

EFFECT OF THE DENSITY AND OF THE DISTANCE OF *Brachiaria decumbens* STAFF ON THE INITIAL GROWTH OF *Coffea arabica* L. SEEDLINGS

Livia Weyand Marcolini¹, Pedro Luís da Costa Aguiar Alves²,
Tomás Carneiro de Souza Dias³, Mariana Casari Parreira⁴

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ABSTRACT: The aim of this work was to evaluate the interference of three densities (4, 8 and 16 plants/m²) of *Brachiaria decumbens* Stapf distributed at three different distances (0, 10 and 20 cm from coffee plants) on the initial growth of *Coffea arabica* L. seedlings. Dark red Latosol was used as substrate to fill up 70 liters cement boxes. Coffee seedlings at 15 cm height and 8 leaves stage were planted in each box. *B. decumbens* seedlings were transplanted when they reached two to four leaves stage. The experimental design was a randomized blocks with ten treatments and three replications. At the end of the experiment were measured, height, leaf number, leaf area, chlorophyll content and dry weight of coffee plants. Dry weight of *B. decumbens* leaves was also evaluated. The leaf area and leaf dry weight was shown to be more sensitive parameters to the interference of *Brachiaria* plants. Dry weight of coffee plants were reduced from 60% to 88% when the *B. decumbens* were transplanted 0 cm from the coffee plant. With distance of 10 cm the reduction of dry weight increased with the increase of the density of the *B. decumbens*. In the coexistence of the coffee plants with 16 plants/m² of *B. decumbens*, there was a reduction in the dry weight of about 80% at the distances of 0 and 20 cm. Regarding leaf area, the reduction was 47% on the average in the density of 4 plants/m² of *B. decumbens*. The reduction in leaf area at other densities was higher at the distance of 0 and 20 cm, and 55% reduction was obtained at the distance of 10 cm.

Key words: Coffee, *Brachiaria decumbens*, competition, *Coffea arabica*.

EFEITO DA DENSIDADE E DA DISTÂNCIA DE *Brachiaria decumbens* STAFF SOBRE O CRESCIMENTO INICIAL DE MUDAS DE *Coffea arabica* L.

RESUMO: Objetivou-se estudar, através deste trabalho, a interferência da densidade da *Brachiaria decumbens* Stapf (4, 8 e 16 plantas/m²), em três distâncias (0, 10 e 20 cm das plantas de café), no crescimento inicial de mudas de *Coffea arabica* L. Uma muda de café foi transplantada no centro de caixas de 70 L e o capim-braquiária foi transplantado de acordo com o tratamento. O delineamento experimental adotado foi em blocos casualizados, em esquema fatorial 3 (densidades) x 3 (distâncias) + T (sem braquiária), em três repetições. A área foliar e a massa seca das folhas do cafeeiro se mostraram mais sensíveis à interferência. Quando o capim-braquiária foi plantado junto à muda (0 cm), provocou uma redução de 60% a 88% na massa seca do cafeeiro. Com distância de 10 cm a redução de massa seca aumentou com o aumento da densidade da braquiária. Na convivência do cafeeiro com 16 plantas/m² de capim-braquiária, a redução de massa seca foi de 80% nas distâncias de 0 e 20 cm. Em relação à área foliar, a redução foi em média 47% na densidade de 4 plantas/m² de capim-braquiária e nas demais densidades a redução foi maior nas distâncias de 0 e 20 cm.

Palavras-chave: Café, capim-braquiária, competição, *Coffea arabica*, *Brachiaria decumbens*.

1 INTRODUCTION

The coffee plantation occupies an important position in the Brazilian economy, and as any vegetable, it is subject to a series of factors that affect plant development and production. Such factors may be abiotic (water availability, nutrition, soil pH, light, etc...) or biotic, those are due to the action of living animals (PITELLI & MARCHI, 1991). Regarding

the biotic factors, is important the interference of harmful plants such as weeds, which compete for light, nutritious, water and space, in addition these plants act as hosts of plagues, diseases and they also have allelopathic effects. According to Bardner (1978), the world losses of coffee due to the interference of weed reach 15%.

The problems related to the interference imposed by weeds become serious when the coffee

¹Master Student in Crop Science. ESALQ/USP – Guaporé, n. 340 – 13417-290 – Piracicaba, SP – marcolin@esalq.usp.br.

²Assistant Professor, Dr. Departamento de Biologia Aplicada à Agropecuária, FCAV/UNESP – Via de Acesso Prof. Paulo Donato Castellane s/n – 14884-900 – Jaboticabal, SP – plalves@fcav.unesp.br

³Agronomist Engineer - MS in Crop Science. Cooperativa dos Agricultores da Região de Orlândia, CAROL. Rod. BR 452, Km 234 – 38175-000 – Santa Juliana, MG – tcsdias@carol.com.br

⁴Master Student in Crop Production. FCAV/UNESP – Via de Acesso Prof. Paulo Donato Castellane, s/n – 14884-900 – Jaboticabal, SP – mariana.parreira@posgrad.fcav.unesp.br

plantation is starting and when coffee plant is beginning its development. In this phase, the coffee plants present growth relatively slow, which allows the weeds plants to occupy the areas between the coffee seedlings increasing the competition for natural resources. This problem becomes more serious when the responsible weeds are a Poacea, which shows largest aggressiveness and faster growth (KISSMANN, 1995).

Among the Poacea species present in coffee plantation, *Brachiaria decumbens* Stapf (capim-braquiária), needs to be considered due to the exploration of this species as pasture in commercial coffee plantation. Souza Filho et al. (2005) mentioned that species from the *Brachiaria* genus have allelopathic activity in seeds and in plants aerial parts, by inhibiting seed germination and the development of plants of different species.

One of the factors that determine higher or lower interference of weed on cultivates plants is its density in the area. Thus, with the aim of understanding the interference relationships between *Brachiaria decumbens* and coffee plants, this study had the objective of evaluate the effect of the density and of the distance of *Brachiaria decumbens* on the initial development of *Coffea arabica* seedlings.

2 MATERIAL AND METHODS

The present work was installed and performed under semi-controlled conditions (without restriction of water), in an experimental area belonging to the Department of Applied Biology to the Agricultural (FCAV - UNESP, Campus of Jaboticabal). Cement asbestos boxes with capacity for 70 liters of substratum were filled with Red Latosol (Table 1), collected in the plowing layer of the soil, to which was added simple superphosphate and dolomitic calcareous. Only one seedling of coffee (*Coffea arabica* cv. Catuaí Amarelo) was transplanted to the center of the box 30 days after soil correction,

when the seedlings showed 15 cm of height and with 8 leaves.

The experimental treatments consisted of three densities (4, 8 and 16 plantas/m²) of *Brachiaria decumbens* transplanted at different distances (0, 10 and 20 cm) of the coffee seedlings, with a control without the weed.

The coffee seedlings were acquired in Arceburgo district (State of MG-Brazil) and they had approximately 120 days of age. The seedlings of *Brachiaria decumbens* were obtained through seeds that were sown in trays and they were transplanted when they showed 2 to 4 leaves.

The experimental design used was in randomized blocks, with the treatments arranged in factorial a design 3 x 3 + T, with three repetitions, being considered the main factors the three densities of the weed plant, the three distances of the cultivated plant and the control without coexistence.

At the end of the experiments, at 120 days after the transplant, the characteristics evaluated in the coffee plants were: leaf area (LI 3000A, LiCor), relative content of total chlorophyll (SPAD 502, Minolta) and dry mass of the coffee plants, while the characteristic *Brachiaria decumbens* evaluated was leaf dry mass. The dry mass was obtained after drying the materials in an oven air circulation at the temperature of 70°C for at least 96 h.

To the obtained data were applied variance analysis (F test) and the averages were compared with the Tukey test at the level of 5% of probability.

3 RESULTS AND DISCUSSION

All the characteristics evaluated in coffee were negatively affected by the interference of the *Brachiaria decumbens*, but the leaf area and the leaf dry mass showed to be more sensitive to the interference, being observed significant interaction among the factors (Table 2). Similar results were observed by Costa (1997), Costa et al. (1998, 2006), when they studied the effect of different densities of

Table 1 – Result of the soil chemical analysis used in the experiment. Jaboticabal, 2006.

pH CaCl ₂	M. O g/dm ⁻³	P Resin	K	Ca	Mg	H+Al	SB	T	V
									%
									mmol _c /dm ₃
4.2	15	24	2.6	36	19	13	57.6	70.6	82

Table 2 – Independent effect of the density of *Brachiaria decumbens* plants and distance of those on the leaf area, leaf dry mass and stem and relative content of total chlorophyll of coffee plants.

Variables	Leaf area (cm ²)	Dry weight (grams)		Chlorophyll content (UR)
		Leaf	Stem	
Density (plants/m ²) - D				
4	115.8 a	0.91 a	1.04 a	26.36 a
8	80.12 b	0.74 a	0.76 ab	18.58 a
16	42.08 c	0.35 b	0.54 b	19.58 a
Distance (cm) - H				
0	60.21 b	0.48 b	0.61 a	15.73 a
10	99.54 a	0.86 a	0.94 a	26.58 a
20	78.26 b	0.66 ab	0.78 a	22.43 a
Control	216.73	2.22	0.99	40.66
CV (%)	31.02	34.77	41.80	42.24

Averages followed by the same letter do not differ by the Tukey test.

Brachiaria decumbens (in summer), *Panicum maximum* Jacq. and *Commelina benghalensis* L., (in winter), and *Spermacoceo latifolia* Aubl. on initial growth of *Eucalyptus grandis* seedlings. Dias et al. (2004), concluded that leaf area and leaf dry mass were among those that was affected by the density of *Brachiaria decumbens* on the initial growth of the coffee seedlings.

When was considered the stem dry weight of the coffee plants, there was no significant difference among the effects of the distances for the densities of 4, 8 and 16 plants/m², except at the distance of 20 cm, that differed significantly of the others treatments.

For leaf dry mass of coffee (Table 3), the statistical analysis did not show significant difference among the densities for the distance of 10 cm, and all reduced that characteristic significantly, when compared with the control. When they were planted close to seedling, the densities of 8 and 16 plants of *Brachiaria decumbens*/m² reduced more the dry mass of the coffee leaves, without differentiate to each other. In the distance of 20 cm, was verified reduction in this characteristic mainly when the *Brachiaria decumbens* achieved the density of 16 plants/m². When the effect of the distances was analyzed inside of the density, the effect of 4 plants/m² was not verified but in the densities of 8 and 16

plants/m² there was a more accentuated reduction in that characteristic when the *Brachiaria decumbens* was 0 cm of distance from the coffee plant, in the case of 16 plants/m² and 20 cm. The same behavior was observed for leaf area of the coffee plant (Table 4).

In a general, there was reduction of the leaf dry weight as well as in the leaf area of coffee plants when increased the density of *Brachiaria decumbens* plants in the box, independently of the distance of those from the seedlings. Those results confirm the fact that as larger as the density of the infesting plants, more intense will be the competition suffered by the culture, as mentioned by Pitelli & Karam (1988). Ronchi & Silva (2006), studying the interference of weed on coffee plants in its initial developmental phase observed that *Bidens pilosa* L., *Commelina diffusa* Burm. f., *Leonurus sibiricus* L. and *Richardia brasiliensis* Gomes, caused severe reduction on growth of coffee plants, mainly with the increment of the density.

When *Brachiaria decumbens* was in the plantation line, it provoked from 60% to 88% of reduction of dry mass of the coffee plants (of 4 to 16 plants of *Brachiaria decumbens* /m², respectively). In the distance of 10 cm, the reduction of dry mass intensified with the increase of *Brachiaria decumbens* density. In the case of the coexistence

Table 3 – Effects of the distance of *B. decumbens* in different densities on the dry weight of leaf and stem of coffee plants.

Leaf dry weight (g)				
	Variables	Distance (cm)		
		0	10	20
Density (plant/m ²)	4	0.89 Aa	0.86 Aa	0.98 Aa
	8	0.28 Bb	0.99 Aa	0.94 Aa
	16	0.26 Ab	0.77 Aa	0.06 Bb
Control		2,22		
Stem dry weight (g)				
	Variables	Distance (cm)		
		0	10	20
Density (plant/m ²)	4	0.96 A	0.89 A	1.29 A
	8	0.40 A	0.93 A	0.94 A
	16	0.49 Ab	1.01 A	0.12 B
Control		0,99		

Averages followed by the same letter do not differ by the Tukey test. The capital letters compare the average in the columns and the lower-case in the rows.

Table 4 – Effects of the distance of *B. decumbens* in different densities, on leaf area of coffee plants.

	Variables	Distance (cm)		
		0	10	20
Density (plants/m ²)	4	121.50 Aa	101.0 Aa	124.93 Aa
	8	25.16 Bb	114.0 Aa	102.20 Aa
	16	33.96 ABb	83.63 Aa	8.66 Bb
Control		216.73		

Averages followed by the same letter do not differ by the Tukey test. The capital letters compare the average in the columns and the lower-case in the rows.

of coffee plants with 16 plants of *Brachiaria decumbens*/m², the reduction of dry mass was of 80% in relation to the control, when *Brachiaria decumbens* was close to the seedling and at the distance of 20 cm. In relation to the leaf area, the reduction was of 47% in the density of 4 plants of *Brachiaria decumbens*/m². In the others densities, the reduction of leaf area was larger in the distances of 0 and 20 cm, being the distance of 10 cm around

55%. Studying only the density of *Brachiaria decumbens* on coffee seedlings, Dias et al. (2004), concluded that the density of 4 plants/m² reduced 41.4% the leaf dry mass of the coffee plants.

Souza et al. (2003), highlighted that *Brachiaria decumbens* is one of the weed that provoked drastic effects in *Eucalyptus* by reducing the growth of seedlings. Toledo et al. (2001) also working with *Eucalyptus*, concluded that *Brachiaria decumbens*

starting from the density of 4 plants/m², interfered negatively on the initial growth of *Eucalyptus* seedlings, being the biomass dry weight of the branches and of leaves the most sensitive parameters.

4 CONCLUSIONS

Thus, we concluded that *Brachiaria decumbens* starting from the density of 4 plants/m², independently of the distance, interferes negatively on the initial growth of coffee seedling, being the leaf area and the leaf dry matter of the coffee plants the most sensitive characteristic. When *Brachiaria decumbens* was close to the coffee plants (0 cm), there was pronounced effect with the increasing of the density of the weed, while at 10 and 20 cm of distance the effect was pronounced with the density of 16 plants/m².

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