



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

# IJDR

International Journal of Development Research

Vol. 12, Issue, 12, pp. 60664-60670, December, 2022

<https://doi.org/10.37118/ijdr.25576.12.2022>



RESEARCH ARTICLE

OPEN ACCESS

## PERIOD BEFORE INTERFERENCE ON CASSAVA CROP IN THE PRESENCE AND ABSENCE OF LIMING

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### ARTICLE INFO

#### Article History:

Received 20<sup>th</sup> September, 2022

Received in revised form

17<sup>th</sup> October, 2022

Accepted 26<sup>th</sup> November, 2022

Published online 25<sup>th</sup> December, 2022

#### Key Words:

*Manihot Esculenta Crantz;*

Maniva; Position; Interference Periods.

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### ABSTRACT

Cassava is one of the main plants grown in Brazil and is generally cultivated by small producers as a subsistence crop, in different types of production systems, as it is a rustic plant with good productivity, however, the competition for nutrients with the Weeds is very harmful to the development of the crop, especially in the period that they remain vegetating together. This work aims to determine the period before interference (PAI) in the cassava culture installed in two planting systems. Thus, the experimental treatments consisted of seven periods in contact with the weeds: 0-25, 0-50, 0-71, 0-91, 0-111, and 138 days after emergence (DAE) and another witness without coexistence with the infesting community. The experimental treatments were arranged in a randomized block design, in four replications. The results showed that 15 and 5 days were the periods before the interference for the planting system with the presence of lime and in the planting system without the presence of lime respectively, when in coexistence with the weeds of the species *Eleusine indica*, *Cyperus laxus*, *Digitariasp*, and *Cyperus iria*.

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Citation: Mariana Casari Parreira, Evaldo Morais da Silva, Antonio Marcos Quadros Cunha, Rafael Coelho Ribeiro et al. 2022. "Period Before Interference on Cassava Crop in The Presence and Absence of Liming", *International Journal of Development Research*, 12, (12), 60664-60671.

## INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a perennial species, native to South America, which produces starchy roots with high protein concentrations (Curcelli, 2013). It represents the *Euphorbiaceae* family, of the genus *Manihot*, it is a tropical plant, adapted to low fertility soils and can be propagated by cuttings or seeds (Ferreira Filho et al., 2013). However, according to Martins (2018 apud Serrat et al., 2002) liming is necessary, mainly by applying lime, adjusting the pH range, and consequently subsidizing the absorption of nutrients available in the soil for the plant. With estimated production for the year 2020 of approximately 19 million tons, in a cultivated area of 1.3 million hectares, cassava has a significant social and cultural importance in Brazil for being the economic basis of thousands of properties and the food security of millions of Brazilians, mainly in the North and Northeast regions. Together they produce approximately 10.6 tons of national production (IBGE, 2020). In the region of Baixo Tocantins (northeast Pará) cassava stands out as the main plant cultivated by family farmers, but in almost all of them, technologies to improve production are not adopted, liming is absent, inadequate spacing is used, and weed control is absent, resulting in low productivity. This situation repeats itself year after year, due to a rudimentary cultivation system involving the cleaning of the area by clearing, burning, and coppicing the forest or secondary vegetation, disregarding fundamentals of the production system (Alves; Junior, 2012). Among the factors that can affect the productivity of cassava are the interference caused by weeds. Weeds compete with the crop, mainly for water and nutrients, considerably reducing the productivity of the crop (Alves; Junior, 2014). The degree of interference between crop plants and weeds depends on several factors related to the weed community (specific composition, density, and distribution) and the crop itself (genus, species or cultivar, spacing between rows and sowing density). Moreover, it also depends on the time and duration of the period of mutual coexistence, being modified by soil and climatic conditions and by cultural treatments (Biffe et al., 2010). The Period Before Interference (PAI) is the period in which the crop can remain in coexistence with a weed community without negative interference in its final production. This period represents great importance in the crop cycle, from which productivity is affected due to competition caused by weeds (Moratelli, 2017). Through the above, the objective of this work was to determine the period before interference (PAI) in cassava culture installed in an area present and absent liming in the Lower Tocantins.

## MATERIALS AND METHODS

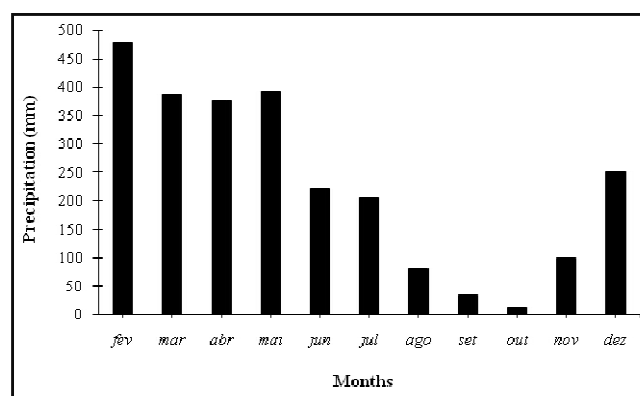
Two experiments were conducted under field conditions, in the municipality of Cametá - PA which is located at 01°56'54" latitude, 49°27'14" longitude, and an altitude of -6m. For this, we used the cultivar commonly known by local farmers as cassava "imitation", where it originates the white flour, having a short cycle of about six months, being cultivated by farmers in the region for decades showing itself well adapted to the environment. In the experimental areas, the manioc (part of the branch destined for planting) were planted in a horizontal position, and one area was limed and the other was not. The soil of the areas was classified as a Sandy Yellow Latosol, with light density and well drained (Santos et al., 1999), and the area that underwent the liming process was performed based on calculations according to Cravo et al (2010), whose result recommended 2,320 kg/ha of dolomitic limestone, according to the values presented by the chemical analysis of soil performed in the area, shown in (Table 01).

**Table 1. Chemical analysis of the soil of the experimental area**

Chemical Analysis										
Ph	M.O.	P Resin	K	Ca	Mg	H+Al	SB	T	V	
CaCl <sub>2</sub>	g/dm <sup>3</sup>	mg/dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	mmol <sub>c</sub> /dm <sup>3</sup>	%
4,7	18,46	2	16	0,2	0,4	12,51	3,61	12,98	3,63	

SOURCE: SoilLaboratories - Embrapa Amazônia Oriental, 2017

The planting was performed manually, in the year 2018, using healthy manioc with lengths around 20 cm, integrating 5 to 7 buds, in pits with a depth of approximately 10 cm. The culture was conducted according to the family farmers of the Lower Tocantins, in which there was no application of pesticides and fertilization and no supplemental irrigation. The experiments were conducted in an area with a history of homogeneous infestation of weeds of different species, and seven treatments with four repetitions were applied within this area, totaling 28 plots. The treatments for the two experimental areas consisted of the crop living with weeds from emergence to different phenological stages: 0-25, 0-50, 0-71, 0-91, 0-111, and 0-138 days after emergence (DAE) and control without living with weeds. After each of these initial coexistence intervals, the plots were kept free of weeds until the end of the cassava cycle, in the presence and absence of liming. A randomized block design with four repetitions was used for each soil management. The data for rainfall, relative humidity, and minimum, maximum, and average temperatures over the experimental period are presented in Figure 1.



**Fig. 1. Rainfall during the experimental period (2018) Source**

The weed community was evaluated at the end of each coexistence period in each plot. The weeds present in two sample areas, of 0.25 m<sup>2</sup> taken at random in the experimental plots were removed, identified, separated by species, counted, and weighed with the aid of scales with the precision of 0.01 g. The experimental plots, after the end of their respective coexistence periods, were then kept free of weeds until harvest by periodic weeding. With the weed community data, the relative importance of the weed community was calculated, which consists of an index involving three factors: relative frequency, relative density, and relative dominance, following formulas proposed by Mueller-Dombois & Elleberg (1974). The harvest started at 170 DAE, manually, and the harvested roots were weighed on scales. The yield data analysis was performed individually for each planting position and the results were submitted to regression analysis using Boltzman's sigmoidal model (Kuva et al. 2001).

$$y = \frac{(P1 - P2)}{1 + e^{(X - X_0)/dx}} + P2, \text{ Where:}$$

y = productivity of cassava roots as a function of coexistence periods.  
P1 = maximum yield obtained in plants kept weeded throughout the cycle.

P2 = minimum yield obtained on plants living with the weeds for the maximum period of 138 days).

(P1 - P2) = production losses.

X = upper limit of the coexistence period.

X0 = upper limit of the coexistence period, which corresponds to the intermediate value between the maximum and minimum production.

dx = parameter indicating the speed of production loss as a function of coexistence time.

Based on the regression equation, the previous period of weed interference was determined for arbitrary tolerance levels of a 5%

reduction in productivity of cassava roots, about the treatment maintained in the absence of weeds. Based on the regression equations, the Origin® program was used to perform the regression analyses.

## RESULTS AND DISCUSSION

**Weed Community:** The weed community was represented in both experimental areas by 23 weed species (Table 2). Of this total, 13 species (56.52%) are monocots and 10 species are eudicots (43.48%). In the monocot group, the family that stood out most in the number of individuals was the Poaceae with 5 species. As for the Eudicots, the Solanaceae family, which has only 2 species, is the one that stands out. We observe a high number of weed communities living together with the plants, causing competition for nutrients to be fierce among the species. According to Miléo (2014), this diversification of weeds is not specific to our northern region, but practically all regions of cultivated areas in Brazil.

**Relative importance:** In the two experimental areas analyzed, the relative importance (IR) was given by the species *Eleusine indica* (L.) Gaertn, *Cyperus laxus* L and that were relevant both in the presence and absence of liming. *Digitaria* sp appeared in a relevant way in the presence of liming, while *Cyperus iria* L. was one of the most relevant in the form of soil preparation without liming (Figure 2).

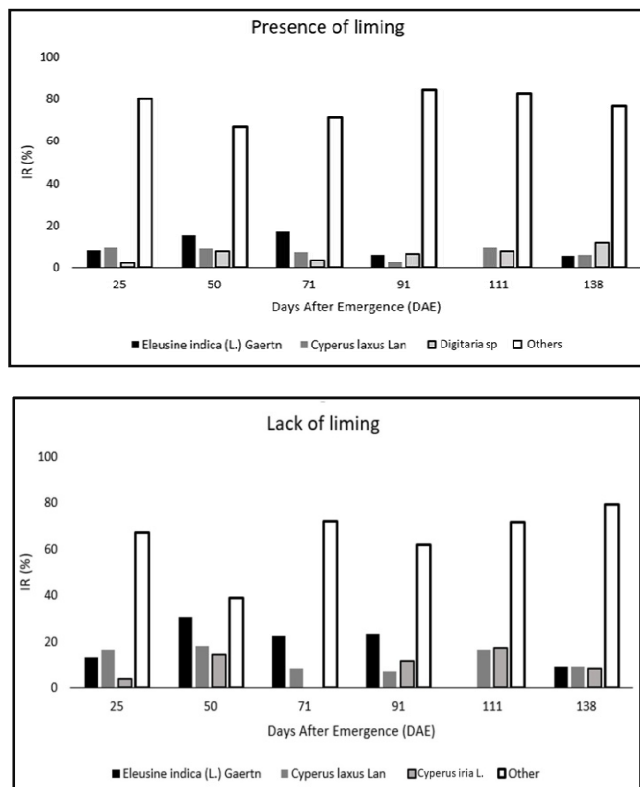


Fig. 2. Relative importance (%) of main weeds during the experimental period in areas with and without liming

**Presence of liming:** In the soil preparation with liming at 25 DAE, the IR of *E. indica* averaged 8%, reaching 17% at 50 DAE and reaching its maximum peak at 71 DAE with an average of 18%, after this period there was a decline in this species in this index so that at 111 DAE it was not found, however, at the end of the experimental period the species returned to present an IR index of approximately 5%. The species *C. laxus* that reached 10% IR 25 DAE, decreased to 9% (50 DAE) and continued decreasing to 8% and 2% in 71 DAE and 91 DAE respectively. At 111 DAE it again reached 10% IR and near the harvest (138 DAE) it decreased again to 7%, thus remaining in coexistence throughout the experiment period, even if with different intensity. Regarding the species *Digitaria* sp, it is observed at 3% in the first evaluation (25 DAE) of IR, increasing to 8% (50 DAE) and

at 71 DAE decreases to 4%, however, in the subsequent evaluation, at 91 DAE showed 7% of IR, increasing approximately to 8% at 111 DAE and near the end of the experimental period (138 DAE) was found 12% of IR of this species, which like the previous species, the *Digitaria* sp remains in coexistence for the entire period.

**Lack of liming:** In the no liming soil preparation, at 25 DAE the IR of *E. indica* was 13%, rising to 30% at 50 DAE, then declining to 22% at 71 DAE and reaching almost the same average at 91 DAE with 23%, not being found at 111 DAE and returning with approximately 9% IR at 138 DAE. The species *C. laxus* presents itself with 16% IR in 25 DAE, evolving to 18% in 50 DAE drops 8% and 7% in 71 DAE and 91 DAE respectively, increasing again to 16% in 111 DAE and ending the experimental period with approximately 9% IR in 138 DAE. It is worth noting that the species maintain coexistence throughout the experimental period in both forms of soil preparation. As for the species *C. iria*, it presents at 25 DAE the IR of 4%, evolving to 14% at 50 DAE and not being found at 71 DAE, becoming relevant again at 91 DAE with 11%, passing through 17% at 111 DAE and dropping to 8% IR at the end of the experiment (138 DAE). The IR exerts significant influence on the vegetative development of the main crop, given that it is from this parameter that one identifies the voracity with which the weeds manifest themselves in the crop space (Moratelli, 2017).

**Weed community density:** The number of weed community plants varied according to soil preparation throughout the experimental period (Figure 03).

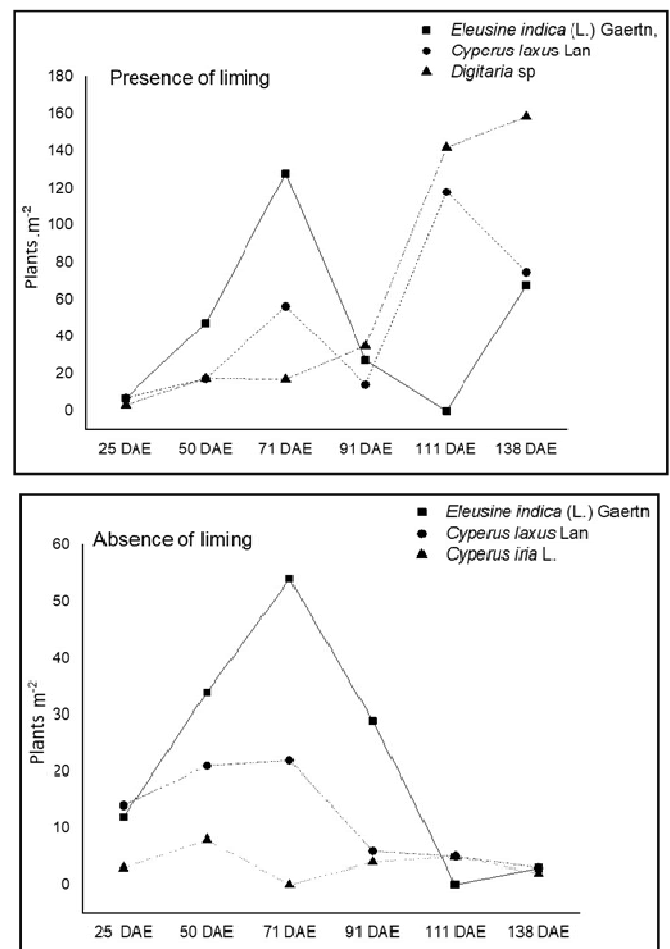


Fig. 3. Density of main weed infestants (plants  $m^{-2}$ ) at the end of the coexistence periods, in cassava crop in the presence and absence of liming

At the beginning of the experimental period (25 DAE), in the soil preparation with liming it was observed that the species *E. indica*, *C. laxus*, and *Digitaria* sp had practically the same number of plants (per  $m^{-2}$ ), approximately 8 plants each. In the other preparation mode, without liming, all the most relevant species *E. indica*, *C. laxus*, and

*C. iria*, showed a density of approximately 12, 14, and 4 plants per m<sup>2</sup> respectively. At 50 DAE in the planting in the presence of liming, the density of *E. indica* reaches 50 plants per m<sup>2</sup>, the species *C. laxus* reached approximately 18 plants per m<sup>2</sup> and *Digitaria sp.* reaches the same average of 18 plants per m<sup>2</sup>. In the area without liming, the species *E. indica* reached the number of 34 plants per m<sup>2</sup>, *C. laxus* reached the mark of 21 plants and *C. iria* decreased to 12 plants per m<sup>2</sup>. At 71 DAE in the planting performed in the area with liming, the species *E. indica* reaches its peak with the highest density in this form of planting with approximately 130 plants per m<sup>2</sup>, *C. laxus* obtained a density of 50 plants per m<sup>2</sup> and *Digitaria sp.* reaches 20 plants per m<sup>2</sup>. In the planting performed in the area without liming, the species *E. indicais* found in this evaluation with 55 plants per m<sup>2</sup>, *C. laxus* presents a density of 22 plants per m<sup>2</sup> and *C. iria* presents a density of 1 plant per m<sup>2</sup>. At 91 DAE in the planting in the area with liming the number of individuals found of the species *E. indica* reduced to approximately 28 plants per m<sup>2</sup>, *C. laxus* also showed a reduced value in density, with approximately 10 plants per m<sup>2</sup> and *Digitaria sp.* evolved to approximately 30 plants per m<sup>2</sup>. In the planting in the area without liming, the number of plants found of the species *E. indica* reached a density of approximately 30 plants per m<sup>2</sup>, *C. laxus* reached approximately 17 plants per m<sup>2</sup> and *C. iria* reached a density of approximately 15 plants per m<sup>2</sup>. At 111 DAE in the plantation in the presence of liming, *E. indica* was not found, *C. laxus* showed approximately 120 plants per m<sup>2</sup> and *Digitaria sp.*, 150 plants per m<sup>2</sup>. In the area without liming, *E. indica* was not found either, while *C. laxus* and *C. iria* reached 5 plants per m<sup>2</sup> each. At 138 DAE, in the area with liming, the species *E. indica* presented a density of 70 plants per m<sup>2</sup>, *C. laxus* presented 78 plants per m<sup>2</sup> and *Digitaria sp.* appeared with approximately 160 plants per m<sup>2</sup>. In the plantation with soil preparation without liming, all species presented the same density per m<sup>2</sup>, that is, 5 plants. Cassava plants competing with increasing weed densities showed marked and differentiated reductions in the variables that define crop growth seriously impairing its production (Ferreira et al, 2015).

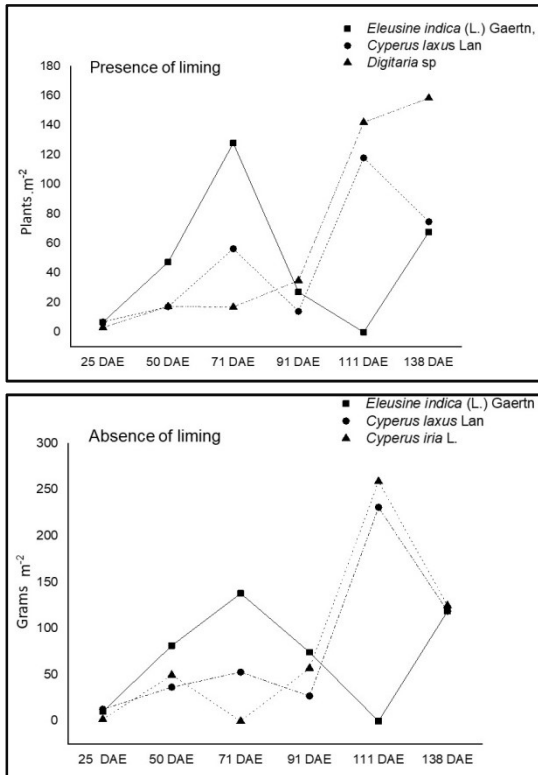


Fig. 4. Fresh mass of the main weeds (g m<sup>-2</sup>) at the end of the coexistence periods for the cassava crop in the presence and absence of liming

**Weed community fresh mass:** The weeds present in the experiment accumulated fresh mass throughout the experimental period, and in the soil preparation with liming, at 25 DAE, the species *E. indica*, *C. laxus*, and *Digitaria sp.* showed approximately 10 g m<sup>-2</sup> of fresh mass

each, the same value found for the most relevant species in the planting with soil preparation without the presence of liming. At 50 DAE in the planting area with liming, *E. indica* presented 50 g m<sup>-2</sup>, *C. laxus* reached approximately 20 g m<sup>-2</sup> of fresh mass and *Digitaria sp.* also reached 20 g m<sup>-2</sup>. At planting in the area without liming, *E. indica* appears at 75 g m<sup>-2</sup> approximately, and the species *C. laxus* and *C. iria* presented at approximately 40 and 50 g m<sup>-2</sup> respectively. At 71 DAE in the presence of liming, *E. indica* reached 130 g m<sup>-2</sup> of fresh mass, *C. laxus* obtained 50 g m<sup>-2</sup> and *Digitaria sp.* appeared with 20 g m<sup>-2</sup>. In the area without liming, *E. indica* increased the fresh mass to approximately 150 g m<sup>-2</sup>, *C. laxus* got 50 g m<sup>-2</sup> and *C. iria* did not show fresh mass, because it was not found in the area. At 91 DAE in the form of soil preparation with liming, *E. indica* presents a value of 30 g m<sup>-2</sup> of fresh mass, *C. laxus* reduces its fresh mass to approximately 10 g m<sup>-2</sup>, while *digitaria sp.* raises to 40 g m<sup>-2</sup> its mass. In the form of soil preparation without the presence of liming, *E. indica* presents 50 g m<sup>-2</sup> of fresh mass, *C. laxus* obtained 25 g m<sup>-2</sup> of mass, and *C. iria* raises the mass to approximately 50 g m<sup>-2</sup>. At 111 DAE in the presence of liming, *E. indica* was practically not found in the experimental area, *C. laxus* and *Digitaria sp.* increased considerably their fresh masses reaching 120 g m<sup>-2</sup> and 140 g m<sup>-2</sup> respectively. In the absence of liming, *E. indica* was practically not found in the area again, and *C. laxus* and *Cyperus iria* again increased their fresh mass weight to 230 g m<sup>-2</sup> and 260 g m<sup>-2</sup> respectively. At the end of the experimental period at 138 DAE, in the planting area with liming, the species *E. indica* and *C. laxus* showed 70 and 75 g m<sup>-2</sup> respectively, while *Digitaria sp.* reached 160 g m<sup>-2</sup>. In the form of soil preparation without liming, all species relevant to this form of planting showed almost the same average fresh mass among them, approximately 125 g m<sup>-2</sup>. The accumulation of a fresh mass of the weed community is a very important factor because it is this parameter that indicates the intensity of competition that they offer to the plant with which they coexist in the cultivation area because the greater the mass of those plants, the greater the competition for nutrients, water, and energy, leading to limitation of resources for the cassava plant (Silveira Junior, 2015).

**Productivity:** In the production components with soil preparation with liming, the number of roots per plant began to be affected from 71 DAE, staying around 4.08 roots per plant. After this period, the number of roots began to decline, reaching 138 days of coexistence with weeds, with only 1.16 roots per plant (Table 3). The diameter of the roots per plant was affected only after 111 DAE, dropping from approximately 5 cm to less than 4 cm, remaining at this average until the end of the experiment. The length of the roots (Table 3) showed greater efficiency when they did not have competition with weeds during the entire cycle, reaching a depth of 22.65 cm. The lowest rates were reached after 91 DAE, reaching the end of the experimental period (138 DAE) with practically only 10 cm in length. The root development of cassava when in competition with weeds, can present a certain concentration of superficial roots, however, poorly developed, a result of a competition for nutrients, on the other hand, competition-free plants can present a much greater root development and therefore deeper, this can explain the reduction in the length of the most superficial roots to the detriment of the deeper ones (Soares et al, 2019). In the form of soil preparation without the presence of liming, the number of roots is similar to the absence of competition by weeds until 111 DAE, with approximately 4 roots per plant on average, however, at the end of the experimental period (138 DAE), there is a sharp drop in the number of roots per plant, reaching only 1.38 root per plant (Table 4). Analyzing the diameter of the roots (Table 4) it was verified that until 71 DAE of coexistence with the weed community, there was no influence on this parameter, ranging from 15.34 cm to 14.30 cm. However, as the period of coexistence increased, the diameter found was smaller, reaching 9.75 cm at the end of the experiment (138 DAE). In the root length parameter, the same behavior was observed for the plants that were planted in the planting with liming, with the deepest roots being present in the plants that did not have competition with the weeds (13.62 cm deep) and the shallowest roots were those that had a competition with the weeds during the entire cycle of the crop.

**Table 2. Weed community components in the experimental area**

Family	Name Scientific	Name Popular	CotyledonaryClass
Arecaceae	<i>Astrocaryumaculeatum</i>	Tucumã	Monocot
	<i>Desmoncusorthacanthos</i> Mart.	Jacitara	Monocot
Connaraceae	<i>Roureaacuspadata</i> Benth. ex Baker	Carvoeiro	Eudicotyledonous
Convolvulaceae	<i>Ipomoeaasarifolia</i>	Batatarana	Eudicotyledonous
Cyperaceae	<i>Fimbristylismiliaceae</i>	Cuminho	Monocot
	<i>Cyperusrotundus</i> L.	Tiririca	Monocot
	<i>Cyperus iria</i> (L.)	Junquinho	Monocot
	<i>Cyperuslaxus</i> Lan.	Espigão Grass	Monocot
Fabaceae	<i>Senna obtusifolia</i> (L.) H. S. Irwin & Barneby	Fedegoso	Monocot
	<i>Swartzialaurifolia</i> Benth	Tapiririca	Eudicotyledonous
Hypericaceae	<i>Vismiaagianensis</i> (Aubl.) Choisy	Matamata	Eudicotyledonous
Lamiaceae	<i>Cantinoa americana</i> (Alblet.) Harley & J.F.B. Pastore	Mint	Eudicotyledonous
Melastomataceae	<i>Miconia ciliate</i> (Rich.) DC.	Envireira	Eudicotyledonous
Poaceae	<i>Oryza sativa</i> L.	Straw rice	Monocot
	<i>Eleusine indica</i> (L.) Gaertn	Crowfoot	Monocot
	<i>Echinochloa colona</i> (L.) Link	Crabgrass	Monocot
	<i>Digitaria</i> sp.	Weedgrass	Monocot
	<i>Echinochloa crus-pavonis</i>	Gervão	Monocot
Rubiaceae	<i>Tocoyena brasiliensis</i> Mart.	Dairy	Eudicotyledonous
Sapotaceae	<i>Micropholisacutangula</i> (Ducke) Eyma	Pau-de-caibro	Eudicotyledonous
Smilacaceae	<i>Smilax syphilitica</i> Humb. & Bonpl. ex Willd.	Cipó-espinho	Monocot
Solanaceae	<i>Solanumstramonijfolium</i> jacq.	Jurubeba	Eudicotyledonous
	<i>Physalisangulata</i> L.	Camapú	Eudicotyledonous

**Table 3. Several roots per plant, root diameter per plant, and root compliance of cassava crop in the presence of liming, as a function of periods of coexistence with weeds**

	Root number	Root diameter	Length Root
0 AAD	5,15 a	5,02 a	22,65 a
25 DAA	5,16 a	5,32 a	15,72 c
50 DAA	4,83 a	5,14 a	15,04 c
71 DAA	4,08 b	5,21 a	18,75 b
91 DAA	3,08 c	5,09 a	12,37 d
111 DAA	2,83 c	3,85 b	11,90 d
138 DAA	1,16 d	3,48 b	10,02 e
F trat	35,22**	23,13**	348,37**
CV%	13,3	6,5	3,0

Means followed by the same letter in the column do not differ in the Scott&Knott test. \*, \*\* significant at 5 and 1% probability, respectively. NS- non-significant, CV (%) = coefficient of variation.

**Table 4. Number of roots per plant, root diameter per plant, and root compliance of cassava crop in the absence of liming, as a function of the periods of coexistence with weeds**

	Root number	Root diameter	Length Root
0 AAD	4,41 A	15,34 A	13,62 A
25 DAA	4,25 A	15,92 A	10,43 B
50 DAA	4,41 A	14,83 A	10,85 B
71 DAA	4,16 A	14,30 A	10,89 B
91 DAA	3,83 A	12,46 B	8,73 C
111 DAA	4,08 A	12,13 B	7,82 C
138 DAA	1,38 B	9,75 B	10,15 B
F trat	27,72**	7,96**	25,72**
CV%	12,90	16,13	7,0

Means followed by the same letter in the column do not differ in the Scott & Knott test.

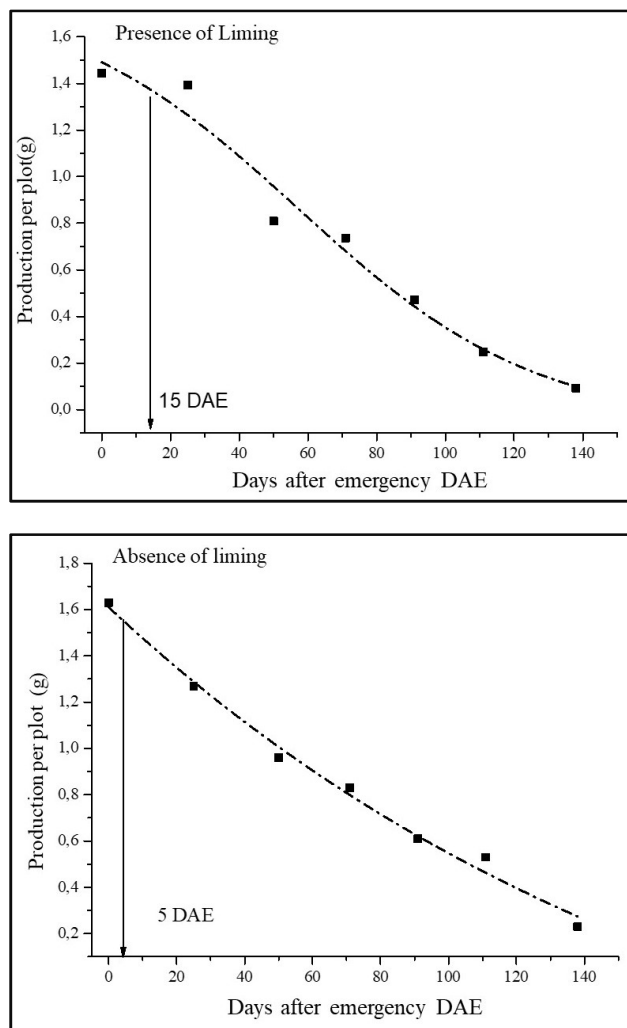
\*, \*\* significant at 5 and 1% probability, respectively. NS- non-significant, CV (%) = coefficient of variation.

**Table 5. Parameters determined for the Boltzman sigmoidal equations adjusted to the productivity data of cassava roots as a function of the periods of coexistence with weeds in the two modes of planting**

Parameters	Liming	
	Presence	Absence
P1	1,789	1,634
P2	0,065	0,023
Dx	34,61	39,78
R <sup>2</sup>	0,94	0,98
Productionreduction	96,3%	98,6%

Note: y (productivity of cassava roots as a function of coexistence periods), P1 (maximum production obtained in plants kept weeded during the entire cycle), P2 (minimum production obtained in plants living with weeds during the maximum period of 138 days, dx (upper limit of the period of a parameter that indicates the speed of production loss as a function of coexistence time) and R<sup>2</sup> (regression coefficient).





**Fig. 5. Yield of cassava roots per plot (g) in the absence and presence of liming, in response to the periods of coexistence with weeds, with the representation of the previous periods of interference considering an arbitrary 5% loss in yield.**

Cassava suffers interference from weeds in direct proportion to their proximity, that is, the closer one root system to the other, the greater the damage caused to the crop, and this can occur at different times throughout the cycle of cassava cultivation (Moura, 2000). When analyzing the productivity, the highest production was achieved in the form of soil preparation in the presence of liming, exceeding 1.7 kilograms per plot, in the absence of weeds during the entire cycle of the crop (Table 5). The planting in the area without liming obtained a yield of 1.634 kilograms per plot, also in the absence of weeds during the entire cycle. With the coexistence of weeds in the crop, the highest productivity per plot is also in the presence of liming, obtaining 0.065 kilograms per plot, and in the mode of soil preparation without liming it reaches only 0.023 kilograms per plot. The productivity is drastically reduced when having a competition with weeds until the harvest, no matter the form of planting, the reduction was 96.3% in soil preparation with liming and 98.6% in preparation without liming. These data show that, in the region where the experiment was installed, it is not necessary to apply high doses of limestone to raise productivity, thus avoiding unnecessary costs to farmers, however, the liming operation should be done if it is found that the soil needs it (Martins et al, 2018).

**Pre-Interference Period (PAI):** When considering the arbitrary value of 5% loss in the productivity of the cassava crop, the PAI of 15 days of coexistence with the weed community was found in the soil preparation with the presence of liming and 5 days in the form of planting without the presence of liming (Figure 05). The critical period of competition is the period in which control measures are necessary to avoid continued interference between crops and weeds,

avoiding yield losses (Constantin et al., 2007). Thus, in the area prepared with liming in the soil, it takes more than two weeks of coexistence with the weeds (15 DAE) to have a reduction in production. Compared to the form of soil preparation without liming (5 DAE), the difference is more than a week, making the planting in the area where the soil has been prepared with liming more efficient in competition with the weed community, which may offer the farmer more time to decide on efficient management for weed control.

## CONCLUSION

The period before interference was 15 days for the cassava plant in the soil preparation with liming and 5 days for the soil preparation without liming, with the arbitrary level of yield reduction of 5%, coexisting with the weed community composed predominantly of the species *Eleusine indica*, *Cyperus laxus*, *Digitaria sp.* and *Cyperus iria*.

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