English Version

Adaptation of Stylosanthes Campo Grande to soil conditions in the west of Paraná

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Abstract

This study aimed to evaluate the Campo Grande stylosanthes in the soil conditions of the western region of Paraná. The experiment was conducted in pots in a greenhouse at the Faculty Assis Gurgacz (FAG), in Cascavel - PR. We used four treatments (T) with contrasting conditions as soil texture (sand and clay) being formed: T1-latosol, T2-1/3 latosol plus 2/3 sand, T3: 1/2 latosol plus 1/2 sand, T4:1/4 latosol plus 3/4 sand. The experiment design was completely randomized; the variables analyzed were dry matter (DM), root length and crude protein (CP). There was significant effect (P<0.055) in content of dry matter (DM%) and root length (cm); for content of crude protein (PB%) there was no statistic difference at 5% of significance. The Latossol presented higher production of forage dry matter, Latossol and Latossol with adition of 2/3 of sand presented bigger root length.

Key words: pasture, soil, forage legume

Introduction

Brazil has the largest commercial cattle breed of the world, characterized by the extensive exploitation of the landscapes, with low zootechnical and productivity index, in comparison to the countries which export meat (ARRUDA, 1997).

The production of forages of good quality has been limiting to improve the zootechnical index, being necessary the adoption of management techniques to improve the current index found in the monocultures of grass pasture (GARCIA et al., 2008). According to Aroeira et al. (2005), 80% to 90% of the areas of pasture in Brazil are constituted by grass of the genus *Brachiaria.*

The stylosanthes Campo Grande, legume launched in 2000, is a varietal mixture of the *Stylosanthes capitata* and *S. macrocephala*. The stylosanthes appears as an alternative for the recovery of the productivity in pasture areas with lower cost of maintaining, when adapted to the soil of the region, used along with the pasture of grass increases or maintain the productive capacity (SCHUNKE, 2001). However, it is unknown its resistance and productivity in places with cold seasons and more clayey soils, specially in the West region of Paraná in the south of Brazil, where the prevalent climate of the region is the subtropical, characteristic of the south of the Tropic of Capricorn.

The stylosanthes campo grande presents good seed productivity with natural resseding and good persistence under pasture, low resistance to humid soils and it accepts shading (PIRES, 2006). It was developed for regions with tropical climate of the Midwest, Northeast and Southeast of Brazil. It is tolerant to poor soils, it cannot adapt to places subject to occurrence of frequent frost and clayey soils (ZIMMER et al., 2007).

According to Pires (2006), due to the pasture degradation, and consequent low productivity that is related to the inappropriate management of the cattle and pasture, the low amount of forage provided and the non use of nitrogen fertilizers may interest the farmers in the region in the use along with legumes, improving the production of forages, since

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approximately 97% of the Brazilian cattle is raised exclusively in pasture. The cattle has been increasing constantly, much more due to the expansion of the pasture that to the increase of productivity, the capacity of support of the pastures is around 1.2 animals ha^{-1} (CARVALHO et al., 2001).

Stylosanthes campo grand is a forage which fixes biologically the N (nitrogen) trough the symbiotic association of its roots with bacteria of the genus *Rhizobium*, which constituted the main process of addition of exogenous nitrogen, being this element the most abundant in plants and one of the main limiting factor for its growth (ZIMMER et al., 2007). With the use of the plants in the animal feed, the nitrogen compounds are used for the production of new proteins (KERBAUV, 2004).

In the consortium with grass, in the proportion of 20% to 40%, in sandy soils with low fertility, the stylosanthes campo grande fixes in average 60 to 80 kg of N ha^{-1} $year^{-1}$ (ZIMMER et al., 2007), favoring thus the intercrop forages, accumulating biomass in the pasture, increasing the quantity and quality of the organic matter of the soil (GARCIA et al., 2008). According to Schunke (2001), the application of nitrogen fertilizer benefits the vegetal productivity only in short periods, becoming economically unviable for pasture.

In this sense, the present work has as objective to evaluate the Stylosanthes Campo Grande in the soil conditions of the west region of Paraná with soil of the type tipo Latossolo Vermelho Distroférrico típico[1], evaluating dry matter, root length and crude protein.

Material and methods

The present work was conducted in greenhouse, in vases, in the Fazenda Escola of the Faculdade Assis Gurgacz - FAG, located in the municipality of Cascavel, PR, with coordinated of latitude 24º 57' 21" south and longitude 53º 27' 19" west, altitude of 781 meters, the prevalent climate in the region is subtropical. The soil was classified as Latossolo Vermelho Distroférrico típico (EMBRAPA, 1999). It was used seeds of stylosanthes campo grande which came from Sementes Boi Gordo Ltda, Campo Grande-MS, crop 2007/2008, lot 545, category S2, cultivar BRS Campo Grande 1 (80%)/BRS Campo Grande 2 (20%), pure seeds 96.8%, germination 82%, cultural value 79.4%.

It was used the completely randomized design with four treatments and five replications, in a total of 20 useful parcels. The treatments used were: T1: latossolo (it was weighted the same quantity for the formation of the plots); T2: 1/3 latossolo + 2/3 sand (4.5 kg latossolo + 8.7 kg sand); T3: 1/2 latossolo + 1/2 sand (6.5 kg of latossolo + 6.5 kg of sand), and T4: 1/4 latossolo + 3/4 sand (3.3 kg of latossolo + 9.8 kg of sand per vase).

The soil Latossolo Vermelho Distroférrico típico was taken from the fazenda escola of the FAG in Cascavel – PR, homogenized and placed in the vases. The treatments were previously sampled for the determination of the chemical and physical characteristics, described in Table 1.

After the soil analysis, it was made the correction in relation to the macronutrients, according to the recommendations of Zimmer et al. (2007).

The seeding was performed on February seven 2009, with 0.06 g of seeds per vase, which corresponds to a seeding rate of 3 to 5 kg ha^{-1}, covering lightly the seed at a depth of 1 to 3 cm. Later it was performed the thinning.

The harvest occurred 60 days after the seeding. It was collected 10 plants per vase weighting in order to obtain the fresh matter, measuring the length of the root of 5 plants per vase, after it was analyzed the dry matter (DM) by drying the plants in a container of paper bag in oven with forced circulation of air at the temperature of 105 °C during 72 hours, to eliminate the humidity of the sample. The DM was determined gravimetrically with the remaining residue after the drying.

In order to determine the crude protein it was used the method Micro Kjeldahl, according to Silva and Queiroz (2002), which was divided in three stages: digestion, distillation and titration. The equipments and materials used were: digestor block and N distiller unit, analytic weight with accuracy of 0.0001 g and Kjeldahl flask of 300 ml ot digestor block.

1 According to the Brazilian soil classification

Table 1. Chemical and granulometric characteristics of the treatments.

Results	T1	T2	T3	T4
		$cmol_e\ dm^{-3}$		
Ca (calcium)	5.72	2.07	2.59	1.37
Mg (magnesium)	1.44	0.5	0.64	0.34
K (potassium)	0.19	0.08	0.1	0.06
Al (aluminum)	0.11	0.05	0.07	0.04
S (sum of bases)	7.35	2.65	3.33	1.77
T (CTC)	15.11	6.62	8.29	4.95
		$g\ dm^{-3}$		
OM (organic matter)	34.66	10.29	15.88	7.16
		%		
Al (Sat. Aluminum)	1.47	1.85	2.06	2.21
V (Sat. Bases)	48.64	40.03	40.17	35.8
		$mg\ dm^{-3}$		
P (phosphorus)	8.74	8.2	9.24	9.24
		pH		
$CaCl_2$	4.8	4.8	4.8	4.9
		Relations ($cmol_e\ dm^{-3}$)		
Ca/Mg	3.97	4.14	4.05	4.03
Ca/K	30.11	25.88	25.9	22.8
Mg/K	7.58	6.25	6.4	5.67
		Granulometry %		
Sand	15	70	60	80
Silte	20	12.5	16	7.5
Clay	65	17.5	24	12.5

Source: SOLANALISE, central de análises LTDA.

The data were analyzed by the software INFOSTAT, being used the F test and the averages compared trough the Tukey test at 5% of significance.

Results and discussion

The root length and the values of CP and DM in function of the different soil compositions present normality of the data, with low dispersion, and may be observed in Table 2.

For the average content of crude protein in the Stylosanthes Campo Grande, it was verified that there was no significant effect (P>0.05) for the different soil composition, and thus there is a functional relation between content of crude protein (%) and soil composition with more clay or more sand. The average content observed (10.61%) were close to those found by Zimmer et al. (2007), who found values from 13% to 18% in the entire plant of the Stylosanthes Campo Grande. It was also superior to the results found by Fernandes et al. (2005), who obtained 8.2% of CP for the legume along with *Brachiaria decumbens*, against 5.7% of CP with the grass alone.

According to Almeida et al. (2003), in evaluations of the intercropping of *Brachiaria decumbens* and *brizantha* with *Stylosanthes guianensis*, it was verified that the pastures with *B. decumbens* presented higher proportion of green forage, of greater nutritive value, associated to the presence of the legume and the leaves presented content of CP always superior to 7%.

In accordance with Freitas et al. (2007), when evaluating the effect of different doses of nitrogen (N) in the grass Mombaça (*Panicum maximun* Jacq.) in soil Latossolo Vermelho Distrófico Argissólico of clayey texture, it was found content of CP influenced by the doses of N, the contents were from 8% to 11% of CP. Similar results were found in the present study, being observed content of crude protein of approximately 10.61%. It can also be observed that the intercropping, besides favoring similar index of

the nitrogen fertilization, presents lower cost and improve the characteristics of the soil.

The same was observed by Moreira et al. (2005) in soil classified as Latossolo vermelho amarelo distrófico of clayey texture, in which the content of CP of grass in intercropping with e*stilosantes guianensis* were superior to the values obtained for the grass fertilized with N, either in the first cut with 7% to 8% and in the second 11% to 14%. The same conclusion was also observed by Ruggiero et al. (2006).

In the evaluations referent to the content of DM, it was verified significant effect ($P<0.05$) for the different soil composition. It was observed higher production of DM in the soil composition with 65% of clay (T1), presenting 76.04% of DM, being considered statistically superior to the others. Treatments (2 and 3) with 17.5 and 24% of clay, did not present statistic difference in relation to the other treatments, and provided an intermediate production of DM.

The treatment with 12.5% of clay presented lower productivity with content of DM 58.38%. According to what is presented in Figure 1, the dry matter decreased in function of the higher content of sand, showing that there is viability of the stylosanthes in more clayey soils. The result of the present work is different to the one found by Zimmer et al. (2007), who reports better performance in soils with content of clay lower than 15%¨and satisfactory performance in soils until 35%.

Stylosanthes Campo Grande produces a great part of DM (8 to 14 t ha^{-1} in pure stands), in the intercropping with grass, in which the legume participated of 30% to 40% in the DM of forage, it is expected a production of 3 to 6 t ha^{-1} $year^{-1}$ (ZIMMER et al., 2007). According to studies about digestibility and consumption of DM in intercropping pasture of *Brachiaria decumbens* with *Stylosanthes guianensis*, it was verified that the consumption of DM was directly related to the percentage of legume in the pasture, which potencializes its use in intercropping (AROEIRA et al., 2005).

Brachiaria decumbens with stylosanthes produced 5,033 kg ha^{-1} of dry matter, being 3,762 kg ha^{-1} (75%) for the stylosanthes. The DM found in the present work in soil of the type Latossolo Vermelho Distroférrico típico was 76.04% superior to the one found in the literature providing more productivity (MOREIRA et al., 2005).

For Garcia et al. (2008), in studies to evaluate the weight gain ha^{-1} of cattle, showed that the gains for *Brachiaria* in intercrop with Stylosanthes Campo Grande is higher that the *Brachiaria* exclusive in Latossolo Vermelho amarelo textura média, with content for *Brachiaria decumbens* in intercrop with Styloasnthes campo grande of approximately 3,000 to 5,000 kg ha^{-1} of DM and CP 7.5% to 8.1%; for *B. decumbens* the content of DM was between 2,000 kg ha-1 and CP in 6.9%, corresponding to the present experiment with content of CP higher than 7% and the mass of the stylosanthes campo grande was superior to the one found in *B. decumbens*, with the soil with clayey texture, by contrast, the soil with sandy texture it is below the one found in the literature, contrary to the intercropping.

There was significant difference at the level of 5% of probability for the root length, type pivoting, according to what is presented in Table 2, presenting different effect concerning soil textures.

Table 2. Root length, crude protein (CP) and dry matter (DM), in function of the different soil compositions.

Treatments	Root length	CP (%)	DM (%)
1	14.88 a	10.61	76.04 a
2	15.26 a	10.61	62.34 ab
3	11.76 b	9.63	66.52 ab
4	13.27 ab	10.61	58.38 b
F test	6.14*	2.2 n.s.	4.33*
CV%	10.51	7.14	12.37

Averages, followed by the same letter, inside each parameter, do not differ, by Tukey test, at the level of 5% of significance. T1: latossolo (it was weighted the same quantity for the formation of the plots); T2: 1/3 latossolo + 2/3 sand (4.5 kg latossolo + 8.7 kg sand); T3: 1/2 latossolo + 1/2 sand (6.5 kg of latossolo + 6.5 kg of sand), and T4: 1/4 latossolo + 3/4 sand (3.3 kg of latossolo + 9.8 kg).

*CV = coefficient of variation; n.s. = non significant; * significant at 5% of probability.*

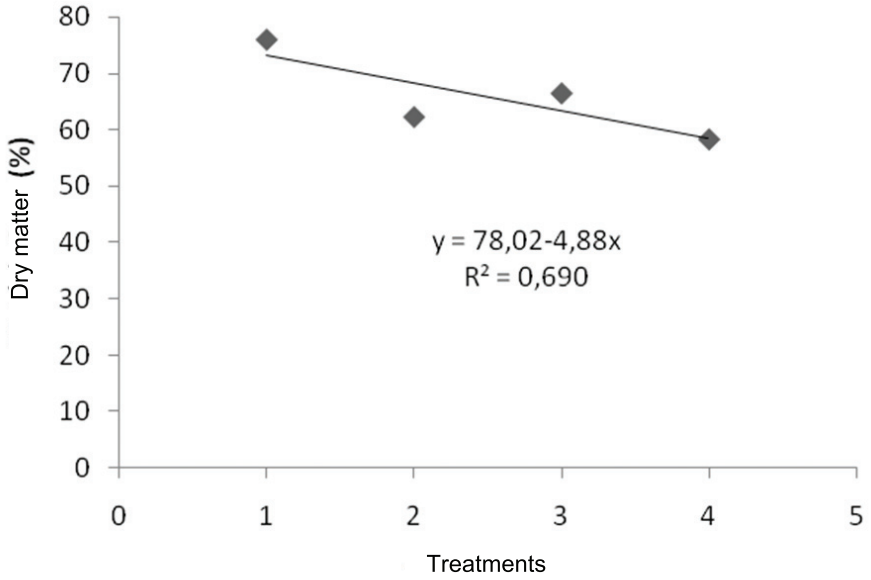

Figure 1. Content (%) of Dry Matter (DM) in function of the different soil compositions (treatments), significant at 5% of probability.

According to Marenco and Lopes (2005), the root system reflects the effects of factors of the mean as soil density, the texture and concentration of CO2 and O2, factors that influence the formation of the absorbent fibers, important to the absorption of mineral salts, water and root growth.

The values found for the root length are in accordance with the research performed by Fante et al. (1999), who evaluated the distribution of the roots in forage oak in latossolo vermelho-escuro and the roots were concentrated in the initial layer of 0 - 20 cm of the soil. The result observed is similar to the present experiment, where the roots are concentrated in the layer of 0 - 20 cm.

Therefore, it is evidenced that stylosanthes campo grande may be used as forage in intercropping with grass in clay soil of the type Latossolo Vermelho Distroférrico típico, being necessary more studied about the climate condition and the management.

Conclusions

Between treatments, the soil with 65% of clay presented higher production of dry matter of forage, considering that this and the treatment with 17.5% of clay presented higher root length. The crude protein did not differ statistically between the treatments.

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