

# Quality and availability of buffel grass forage in a silvopastoral system with mesquite in the Brazilian semi-arid region

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## Introduction

Livestock grazing has been a traditional activity in the Brazilian semi-arid region. However, production is low, mainly due to low quality or even total lack of pasture during the dry season. In order to overcome the nutrient deficiency, local farmers started to grow mesquite trees (*Prosopis juliflora* (SW) DC) mainly for pod production as a supplemental fodder.

The objective of this study was to study the influence of mesquite tree on several aspects of a silvopastoral system for the region involving buffel grass (*Cenchrus ciliaris* var. Biloela).

## Material and methods

The experiment was established at Petrolina, PE, at latitude 09°09'S and longitude 40°22'W, at 365 m elevation above sea level. The study was based on observations made during the period of August 1997 to April 1998, in a silvopastoral system which is 15 years in operation. The experiment was set up in a randomized block design with ten replications of treatments consisting of two sampling points under the tree canopy and a third located 20 m away from each selected tree, representing the conditions of a monoculture pasture.

With a "LI-COR" portable photosynthesis measurement device, the following variables were measured: photosynthetically active radiation (PAR), net photosynthesis, photosynthetic efficiency, air temperature, relative humidity, and buffel grass leaf temperature. After harvesting the grass, the following data were collected: a) above ground dry matter yield; b) content of dry matter in the forage; c) content of chlorophyll *a* and *b* in the leaves; d) specific leaf area (SLA); e) nutritional value (crude protein, fiber and digestibility), and f) mineral composition of the forage (N, P, K, Ca and Mg). Soil data included contents of moisture, organic matter and nutrients (N, P, K, Ca, and Mg).

## Results

Mesquite trees had, on average, 7.4 m total height; 1.8 m commercial stem height; 5.6 m crown height; 10.4 m crown diameter, and 25.7 cm stem base diameter. PAR measured

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under the tree canopy was 50.4% during the dry season and 43.8% in the rainy season, in relation to full light conditions. On average, there was a reduction of 1.5°C in air temperature and 2.7°C in grass leaf temperature.

The presence mesquite trees in buffel grass pasture improved soil fertility by increasing the contents of organic matter, nitrogen and phosphorus and decreasing soil pH. Grass dry matter yield decreased under tree canopies. However, the forage produced under such condition (reduced light) had higher nutrient value. There was a significant increase in crude protein content. In spite of that, there was no statistically significant difference between full light and shaded conditions on the average content of neutral detergent fiber (NDF) or on "*in vitro*" dry matter digestibility (IVDMD), except during the rainy season.

The chemical composition of buffel grass forage was differently affected by the presence of mesquite tree. There was an increase in the concentration of some macronutrients (N and Mg) and decrease in others (P, K and Ca).

Under reduced light, buffel grass produced larger specific leaf area (SLA) and higher contents of chlorophyll, of both *a* and *b* types than under full light. Also, buffel grass grown in shaded environment compensated the low level of PAR with a higher photosynthetic efficiency.

## Discussion and conclusions

Mesquite leaf abscission occurs year all round, but with higher intensity during the dry season. Sprouting of new leaves occurs mostly during the rainy season, from December to May (Lima, 1994). The shading by mesquite trees contributes to the conservation of soil moisture, thereby improving the environmental conditions for the pasture. Increases in SLA and in chlorophyll contents under shaded conditions were, also, reported in other species elsewhere (Friendship-Keller *et al.*, 1987; Igboanugo, 1989; Valenzuela *et al.*, 1991; Morita *et al.*, 1994).

Mesquite tree is considered a potential species for the restoration of fertility and productivity of degraded soils. Garg (1998) and Bhojvaid and Timmer (1998) showed this species ability to reduce electrical conductivity and to increase both the organic carbon content and the nutrient availability in the soil. The effect of trees on the soil, in different silvopastoral systems is, usually, in the form of improved fertility due to increase in nitrogen content (Sanchez and Palm, 1996; Bhojvaid and Timmer, 1998; Buresh and Tian, 1998; Botero and Russo, 2000).

Lower dry matter yield but with higher nutrient value in buffel grass observed under this silvopastoral system was similar to other experiences involving different grass species, although, in some cases, dry matter yield has been greater in shaded environment (Botero and Russo, 2000; Hernández *et al.*, 2000). According to Giraldo *et al.* (1995) and Daniel and Couto (2000), forage production, normally, decreases as tree canopy cover increases, with higher intensity with more than 50% cover.



Except for phosphorus, macronutrient contents in buffel grass under mesquite trees meet the nutrient requirements for cattle (National Research Council, 1984), even with the slight decrease in potassium and calcium contents as observed in this study.

The compensation with higher photosynthetic efficiency under low PAR observed in this experiment was similar to the case reported by Cruz (1997). In his study, *Dichanthium aristatum* had a higher rate of CO<sub>2</sub> assimilation and a higher RUE (radiation use efficiency) under *Leucaena leucocephala* canopy than under full light.

Therefore, silvopastoral systems made up with buffel grass and mesquite tree are potentially viable for the semi-arid region in Brazil, given the importance of this leguminous tree as a source of timber as well as pods for supplemental fodder during the dry season.

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