Morphological characteristics of *Crotalaria ochroleuca* for the production of hay and pre-dried

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Introduction The annual leguminous *Crotalaria ochroleuca* has a wide adaptation and distribution by the tropical areas of the world and its use is restricted to the improvement of soil fertility as green fertilizer and weed control. However, this scenario is changing in Brazil. *C. ochroleuca* is a non-host culture of phytoparasitic nematodes of soybean crop (*Pratylenchus brachyurus*, *Meloidogyne incognita* and *Meloidogyne javanica*) being used in crop rotation to reduce the population of these (Flores and Miotto, 2005). Already proven studies have shown that *C. ochroleuca* has no toxicity to animals and can be supplied to cutting and milk animals. Its use in rotation with the soybean crop starts to provide quality forage that can be stored in the form of hay, pre-dried or silage. The residual mass that remains after the cut to produce hay along with its roots are sources of organic matter for the soil and dead cover for the planting of the successor culture (Padua et al., 2006). The study of the morphological characteristics of *Crotalaria ochroleuca* becomes important considering that these characteristics are related to the time required for dehydration of plants and management of areas for the production of preserved bulky. In this context, the objective was to evaluate the morphological characteristics of *Crotalaria ochroleuca* in different cultivation systems and growth periods.

Materials and Methods The experiment was conducted at the experimental farm of Universidade Estadual do Oeste do Paraná – Marechal Cândido Rondon *Campus*. The experimental design was in randomized blocks with split-plots in time, with 2 cropping systems of crotalaria (conventional and no-tillage) in the main plots and 3 sampling times allocated in the subplots (54, 68 and 82 days after emergence), with 5 repetitions. The sowing of the *Crotalaria ochroleuca* in no-tillage or conventional planting systems was performed using 12 kg ha^{-1} of seeds, in the depth of 2 cm, in the spacing between lines of 0.5 m. Plant emergence was verified 20 days after sowing. Plant height (cm), culm diameter (mm), root length (cm) and number of branches data were collected from 10 random plants in each plot every 14 days. The height of the plants was measured from the soil surface to the base of the last completely opened bud. The culm diameter was measured with a digital caliper, at 5 cm from the soil surface. For root length, the collected plants were marked at the level of the soil surface, subsequently removed with the aid of appropriate tools and the total root length was measured. The number of branches was obtained from the direct count of the number of branches inserted in the main stem in each plant. The data were subjected to statistical analysis using the MIXED procedure of the Statistical Program SAS® University Edition, at a level of 5% significance.

Results and Discussion The variables plant height, culm diameter, root length and number of branches were not influenced ($P < 0.05$) by cultivation systems, presenting average values of 161.69 cm; 16.90 mm; 25.85 cm and 25.97 branches, respectively (Table 1). For the growth ages of *C. ochroleuca*, it was observed that, with the advance of the plant age to 82 days of growth, the height and the number of branches increased 75.34 and 149.65%, respectively, when compared to 54 days. There was no effect of age on culm diameter and root length

parameters. The growth cycle of a plant is gradual and establishes in a maximum point and then declines as it develops (Fernandes et al., 2005). In the present study, this growth was perceived by plant height and number of branches, which were increasing with the age of the plant, demonstrating that the *Crotalaria ochroleuca* was in development even at 82 days after planting.

Table 1 Morphological characteristics of *Crotalaria ochroleuca* at different growth ages and cultivation systems.

	System		Age (days)			Means	SEM[1]	P-value[2]		
	Conv.	No-tillage	54	68	82			S	A	S*A
Plant height (cm)	162.2	161.1	115.4^{c}	167.4^{b}	202.3^{a}	161.7	6.9535	0.8181	<0.0001	0.5042
Culm diameter (mm)	16.9	17.0	13.5	17.3	19.9	16.9	0.7919	0.8909	0.0012	0.0293
Root length (cm)	24.0	26.2	22.5	26.6	25.9	25.1	0.9881	0.1862	0.2711	0.0570
Number of branches	26.3	25.6	14.3^{c}	27.9^{b}	35.7^{a}	25.9	2.2203	0.8378	0.0001	0.1566

[1]SEM = Standard error of the mean.
[2]S = Effect of the cultivation system; A = effect of age; S*A= effect of interaction between cultivation system and age. Averages followed by lowercase letters in the line differ from each other by the Tukey test ($P \leq 0.05$).

Regarding the variable culm diameter, there was interaction between the cultivation systems and growth age of *Crotalaria ochroleuca* (Table 2), wherein the conventional system had the larger culm diameter (21.92 mm) at 82 days, while in the no-tillage cultivation system the diameter was thinner (13.64 mm) at 54 days of development.

Table 2 Interaction between growth ages and cultivation systems on the culm diameter of *Crotalaria ochroleuca*.

	Culm diameter (mm)		
	54 days	68 days	82 days
Conventional	13.29^{Ba}	15.82^{Ba}	21.92^{Aa}
No-tillage	13.64^{Ba}	18.82^{Aa}	17.92^{Aa}

$^{A-a}$Means followed by the same letter, lowercase in the columns, and capitalized in the line, do not differ from each other by the Tukey test ($P \geq 0.05$).

Conclusions The morphological composition of *Crotalaria ochroleuca* does not change with different planting systems, either no-tillage or conventional. As the plant age progresses, the plant height and the number of branches increases, for the other variables of morphological composition, the growth age does not interfere.