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Production, chemical and mineral composition of Pornunça (*Manihot* sp.) under different planting densities and phosphorus fertilization - Producción, composición química y mineral de la Pornunça (*Manihot* sp.) bajo diferentes densidades de plantación e abonación fosfatada

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Abstract

This study aimed to evaluate the effect of different planting densities and phosphorus fertilization on yield, chemical and mineral composition of Pornunça (*Manihot* sp.) cultivated under rainfed system, from May 2010 to October 2011. It was adopted the randomized blocks design in a factorial 4 x 4 with three replications, 4 spacing (1.5 x 1.5, 1.5 x 2.0, 2.0 x 2.0 and 2, 5 x 2.0 meters) and 4 phosphorus levels (0.0, 56.66, 113.32 and 169.98 g plant^{-1} superphosphate). For the total dry mass (TDM) of Pornunça there was effect (P=0.023) isolated from different plant spacing used, and the spacing 1.5 m x 2.0 m provided greater TDM. The planting spacing and phosphorus fertilization showed interaction effect (P<0.05) in the chemical composition only for organic matter and mineral composition presented individual effect for phosphorus levels in the soil and in the phosphorus content of Pornunça plant. For the other variables, there was no effect on the interaction and individual factor (planting spacing and phosphorus fertilization). In dry conditions, planting spacing influences the dry matter forage production and organic matter Pornunça, presented greater value for both the spacing of 1.5 m x 2.0 m. Fertilizing with simple superphosphate increases soil organic matter of Pornunça, until the dosage of 56.66 g plant^{-1} in the spacing of 1.5 m x 2.0 m, and linearly for the phosphorus content of the plant used regardlessof spacing.

Key words: Caatinga | forage | maniçoba | semiarid

Resumen

El objetivo del presente trabajo fue evaluar el efecto de diferentes densidades de plantación y abonación fosfatada sobre la producción, composición química y mineral de la Pornunça (*Manihot* sp) cultivada en sistema de sequedad, en el período de mayo 2010 a octubre 2011. Se adoptó el delineamiento en parcelas casuales, en esquema factorial 4 x 4, con tres repeticiones, siendo 4 parcelas (1.5 x 1.5; 1.5 x 2.0; 2.0 x 2.0 e 2.5 x 2.0

metros) y 4 dosis de fósforo (0.0; 56.66; 113.32 e 169.98 g covas^{-1} de superfosfato simple). Para la producción total de masa seca (PTMS) de la Pornunça hubo efecto (P = 0.023) aislado de las diferentes parcelas de plantación utilizadas, siendo que la parcela de 1.5 m x 2.0 m proporcionó mayor PTMS. La extensión de plantación y abonación fosfatada presentó efecto interactivo (P <0,05) en la composición química, sólo para materia orgánica y en la composición mineral presentó efecto individual para las dosis de fósforo en el suelo en el contenido de fósforo de la planta de Pornunça. Para las demás variables no hubo efecto en la interacción e individual de los factores (extensión de plantío y abonación fosfatada). En condiciones de sequedad, la extensión de plantación influye en la producción de masa seca de forraje y materia orgánica de la Pornunça, presentando mayor valor para ambas variables en el espaciamiento de 1.5 m x 2.0 m. Para la abonación con superfosfato simple aumenta los niveles de materia orgánica de la Pornunça hasta la dosificación de 56.66 g covas^{-1} en la parcela de 1.5 m x 2.0 m, y de forma lineal para el contenido de fósforo de la planta independiente de la parcela utilizada.

Palabras-clave: Caatinga | forraje | maniçoba | semiárido

INTRODUCTION

The native forages cultivation of in semiarid regions in the form of regular xerophile farming is an agricultural practice that can reduce the risk of loss in production resulting from seasonal fluctuations in rainfall. The dynamics of herbage mass accumulation in the different species of the caatinga vegetation is still little known, which certainly hampers the greatest advances in the cultivation of forage quality plants for animal feed in the region (Andrade *et al*., 2006).

The native vegetation is vulnerable to inadequate management, requiring specific techniques and management practices so that the cattle ranching can be conducted on a sustainable basis. Giulietti *et al*. (2004), draws attention to the fact that the caatinga yields vegetation plants are understudied, and it has been easier to use exotic species than selecting and improving native species. Among the species found in this environment, we highlight the plants of the genus *Manihot*, for example, Pornunça.

This species belongs to the family *Euphorbiaceae*, perennial plant from subshrubs to small trees, with high drought resistance, tolerance to poor and acid soils, high protein in the leaves, tuberous roots and rich in carbohydrates and high yield potential.

Phosphorus deficiency available in the soil reduces the yield potential for the lower plant growth (Oliveira Junior *et al*., 2011) this fact associated with an inadequate density of plants can provide a mishandling of the species. Thus, we hypothesized that management practice Pornunça using higher density and higher amount of phosphorus in the planting will provide higher productivity and improve the quality in relation to the chemical and mineral composition of this species for animal feed.

Thus, the objective with this study was to evaluate the effect of different planting spacings and phosphorus levels in production, Pornunça (*Manihot* sp.)chemical and mineral composition in the semiarid Paraiba, Brazil.

MATERIAL AND METHODS

The experiment was conducted under field conditions from May 2010 to October 2011, at the Experimental Station of the National Institute for Semiarid (INSA), located in the city of Campina Grande, Paraíba, Brasil with an altitude of 552 meters, maximum temperature of 31-32 °C and minimum around 15-23 °C, relative humidity between 75-82% and cumulative rainfall during this period of 1.046 mm^3.

The soil was collected at the horizon and was analyzed in the Soil Analysis Laboratory of the Federal University of Campina Grande, *Campus* Patos. The soil classification textural features (USDA) Sand Franca sandy texture (820 g kg^{-1} sand, 80 g kg^{-1} silt and 100 g kg^{-1} clay) and the following chemical properties: pH ($CaCl_2$ 0,01M) = 4,3; M.O. = 9,4 g dm^{-3}; P = 2,9 mg dm^{-3}; K = 0,17 $cmol_c$ dm^{-3}; Ca = 1,4 $cmol_c$ dm^{-3}; Mg = 0,8 $cmol_c$ dm^{-3}; Na= 0,69 $cmol_c$ dm^{-3}; H+Al = 3,10 $cmol_c$ dm^{-3}; T = 6,2 $cmol_c$ dm^{-3} e V(%) = 49,7.

The experimental design was a randomized complete block in a factorial (4 x 4) with three replications. With 4 spacing (1.5 x 1.5, 1.5 x 2.0, 2.0 x 2.0 and 2.5 x 2.0 meters) and 4 phosphorus levels (0.0, 56, 66, 113.32 and 169.98 g $plant^{-1}$ of super simple phosphate).

The Pornunça seedlings , plant of the genus *Manihot* sp. (species of compound leaves composed of 3 to 5 palm lealflet type), they were made from cuttings planted in plastic bags containing sand plant substrate and cattle manure in the ratio of 2:1. Then we performed the transplant (late May 2010) of the seedlings to pits containing 6 liters of manure tanned in spacings of 2.0 x 2.0 m; after 45 days it was carried out uniformity cutting the height of 50 cm. Previously, the soil was fertilized with N and K according to soil analysis, taking as a basis the Cassava crop. Equal levels of nitrogen (12.75 g $plant^{-1}$ urea in the foundation and 17 g $plant^{-1}$ urea in coverage) and potassium (11.30 g $plant^{-1}$ in the foundation) were applied, phosphorus was applied under treatment. Phosphate fertilizers were defined below, equal and higher than recommended in the Cassava crop, given that for Pornunça there is no recommendation for fertilization.

192 plants in total were selected and marked, with 4 plants per plot for production evaluation, chemical and mineral composition of the plant (consisting of leaves + petiole + branches Ø<5 mm) after cutting in October 2011 to 50 cm of the soil. The collected material was weighed in the field to obtain the total green mass, 500 g fresh weight was taken and samples were dried in a circulation stove and air exchange, at a temperature of about 55 °C to constant weight to determine the total dry mass production.

The samples were conducted for the Animal Nutrition Laboratory of the Federal University of Ceará, *Campus* Pici to determine the chemical and mineral composition. For dry matter (DM), crude protein (CP), organic matter (OM), ether extract (EE), ash and neutral detergent fiber (NDF), we used the techniques described by Silva and Queiroz (2002) and neutral detergent fiber corrected for ash and protein (NDFap), according to Van Soest (1991). Total carbohydrate (TCHO) and not fibrous carbohydrate (NFC) were estimated by the method proposed by Sniffen *et al*. (1992) and Weiss (1999) from the equations: TCHO = 100 – (CP + EE + ASH) e o NFC = 100 – (CP +EE + NDFap + ASH), respectively.

The minerals were determined by following a hyper-perchloric digestion of the samples pre-dried, filtered, diluted by respective reactants and then the readings performed in atomic absorption spectrophotometer for calcium (Ca), magnesium (Mg), potassium (K) and phosphorus (P) by visible spectrophotometry technique (Embrapa, 1997).

Data were submitted to analysis of variance using the SISVAR software version 5.0, developed by the Federal University of Lavras (Ferreira, 2011). Comparing the factors unfolding of planting density and phosphorus doses used 5% level of significance. The comparison between the averages planting density was performed using the Tukey test and the means of phosphorus levels by regression method.

RESULTS AND DISCUSSION

For the total dry mass (TDM) of Pornunça there was no effect (P=0.023) isolated from different plant spacings, with the spacing 1.5 m x 2.0 m it was provided greater TDMP. There was no significant effect on the levels of phosphorus and interaction between factors (Table 1).

Table 1. Total dry mass (TDM) in g m^{-2} Pornunça (*Manihot* sp.) under space planting and phosphorus fertilization.

Variable		Average (g m^{-2})	Q	SEM	CV(%)
TDM	Spacing	57,90	0,023*	15,87	24,97
	Fertilizing		$0,742^{ns}$		
	Spacing x Fertilization		$0,702^{ns}$		
	1,5 x 1,5 m	73,88 ab			
	1,5 x 2,0 m	92,78 a			
	2,0 x 2,0 m	34,59 b			
	2,5 x 2,0 m	30,34 b			

Q: Significant 0.05* and no significant ^{ns} to 0.05; SEM: standard error of mean; CV%: coefficient of variation
Means followed by different letters in the column differ by Tukey test at 5%

The spacing of 1.5 m x 2.0 m presents a greater TDM of 92.78 g m^{-2}, equivalent to a productivity of 927.8 kg ha^{-1} mass forages, production below obtained by Araujo Filho *et al*. (2013) in Maniçoba (*Manihot pseudoglazovii*) fertilized with 50 kg ha^{-1} of nitrogen and irrigation which was 1824 kg ha^{-1} TDM, the highest production achieved in Maniçoba is mainly due to irrigation since that in this experiment the Pornunça cultivation was rainfed. It is observed that spacing greater than 1.5 m x 2.0 m provided a reduction in the productivity of this species, this occurred probably due to the morphological characterization of Pornunça that produces few leaves and presents a shrub size, different from Maniçoba species of the same genus that is also native to caatinga vegetation has size arboreal.

The planting spacing and phosphorus fertilization showed interaction effect (P<0.05) in the chemical composition only to organic matter (Table 2 and 3), and mineral composition presented individual effect for phosphorus levels in the soil (Table 4) in the phosphorus content of Pornunça plant.

The finding of no effect for the other variables of chemical and mineral composition in Pornunça indicates that the species is little influenced by the different planting densities and phosphorus fertilization. It is positive for the cultivation of Pornunça the fact of having used a narrower spacing not having provided change in the chemical and mineral composition of the plant. On the other hand, no response at higher doses of phosphate fertilizers, may indicate the need for breeding works in this species, aiming to get individuals to respond more effectively to phosphorus fertilization. Overall, P has its importance in the forage crops establishment , on characteristics such as tillering and root development (Italiano *et al*., 1981) influencing little on the chemical plant quality (Costa *et al*., 1983; Carneiro *et al*., 1992).

Table 2. Chemical composition (g kg^{-1}) Pornunça (*Manihot* sp.) under space planting and phosphorus fertilization.

Variable		Average (g kg^{-1})	Q	SEM
DM[1]	Spacing	287,40	$0,070^{ns}$	12,47
	Fertilizing		$0,057^{ns}$	
	Spacing x Fertilization		$0,372^{ns}$	
CP[2]	Spacing	113,13	$0,974^{ns}$	15,99
	Fertilizing		$0,637^{ns}$	
	Spacing x Fertilization		$0,908^{ns}$	
OM[3]	Spacing	950,07	$0,458^{ns}$	0,73
	Fertilizing		$0,054^{ns}$	
	Spacing x Fertilization		0,006*	
EE[4]	Spacing	46,51	$0,659^{ns}$	21,63
	Fertilizing		$0,847^{ns}$	
	Spacing x Fertilization		$0,307^{ns}$	
NDF[5]	Spacing	641,16	$0,450^{ns}$	11,49
	Fertilizing		$0,944^{ns}$	
	Spacing x Fertilization		$0,775^{ns}$	
TCHO[6]	Spacing	790,41	$0,928^{ns}$	2,81
	Fertilizing		$0,309^{ns}$	
	Spacing x Fertilization		$0,563^{ns}$	
NFCHO[7]	Spacing	236,10	$0,224^{ns}$	21,94
	Fertilizing		$0,789^{ns}$	
	Spacing x Fertilization		$0,348^{ns}$	

DM[1]: Dry matter, CP[2]: Crude Protein, OM[3]: Organic Matter, EE[4]: Ethereal Extract, NDF[5]: indigestible Neutral Detergent Fiber, TCHO[6]: total carbohydrates, NFCHO[7]: non-fibrous carbohydrates

Q: Significant 0.05 * and no significant ns to 0.05; CV%: coefficient of variation.

The average concentration of dry matter (DM) between the components of the plant was 287.4 g kg^{-1} and 113.13 g kg^{-1} crude protein (CP) Table 2. Vasconcelos *et al*. (2010) and Ferreira *et al*. (2009) showed similar values for DM. For CP, these two authors show 139.10 and 263.50 contents g kg^{-1}, respectively, for Pornunça. Araújo Filho *et al.* (2011) reported levels of 227.20 (DM) and 231.60 g kg^{-1} CP for Maniçoba subjected to two planting spacing and organic fertilization. Differences between these values may have occurred because of climatic factors and plant cutting age, thereby promoting a lower CP content in this experiment to Pornunça.

The average CP content of 113.13 g kg^{-1} is above the minimum level of crude protein requirement in ruminant diets (70 g kg^{-1}), described by Van Soest (1994), according to the author contents of less than this may damage the ruminal fermentation. In general, it is clear that the protein levels of the forage meets maintenance needs and animal production.

It is observed interactive effect (P<0.05) for planting spacing and phosphorus fertilization in organic matter (OM) of Pornunça (Table 2 and 3). At the dose 0.0 and 56.66 g of phosphorus plant in relation to planting spacing there was difference (P<0.05), wherein the dose of 56.66 g $plant^{-1}$ spaced 1.5 m x 2.0 m was highest value for the amount of OM with 967.7 g kg^{-1}. The spacing 1.5 m x 2.0 m had no significant effect of phosphorus doses, for the other spacings used in Pornunça quadratic effects in relation to the dose of phosphate fertilizer with maximum point for OM in superphosphate dosage of 56.66 g $plant^{-1}$ independent spacing.

Table 3. Organic matter (g kg^{-1}) Pornunça (*Manihot* sp.) in phosphate fertilizer and planting spacing.

Spacing (m x m)	superphosphate doses (g $plant^{-1}$)				Regression equation	R^2
	0,0	56,66	113,32	169,98		
1,5 x 1,5	943,3b	952,4ab	949,7a	943,4a	$y=944,0550 + 0,1930^*x - 0,0001^*x^2$	0,95
1,5 x 2,0	946,5ab	967,7a	944,2a	947,7a	$y=950,1200 + 0,1980^{ns}x - 0,0001^{ns}x^2$	0,27
2,0 x 2,0	959,7a	947,8b	946,7a	947,2a	$y=959,2730 - 0,2330^*x + 0,0000^*x^2$	0,96
2,5 x 2,0	943,4b	955,4ab	955,0a	953,2a	$y=943,4950 + 0,2000^*x - 0,0000^*x^2$	0,99

Means followed by different letters in the column differ by 5% Tukey test. *(P <0.05); ^{ns}not significant

Chemical analysis of organic matter (OM) is considered an early indicator of nutritional quality of the food. Authors have reported OM content of 937.10 g kg^{-1} for Pornunça (Vasconcelos *et al*., 2010), 918.20 and 940.00 g kg^{-1} for Maniçoba (Matos *et al*., 2005; Valadares Filho *et al*., 2006) showing similarity of the authors mentioned in this study (Table 3), indicating a similarity between the two species.

The chemical composition of Pornunça *in natura* showed an average content of ether extract (EE) of 46.51 g kg^{-1}. In general, for these conditions,Pornunça obtained higher content of EE when compared with those obtained by Matos *et al.* (2006) who described values of 28.40 g kg^{-1} for Maniçoba *in natura* and 39.60 g kg^{-1} for silage Maniçoba. This was also superior to Carvalho *et al.* (2006), Figueiredo *et al*. (2006) and Nunes *et al*. (2008), when analyzing the hay aerial part of Cassava found mean values of 60.40 g kg^{-1}, 35.20 g kg^{-1} and 20.80 to 34.80 g kg^{-1}, respectively. According to Van Soest (1994), the most important portion of the EE is composed of phospholipids and galactolipids, despite the fact that in this study the phosphorus fertilization did not influence the ether extract content of the plant, because fertilizations with 0.0 g $plant^{-1}$ and 169.98 g $plant^{-1}$ superphosphate did not differ (P>0.05).

The fiber concentrations in neutral detergent fiber (NDF) in Pornunça did not differ (P>0.05) for the factors studied (Table 2), it is observed that the NDF are close to those reported by Moretine et al. (2004) and Nunes et al. (2008) for the hay aerial part of cassava (680.07 and 570.89 g kg^{-1}). However, the results in this test were higher than of Vasconcelos *et al*. (2010) to aerial part of Maniçoba and Pornunça (500.40 and 440.85 g kg^{-1}) and Carvalho *et al*. (2006) for the hay aerial part of Cassava (470.76 g kg^{-1}).

The NDF values quoted in this experimental test are outside the range of 550 to 600 g kg^{-1} preconized by Van Soest (1994), as limiting fuel consumption and digestibility of forage per animal. The consequences of high and low levels can compromise the physical space of the rumen, furthermore, the fiber content is inversely related to the energy content of the diet (Araujo *et al*., 2009), what can consequently consequently limit its consumption (Araujo Filho *et al*., 2011).

The total carbohydrate content (TCHO) in Pornunça presented average of 790.41 g kg^{-1}, the TCHO are the main constituents of fodder plants, the cell wall may be 300-800 g kg^{-1} DM forage plant, where carbohydrates such as cellulose and hemicellulose and pectin are concentrated (Rocha Junior *et al*., 2003). The concentration TCHO of this species was superior to France *et al*. (2010) and Nunes *et al.* (2008) and within the standards cited by Rocha Junior *et al.* (2003) as forage of high nutritional value.

The average concentration of non-fiber carbohydrates (NFC) in Pornunça was 236.10 g kg^{-1} regardless of planting and doses of phosphorus density. Azevedo *et al.* (2006) and Mendonça Junior *et al.* (2008) studied silage and hay upper third of aerial part of Maniçoba cite average values of 312.40 and 227.90 g kg^{-1}, respectively, showing that the nature of the analyzed material can influence the composition of the carbohydrates fractions. The NFC levels reported in this experimental trial corroborate the variation of the aforementioned authors, which promote increased consumption of the food by the animals, once the non-fiber carbohydrates are readily fermentable in the rumen.

The mean potassium (K) was 5.5 g kg^{-1} and 5.5 g kg^{-1} of magnesium (Mg) to Pornunça (Table 4) were similar to Ferreira *et al.* (2009), with regard to potassium concentration (7.1, 4.7 and 5.7 g kg^{-1}) and the superior magnesium (3.4, 3.7 and 3.5 g kg^{-1}), studying the production and nutritional value of the aerial part of Cassava, Maniçoba and Pornunça respectively. Now Araujo Filho *et al.* (2011) found average levels of potassium (14.1 g kg^{-1}) above this search but the average values of magnesium (4.1 g kg^{-1}) were lower, even with the application of dolomitic lime for soil correction purposes.

According to Malavolta *et al.* (1997), the P absorption is influenced by the Mg concentration in the medium, and Mg may be carrier of P into the plant. It is also believed that the existence of the interrelationship of these two ions is due to the need for Mg in energy transfer reactions (Bergmann, 1992). Relationship was not observed in this study, since the Mg concentrations of this study was higher than that cited by Ferreira *et al.* (2009) and Araújo Filho *et al.* (2011), but the P levels are below cited by these authors.

Anyway, although there results indicate that this interaction (Zhang *et al*., 1993; Mengel; Kirkby, 2001), still there are no direct evidence of the effect of P and Mg on the concentration of Mg and P in the soil solution, transport to the surface of roots and the absorption or translocation of these ions in plants (Skinner and Matthews, 1990).

The average content of calcium (Ca) of Pornunça was 28.9 g kg^{-1} (Table 4), the soil has a low concentration of calcium and pH acid and phosphate fertilizer did not affect the

Ca in the plant. According to Cavalheiro and Trindade (1992), studying concentrations of Na, K, Ca and Mg in native pastures, concluded that the concentration of Ca in the pasture is highly correlated with the level of Ca in the soil, the same being observed for Mg. However, Mengel and Kirkby (1982), say the Ca absorption is controlled genetically by plants in high amounts result more than an efficient mechanism of root to absorb it than its content available in the soil.

Table 4. Mineral composition (g kg^{-1}) Pornunça (Manihot sp.) under space planting and phosphorus fertilization.

Variable		Average (g kg^{-1})	Q	SEM
Potassium	Spacing	5,5	0,571 ^{ns}	13,76
	Fertilizing		0,548 ^{ns}	
	Spacing x Fertilization		0,911 ^{ns}	
Magnesium	Spacing	5,5	0,883 ^{ns}	13,71
	Fertilizing		0,626 ^{ns}	
	Spacing x Fertilization		0,733 ^{ns}	
Calcium	Spacing	28,9	0,329 ^{ns}	29,64
	Fertilizing		0,571 ^{ns}	
	Spacing x Fertilization		0,647 ^{ns}	
Phosphor	Spacing	1,4	0,450 ^{ns}	45,98
	Fertilizing		0,026*	
	Spacing x Fertilization		0,817 ^{ns}	
	0,0 g $covas^{-1}$	1,27	y=1,2741 + 0,0025*x	
	56,66 g $covas^{-1}$	1,41	R^2= 0,92	
	113,32 g $covas^{-1}$	1,56		
	169,98 g $covas^{-1}$	1,70		

Q: Significant 0.05 * and no significant ns to 0.05; CV%: coefficient of variation.

This fact corroborates this research because low contents of Mg (0.8 $cmol_c dm^{-3}$) and Ca (1.4 $cmol_c dm^{-3}$) described atthe chemical analysis of the soil do not reflect the contents obtained in the plant (Table 4). This is explained because the calcium despite of having low mobility in soil and plant, its absorption is concentrated in the extremities, where calcium is absorbed by the roots and transportation via the xylem and concentrated in leaves, organ which has a greater demand for transpiration of the plant, where Ca is essential to this process. Another fact that may have compromised the effect of phosphorus fertilization was not soil correction, probably Pornunça, although native of this region, can be sensitive to bad soil Ca and Mg.

Correlating relationships between Ca and P was observed in Pornunça 20.64:1, it was found that the phosphorus fertilization does not raise the levels of phosphorus in the plant regardless of plant density, generating extremely high relations of those recommended by the literature (2:1) to control these two elements in the animal body. This fact can reduce the weight gain due to a reduction in the digestibility of the diet (Mcdowell, 1992), possibly as a consequence of Ca providing rigidity to the cell wall by crossing the pectins in the middle lamella.

The phosphorus fertilization influenced the phosphorus in Pornunça, but the phosphorus content of this study was lower than those of Araújo Filho *et al*. (2011) that subjected Maniçoba to two types of planting spacing and three types of adduction after 120 days a uniform cutting, verifying average levels of PH of 2.5 g kg^{-1}. Ferreira *et al.* (2009), had average values of 2.4 g kg^{-1} for cassava, 1.6 g kg^{-1} for Maniçoba and 1.8 g kg^{-1} for Pornunça, subjected to two types of pruning for a period from 90 to 365 days.

The phosphate fertilizer dose 169.98 g plant^{-1}, obtained content of 1.7 g kg^{-1}, evidencing that to this fact the levels reported by Ferreira *et al*. (2009) for Maniçoba and Pornunça are similar. Corroborating work done by Costa (1983), showing that application of high doses of P, it is possible to increase the concentration of the nutrient in DM plant. It is noticeable that foragers respond to a mineral fertilizer, when there is water content in the soil, because through water there is nutrient diffusion from a certain place to another and to the roots.

The differences observed for the variables in this study in relation to different spacing and doses of phosphorus fertilizer occurred mostly due to high genetic variability within the species. This fact can be confirmed by the high coefficient of variation obtained in this experiment, for being wild species. Due to the fact that Pornunça has not been domesticated yet, it is still necessary to carry out works to select individuals within the species that respond to the nutrients applied to the soil and the management, through the increase in mass productivity and forage quality.

CONCLUSIONS

In rainfed conditions, planting spacing influences the dry matter forage production and Pornunça organic matter, presenting greater value for both the spacing of 1.5 m x 2.0 m. While fertilization with superphosphate increases soil organic matter of Pornunça, until the dosage 56.66 g plant^{-1} at the of 1.5 m x 2.0 m, and linearly for the phosphorus content of the plant regardless of spacing.

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