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Mineral contents of *Acacia mangium* Willd under defoliation conditions[1]

Contenido mineral de *Acacia mangium* Willd bajo condiciones de defoliación

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Abstract

In an *Acacia mangium* Willd plantation, located in the western part of Venezuela, a trial was carried out to assess the mineral content of leaves of *cacia mangium* under three defoliation frequencies (6, 9 and 12 weeks) and three defoliation heights (50, 75 and 100 cm). The factors studied were combined in a factorial arrangement of a random block design with three replications. There were significant differences ($P<0.05$) for the frequency and height of defoliation on the concentrations of K, Mn and Zn. The data showed that levels of Ca, Mg, Na and P were affected by maturity. Mineral contents redution with advancing maturity may be due to a natural dilution process.

Key words: *Acacia mangium*, mineral composition, defoliation

Resumen

En una plantación de *Acacia mangium* Willd, ubicada en el occidente de Venezuela, se llevó a cabo un ensayo para evaluar el contenido mineral de las hojas de *Acacia mangium* bajo tres frecuencias (6, 9 y 12 semanas) y tres alturas de corte (50, 75 y 100 cm). Los factores de estudio se combinaron en un arreglo factorial, en un diseño experimental en bloques al azar con tres repeticiones. Se encontraron diferencias significativas ($P<0.05$) en el efecto de las frecuencias y alturas de defoliación sobre las concentraciones de K, Mn y Zn. Los datos muestran que los niveles de Ca, Mg, Na y P fueron solamente afectados por la madurez. Las reducciones en el contenido mineral con el avance en madurez puede ser debido a un proceso natural de dilución.

Palabras claves: *Acacia mangium*, contenido mineral, defoliación

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Introduction

Minerals are required in livestock diets to meet nutritional and metabolic requirements. To maximize animal productivity, adequate quantities of minerals need to be provided to grazing livestock. The concentration of individual minerals in forages varies greatly depending on soil, plant and management factors (1,2).

It is important to determine the management practices necesary to obtain optimum mineral concentrations. Some investigations have shown that defoliation affect the levels of mineral in tree legumes (6).

A legume recently introduced in Venezuela is *Acacia mangium* Willd, mainly used in some countries for reforestation and as a fuel source. In Venezuela there are few studies on this legume which may have a good potential as a forage source not only because of its nutrients but also because of its adaptability to acid and poor soils that are widely largely extended in tropical regions.

The present study aims at assessing the mineral compositions of the leaves of *Acacia mangium* under defoliations management practices.

Materials and methods

The *Acacia mangium* Willd plantation is located in the western part of Venezuela, agroecologically considered as a tropical dry forest, with an average annual raifall of 1100 mm and average temperature of 29 ºC. A trial was carried out to assess the nutritive value of this plant through the content of minerals in *Acacia mangium* Willd, submitted to different frequencies and height of defoliation.

Sowing was initially carried out in 2 kg pots. The *Acacia* seeds were scarified with hot water (50 ºC) for 10 min and inoculated with a specific *Rhizobium* for *Leucaena leucocephala*. Once sown, plants were kept under nursely conditions with daily irrigation and manual weed control. At 10 weeks of age, a fungicide application was needed with 80% sulphur (Comoran 80^{R}) for *Oidium* sp control, in a dosage of 3 g of the product per litre of solution. The area used for the trial was of 270 m^2, divided in 27 plots each of 10 m^2 (2 x 5). Plants were transplanted after 7 months of growth. Sowing distance was 2 m between rows and 1 m between plants, for a total of 135 plants in the trial. Each plot had 5 plants, where were left as border effect with a total of 3 effective plants per plot. Factors were 3 frequencies (6, 9 and 12 weeks) and 3 defoliation heights (50, 75 and 100 cm measured from the soil), which were combined in a 3x3 factorial arrangement generating 9 treatments. A random block design with 3 replications was used. Once effective plants were harvested, they were separated in the different fractions (leaves and stem). They were dried in a forced air circulation oven at 65 ºC, ground in a Wiley mill and passed through a 1 mm sieve.

Chemical analysis were made for Ca, P, K, Mg, Na and Zn using the methodology of Fick *et al.* (4), with the determination of P by colorimetry and the remaining elements by atomic absorption spectrophotometry.

For the statistical analysis of data, the SAS (10) statistical package was used, applying the GLM (General Linear Model) procedures for the analysis of variance and LSMEANS for the separation of means.

Results and discussion

Table 1 shows the effect of the frequency x defoliation height interaction on the K, Mn and Zn in leaves of *Acacia mangium*. As observed in this table, the concentration of this elements decreased as increasing the cutting frequency, for cutting heights studied.The lowest values of K (0.81%), Mn (36.4 ppm) and Zn (23.1 ppm) were obtained for the combination of cutting frequency of 12 weeks with the defoliation height of 50 cm. The highest values of K (1.27%) and Mn (69.2 ppm) correspond to the frequency of 6 weeks with 100 cm height and for Zn (42.9 ppm) 6 weeks with 50 cm height.

The distribution pattern of K, Mn and Zn were similar in this tree legume. Highest concentrations were usually found in young leaves at lowest at the base of the stems. As the plant advanced in maturity the K, Mn and Zn contents of *Acacia* decreased.

A greater height implies more residual foliar area after each harvest, allowing plant recovery and more photosynthetic activity; the development of the radicular system is not affected and for instant the nutrient uptake by root and the supply the plants with mineral nutrients are not affected (8).

Investigations concerning the distribution of minerals have been carried out by a number of workers. Other authors as Ferrer *et al.* (3) and Miquelena *et al.* (5) have found that, in the tree legumes, mineral contents in leaves declines with maturity.

Frequency of harvest significantly affected the levels of Ca, Mg, P and Na (Table 2). Concentrations of these minerals decreased as harvest interval increased from 6 to 12 weeks. The average decrease was 31% for Ca and Mg, 24% for P and 42% for Na between 6 and 12 weeks old material.

This could be due to a rapid uptake of minerals by Acacia during the early stages of growth with a relative slow production of dry matter. With advancing maturity, photosynthetic areas begin to increase, the dry matter content of this legume generally increase more rapidly than mineral uptake causing due to a natural dilution process, mineral contents decline (9).

Table 1. Mineral contents in leaves of *Acacia mangium* as influenced by defoliation management

Frequency (weeks)	Height (cm)	K (%)	Mn (ppm)	Zn (ppm)
6	50	1.08^{ab}	61.5^{a}	42.9^{a}
	75	1.08^{ab}	62.9^{a}	37.1^{b}
	100	1.27^{a}	69.2^{a}	37.0^{b}
9	50	0.91^{b}	42.5^{bc}	27.3^{c}
	75	0.93^{b}	46.5^{b}	28.7^{c}
	100	0.96^{b}	46.4^{b}	28.4^{c}
12	50	0.81^{c}	36.4^{c}	23.1^{d}
	75	0.82^{c}	36.7^{c}	24.0^{d}
	100	0.91^{b}	39.6^{c}	26.4^{c}

Means in the same column without letters in common differ at P<0.05 (LSMEANS)

Table 2. Effect of frequency of harvest on the macromineral concentration in leaves of Acacia mangium

Frequency (weeks)	Ca	Mg	P	Na
		(%)		
6	0.45^{a}	0.23^{a}	0.29^{a}	0.19^{a}
9	0.38^{b}	0.18^{b}	0.24^{b}	0.14^{b}
12	0.31^{c}	0.16^{b}	0.22^{b}	0.11^{c}

Means in the same column without letter in common differ at P<0.05 (LSMEANS)

Conclusions

Mineral concentrations of Acacia mangium was affected by defoliation treatments. In general the concentrations values did not vary greatly by cutting heights at each harvest frequency.

Acacia mangium showed the highest mineral contents during early growth stages and declined as the plants approach maturity.

This study showed that concentrations of certain minerals in Acacia mangium could be affected by defoliation management practices.

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Literature cited

1. Adejumo, J. And A. Ademosun. 1985. Effects of plant distance, cutting frequency and height on dry matter yield and nutritive value of Leucaena leucocephala sown alone and in mixture with Panicum maximum. J. Anim. Prod. Res. 5:209-225.

2. Clavero, T. 1998. Uso de los árboles forrajeros en la ganadería tropical. En: Clavero, T. (Ed.). Estrategias de Alimentación para la Ganadería Tropical. Venezuela. pp. 101-109.

3. Ferrer, O., T. Clavero y R. Razz. 1999. Frecuencia de defoliación y densidad de siembra en el contenido mineral de la mata ratón (Gliricidia sepium). Rev. Cubana Cien. Agric. 33:325-330.

4. Fick, K., L. McDowell, P. Wilkinson, W. Funk and J. Conrad. 1979. Methods of mineral analysis for plant and animal tissues. Dept. Anim. Sci. University of Florida. Gainesville.

5. Miquelena, E., O. Ferrer, T. Clavero, R. Razz and M. Medina. 2000. Frequency and height of defoliation on the nitrogenous fractions of Acacia mangium Willd. Cuban J. Agric. Sci. 34:65-71.

6. Ngo, V. and V. Nguyen. 1991. Effect of spacing on growth and yield of legume trees on low fertility grey soil in South Easter Vietnam. In: Ly, L., H. Luu and T. Preston (Eds.). Proceedings of International Symposium on Increasing Livestock Production by Marking better Use of Local Resourses in Vietnam. Bangkok.

7. Pérez, J., T. Clavero and R. Razz. 1998. Dry matter production in Acacia mangium plants under different levels of fertilization. Cuban J. Agric. Sci. 32:201-205.

8. Sharma, B. 1990. Ecophysiological studies on Angeratum canyzoides in South West Nigeria. Annals of Arid Zone. 29:105-115.

9. Spears, J. 1994. Minerals in forages. In: Fahey, G. (Ed.). Forage Quality and Utilization. American Society of Agronomy. USA. pp. 281-318.

10. Statistical Analysis System (SAS). 1987. User's guide. Raleigh. North Caroline.