et al*., 2006).

The soluble protein content in *Delonix elata* was 28.5% CP and NPN as %SP was 73.3 and various protein fractions A (readily soluble), $B_1$ ( rapidly degradable), $B_2$ (slowly degradable), $B_3$ (digestible) and C (un available) were 20.1, 7.6, 57.0, 6.3 and 8.2%, respectively (Table 2). This indicates that, slowly degradable fraction $B_2$ was more (59.3%) in the *Delonix elata* as compared to other fractions. The nonstructural carbohydrate (NSC) content was 22.0% and starch was 4.2% as of carbohydrates and different carbohydrate fractions A (readily soluble), $B_1$ (rapidly degradable), $B_2$ (slowly degradable) and C (un available) were 51.8, 2.3, 20.5 and 25.4%, respectively. The highly soluble fraction of carbohydrate (A) content was more (51.8%) compared to other carbohydrate fractions. The total tannin content was 4.1 g%.

The *IVDMD* (%) and *IVOMD* were 76.7±3.7 and 77.4±4.1 %, respectively (Table 3). The *in sacco* dry matter degradability estimation revealed rapidly soluble (%) fraction 'a' of dry matter, 14.3±0.8, slowly degradable (fraction 'b') dry matter fraction 68.7±6.3. The rate constant 'c' of dry matter was 0.0586±0.004. The Effective Degradable Dry Matter (EDDM %) was 55.8±4.1. While *in sacco* crude protein degradability determination showed readily soluble (%) fraction 'a' of protein as 18.3±3.0 and slowly degradable (fraction 'b') protein fraction 60.4±2.4. The rate constant 'c' of protein was 0.0904±0.002. The Effective Degradable Protein (EPD) was 60.8%. The *Delonix elata* contained RDP and UDP of 15.3 and 9.9%, respectively, which indicated that it contains more degradable protein. The carbohydrate and protein fractions and rumen degradability were comparable with mulberry leaves (Deva Sena *et al*., 2006).

The rumen fermentation pattern showed rumen pH from 5.62 ±0.06 (0 h) to 6.03±0.08 (6 h), $NH_3N$ (mg %) from 18.2±0.9 (0 h) to 20.8±1.2 (6 h) and TVFA (meq/L) 56.7±2.8 (0 h) to 68.3±3.1 (4 h), revealed normal trend.

Komwihangilo *et al.* (2005) reported that the palatability of the fodder is quite good which has resulted in DMI of 126.95 g per day in Malya male goats along with hay (*Cenchrus ciliaris*), that

Table 1. Chemical composition of *Delonix elate* (% DM basis)*

| Particulars | Content |
|---|---|
| Dry matter | 32.8 |
| Organic matter | 90.9 |
| Total Ash | 9.1 |
| Crude protein | 25.2 |
| Ether extract | 2.4 |
| Crude fiber | 18.2 |
| NDFIP(%CP) | 46.5 |
| ADFIP (%CP) | 44.1 |
| Total carbohydrates | 63.3 |
| NDF | 46.5 |
| ADF | 24.3 |
| Hemi Cellulose | 22.2 |
| Cellulose | 18.3 |
| ADL | 5.3 |
| Total tannins | 4.1 |
| Calcium | 0.121 |

Table 2. Carbohydrates and Protein fractions of *Delonix elata.*

| Particulars | Content |
|---|---|
| **Carbohydrates Fractions** | |
| A | 51.8 |
| B1 | 2.3 |
| B2 | 20.5 |
| C | 25.4 |
| NSc | 22.0 |
| Starch (% NSC) | 4.2 |
| **Protein Fractions** | |
| A | 20.9 |
| B1 | 7.6 |
| B2 | 57.0 |
| B3 | 6.3 |
| C | 8.2 |
| SP | 28.5 |
| NPN (%SP) | 73.3 |

Table 3. *In vitro* DM and in sacco DM and protein degradability of *Delonix elata.*

| Particulars | Content |
|---|---|
| IVDMD (% ) | 76.7±3.7 |
| IVOMD(%) | 77.4±4.1 |
| a | 14.3±0.8 |
| b | 68.7±6.3 |
| a+b | 82.7±3.55 |
| c, $h^{-1}$ | 0.0586±0.004 |
| EDDM% | 55.8±4.1 |
| a | 18.3±3.0 |
| b | 60.4±2.4 |
| a+b | 78.7±2.7 |
| c, $h^{-1}$ | 0.0904±0.002 |
| EDP | 60.8 |
| RDP (%) | 15.3 |
| UDP (%) | 9.9 |
| CP (%) | 25.2 |

has supported growth of 10.00 (g/d), with 35.06 feed conversion efficiency.

Based on chemical composition, *in vitro* dry matter digestibility, *in sacco* degradability and rumen fermentation pattern estimated in buffalos, it can be inferred that, *Delonix elata* can be used as livestock feed.

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