



Interference of Weeds in Sweet Potato Genotype Growth (*Ipomoea batatas* (L.) Lam.)

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JTC and PVF participated in the idea and management of the experiment, besides writing the article. Authors JLXLC and LLMN were responsible for data collection and analysis. Authors MTS and DSF carried out the experiment from the implementation to the data collection. Authors ABSJ and RAP participated in the management and data collection of the experiment, as well as in the bibliographic review. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was carried out in the Experimental Area of the Plant Genetic Improvement Sector of the Agricultural Sciences Center of the Federal University of Alagoas (SMGP-CECA-UFAL), in the year 2013, where periods of control and weed coexistence of sweet potatoes were evaluated. The experimental design was carried out in randomized blocks in the 3 x 14 factorial scheme with three replications, with three sweet potato genotypes in 14 periods of interference, and distributed in seven control periods (0, 10, 20, 30, 40, 50 and 60 days after planting - DAP), from which the weeds were controlled, and seven coexistence periods, from which the weeds coexisted with the crop. The evaluations consisted of sweet potato genotype shoot samplings at 30, 60, 90, and 120 days after planting (DAP), using one working area plant per plot in each evaluation stage. In the determination of the leaf area, a mechanical integrator was used, and to obtain the shoot dry mass,

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the material was taken to a forced air circulation oven at 65 °C for 72 h, with subsequent weighing. According to the results, it can be observed that, in the coexisting treatments, there was a significant reduction in the shoot growth rates, in comparison to the treatments in which the weeds were controlled, especially the reduction of the leaf area at 120 DAP, where clone 6 and Sergipana showed a reduction of 89.0% and 88.0%, respectively. As for Clone 14, this reduction occurred at 90 DAP, at about 52.0%, which was less expressive, whereas in relation to the shoot dry mass, clones 6, 14, and the Sergipana variety showed a reduction at 120 DAP of 86%, 51%, and 46%, respectively.

Keywords: *Cultures; weed plants; competition; control; coexistence.*

1. INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a plant originating from Latin America corresponding to the sixth most important food produced in the world. Moreover, in developing countries, it is the main food [1]. It has a great socioeconomic importance in Brazil, participating in the calorie and mineral supply in human food. Its growth is divided into three phases: an initial one, with small vegetative and radicular development, which lasts about 50 to 60 days; in the second phase, a great vegetative development takes place, when its greatest development occurs. This development goes from the previous phase until 90 to 105 days, when the formation and final development of the tuberous roots take place; and a third one, of great production and deposition of dry matter in the roots, with a reduction in the shoot growth rate and a rapid growth of the tuberous roots. These phases vary with cultivars, climatic conditions and cultural practices [2,3,4].

In Brazil, this crop has a low average yield of around 13.09 t ha⁻¹ [5]. This is attributed to several factors, such as the occurrence of pests and diseases, inadequate production technology and the lack of selected cultivars. However, weed interference, which spontaneously emerges and competes with culture for water, light and nutrients, causing harmful effects on crop growth attributed to the allelopathic substances produced by infecting species, can also make it difficult to carry out culture treatment harvesting, as well as being hosts of pests and diseases affecting the quantity and quality of the tubers produced [6,7,8,9,10].

According to [11], the largest competition with weeds occurs until 45 days after planting, when the branches of the crop cover most part of the soil. From that moment, it becomes difficult to manage the crop, due to their entanglement. On the other hand, [12] describes that the plant is

undemanding for culture treatments, where the weed-free crop should be maintained in the first 60 days.

However, literature still lacks information on weed damage in sweet potato cultivation. Therefore, the present work aimed to analyze the growth of three sweet potato genotypes according to weed interference.

2. MATERIALS AND METHODS

The experiment was carried out in the Experimental Area of the Plant Genetic Improvement Sector of the Agrarian Sciences Center of the Federal University of Alagoas (SMGP / CECA / UFAL), located at Campus Rio Largo, BR 104 Norte, km 85, Rio Grande - Alagoas, in 2013. A total of three sweet potato genotypes (Variety Sergipana, Clone 6 and Clone 14) were evaluated in a randomized block design in a 3 x 14 factorial, with three replicates, and 14 interference periods. The interference periods were: seven control periods, from which weeds were controlled and seven coexistence periods, when the weed species which had emerged after these intervals, were no longer controlled (0, 10, 20, 30, 40, 50 and 60 days after planting - DAP). The plots contained four 10 m long, 0.30 m high windrows, with 12 plants per windrow, spaced 0.80 x 0.40 m, and two central windrows as working area.

The soil was prepared by plowing and two crossed diskings; the windrows were built with a furrow; mineral fertilisation in the foundation was applied according to recommendations of soil analysis, using 45 kg ha⁻¹ of N, 25 kg ha⁻¹ of P₂O₅ and 60 kg ha⁻¹ of K₂O, planted in May 2013. As for irrigation, it consisted of a sprinkler system, applying a 3 mm blade daily at that time.

The weeds were controlled at the end of each coexistence period and in the control periods, through manual and hoe weeding, according to the treatments.

2.1 Evaluated Weed Variables

Weed community evaluations were performed at the end of the coexistence periods (10, 20, 30, 40, 50 and 60 days after planting - DAP) for treatments with initial weed control periods and at 130 DAP for treatments that constantly remained in competition with weeds. A 0.25 m² hollow square frame was used to collect weeds, which was randomly placed in the working area of each plot. In each sample, plants were collected very close to the soil, and identified according to family, species and common name, determining the number of individuals.

2.2 Shoot Growth Variables of the Sweet Potato Genotypes

During the sweet potato genotype cycle, samples were taken for growth analysis at 30, 60, 90 and 120 days after planting (DAP), in the treatments where the genotypes were kept on control, and in coexistence, throughout the cycle with weeds.

In the evaluation of the leaf area (LA) and shoot dry mass (SDM), a working area plant was used per plot at each evaluation period, when it was sectioned close to the soil, with leaves and branches separated. In leaf area determination, a leaf area mechanical integrator, model LI 300 was used when the leaves were placed onto a belt and, through reading, leaf area was determined in cm²; soon after, the branches and leaves were taken to the forced air circulation oven at 65°C for 72 h, to obtain shoot dry mass (SDM) in grams.

Absolute growth rate (AGR), relative growth rate (RGR) and net assimilation rate (NAR) were determined for each stage, based on leaf area (LA) and shoot dry mass (SDM) according to formulas proposed by [13]:

- AGR (g plant⁻¹ day⁻¹) represents the average daily increment of dry plant mass between two successive evaluations. The formula calculated it $AGR = (SDM_n - SDM_{n-1}) / (T_n - T_{n-1})$, in that SDM_n is the accumulated dry mass up to the n evaluation, SDM_{n-1} is the accumulated dry mass up to the n-1 assessment, T_n is the number of days after the treatment, at n evaluation, and T_{n-1} is the number of days after treatment at n-1 evaluation;

- RGR (g g⁻¹ day⁻¹) expresses plant growth over a period, relative to the dry mass

accumulated at the beginning of this interval, calculated by the formula $RGR = (\ln SDM_n - \ln SDM_{n-1}) / (T_n - T_{n-1})$;

- NAR (g m⁻² day⁻¹) represents the net assimilation rate, in the form of dry mass produced per leaf area unit, per unit of time, calculated by the formula $NAR = [(SDM_n - SDM_{n-1}) / (t_n - t_{n-1})] \cdot [(\ln FAn - 1n - FAn - 1) / (FAn - FAn - 1)]$.

2.3 Variables of Tuberous Roots of Sweet Potato Genotypes

The production components of sweet potato genotypes were evaluated at the time of tuberous roots harvesting at 130 DAP, where:

- For the primary variable, commercial root yield (CRY), obtained through the tuberous root mass "over 80 grams" of each plot and transformed into t ha⁻¹, was determined;

- While the total root yield (TRY) was obtained through the tuberous root mass "over 40 grams" of each plot and transformed into t ha⁻¹.

2.4 Statistical Analysis

Variables related to weeds were analysed descriptively, while the shoot growth and tuberous root yield data of the sweet potato genotypes were submitted to analysis of variance by Tukey's probability test (P: 0.05) with the aid of the statistical software System for Analysis of Variance - SISVAR [14].

3. RESULTS AND DISCUSSION

3.1 Characteristics Related to Weeds

The infesting community was composed of 26 species, between dicotyledons and monocotyledons, distributed in 14 families, as follows: Poaceae and Asteraceae, with four species each, which were the families with the greatest expression, followed by Fabaceae, Solonaceae, Cypraceae, Euphorbiaceae, with two species each. The remaining families were: Amarantaceae, Brassicaceae, Convolvulaceae, Phyllanthaceae, Molluginaceae, Rubiaceae, Turneraceae, Portulacaceae, Scrophulariaceae and Boraginaceae, with only one representative (Table 1).

The highest number of species was observed in dicotyledons, represented by eleven families and covering nineteen species. The monocotyledons were represented only by three families and seven species. This higher and species richness of dicotyledonous plants was also verified in studies on weed interference, according to [15], in beet; and [16] in soybean.

For [17], the Poaceae and Asteraceae are the two main weed families existing in Brazil. According to [18], several species of the family Poaceae are perennial and produce large quantities of seeds, increasing their power of dissemination and colonisation of different environments. The Asteraceae family has been reported as one of the most numerous in weed diversity in different cultures [19].

3.2 Shoot Growth Analysis of Sweet Potato Genotypes

Analyzing the growth results of sweet potato genotypes, there was a significant difference between them by Tukey's test ($P: 0.05$), (Table 2A and B).

Leaf area (LA) shows that it was influenced by both sweet potato genotypes and weed management strategies (Table 2A and B).

With weed control, the Sergipana variety presented continuous and linear growth in all evaluation periods, reaching the end of the cycle with accumulated leaf area around $14445.03 \text{ cm}^2 \text{ plant}^{-1}$, whereas Clone 6 and 14 were maintained in a growing trend up to 90 DAP, declining afterwards to values close to 5000 and $2000 \text{ cm}^2 \text{ plant}^{-1}$, respectively (Table 2 A).

Similar results were found by [20], working with sweet potato cultivars Abóbora and Da Costa, where leaf area increased to 105 DAT in both varieties, reaching maximum LA of 4000 and $5000 \text{ cm}^2 \text{ plant}^{-1}$, respectively. Behaviour such as this is typical in sweet potato cultivation since the appearance of tuberous roots that are strong metabolic drains and with excellent mobilisation force of assimilates induces acceleration in foliar senescence, consequently reducing LA. This reduction is a physiological limiting factor in the use of solar energy since it affects the final production of the crop [21].

Table 1. Weed species collected at the end of each coexistence period (10, 20, 30, 40, 50, 60, 70, and at 130 DAP) in treatments with initial weed control periods and at harvest time in the sweet potato crop. Rio Largo-AL, CECA / UFAL, 2013

Family	Botanic name	Common name
Poaceae	<i>Brachiaria mutica</i> (Forssk.) Staf	Capim-de-planta
Poaceae	<i>Cenchrus echinatus</i> L.	Capim-carrapicho
Poaceae	<i>Digitaria</i> ssp. Willd.	Capim colchão
Poaceae	<i>Eleusine indica</i> (L.) Gaertn.	Capim-pé-de-galinha
Asteraceae	<i>Acanthospermum hispidum</i> DC.	Carrapicho-de-carneiro
Asteraceae	<i>Ageratum conyzoides</i> L.	Mentrasto
Asteraceae	<i>Emilia sonchifolia</i> (L.) DC.	Falsa serralha
Asteraceae	<i>Galinoga parviflora</i> Cav.	Picão branco
Fabaceae	<i>Calopogonium mucunoides</i> Des.	Calopogônio
Fabaceae	<i>Desmodium tortuosum</i> (Sw.) DC.	Carrapicho-beiço-de-boi
Solanaceae	<i>Physalis angulata</i> L.	Balão
Solanaceae	<i>Solanum americanum</i> Mill.	Maria pretinha
Cyperaceae	<i>Cyperus iria</i> L.	Tiririca-de-brejo
Cyperaceae	<i>Cyperus esculentus</i> L.	Junça
Euphorbiaceae	<i>Chamaesyce hyssopifolia</i> (L.) Small	Erva-de-santa-luzia
Euphorbiaceae	<i>Croton lobatos</i> L.	Erva-de-rola
Amarantaceae	<i>Amaranthus deflexus</i> L.	Caruru
Brassicaceae	<i>Cleome affinis</i> DC.	Mussambê
Convolvulaceae	<i>Merremia cissoides</i> (L.) Hallier f.	Jitirana
Phyllanthaceae	<i>Phyllanthus tenellus</i> Roxb.	Quebra-pedra
Molluginaceae	<i>Mollugo verticillata</i> L.	Capim tapete
Rubiaceae	<i>Richardia grandiflora</i> (Cham. & Schltdl.)	Poaia branca
Turneraceae	<i>Turnera subulata</i> L.	Xanana
Portulacaceae	<i>Portulaca oleracea</i> L.	Beldroega
Scrophulariaceae	<i>Lindernia crustacea</i> (L.) F. Muell	Douradinha-do-pará
Boraginaceae	<i>Heliotropium indicum</i> L.	Crista-de-galo

In weed intercropping during the whole cycle of sweet potato genotypes, a reduction of leaf area was observed gradually in all evaluated genotypes, clearly showing the effect of weed interference, regardless of the material studied. Clone 6 and Sergipana were the most affected by weed coexistence, reaching 120 DAP, with leaf area of 555.88 and 1665.94 cm² plant⁻¹, respectively, and a reduction of 88.5% leaf area for both, whereas Clone 14 had about 49.0% reduction in LA, which was considered the lowest (Table 2 B).

This reduction of leaf area is a well-known character in sweet potatoes and common in plants with determined growth [22], which is caused both by the reduction of leaf emission and by leaf senescence.

For the shoot dry mass (SDM) in the treatments with weed control, the Sergipana variety was superior concerning the two sweet potato clones from 60 DAP. In this treatment, it is observed that the dry shoot mass followed the standard pattern of growth until 90 DAP for Sergipana variety and Clone 6, reaching values close to 100 g plant⁻¹. From that point, a decrease occurred until 120 DAP, final phase of the crop cycle, with Sergipana and Clone 6 varieties registering values of 80 and 60 g plant⁻¹, respectively. From 60 DAP, Clone 14 showed a progressive decrease in its mass accumulation until cultivation end, reaching results close to 45 g plant⁻¹ (Table 2A).

In studies performed by [20], working with sweet potato cultivars Abóbora and Da Costa, the total dry matter was always increasing for both varieties, showing a logistic tendency. However, cultivar Da Costa accumulated more dry matter than cultivar Abóbora, during cultivar development.

Fig. 1 (A, B and C) better summarises this relationship between the leaf area of the sweet potato genotypes and the weed population density present in the growing field of each genotype. This shows that the leaf area of the sweet potato genotypes, besides compromised by the physiological factors of the crop itself, was also strongly affected by living with weeds, because in the initial phase, the plant is vulnerable for not promoting a complete soil cover. Consequently, even at a low rate of infestation, weeds cause significant damage to the plant. Besides, the low weed density in the final stage allowed the emergence of new individuals, which developed increasing grass dry mass accumulated throughout the crop cycle.

During the sweet potato genotype cycle, between 30 and 60 DAP, there is a reduction in the weed population density in cultivated areas with the three sweet potato genotypes stabilizing up to 90 DAP, except for the area developed with Sergipana variety, where the decrease in weed density continues gradually until the end of the crop cycle. In cultivated areas with Clones 6 and 14, weed density only decreased again in the final phase, starting at 90 DAP.

Table 3 (A and B) presents the mean data of the estimates of physiological growth parameters of sweet potato genotypes, such as absolute growth rate (AGR), relative growth rate (RGR) and net assimilation rate (NAR). It is observed that, for the treatments in which sweet potato genotypes are maintained on weed control, Sergipana variety stood out at 60 DAP and Clone 6 at 90 DAP, with the highest AGR. In treatments coexisting with weeds, AGR of the sweet potato genotypes remained at low levels, which was mainly attributed to competition for light, since the sweet potato crop presents a prolonged initial growth rate, shaded by taller weeds [22].

Table 2 (A and B). Mean values of leaf area (LA) and shoot dry mass (SDM) of sweet potato genotypes as a function of control periods (A) and weed coexistence (B). Rio Largo-AL, CECAL-UFAL, 2013

	Weed control (A)				Weed coexistence (B)			
	Leaf area (cm ² plant ⁻¹)				Leaf area (cm ² plant ⁻¹)			
Genotypes	30 DAP	60 DAP	90 DAP	120DAP	30 DAP	60 DAP	90DAP	120DAP
Clone 6	8584.5a	7822.5a	8388.2a	4862.5b	4653.2ab	3181.5a	2157.3a	555.9b
Clone 14	2961.6b	4390.7b	4786.9b	2047.0c	3588.9b	2948.8a	1587.5a	1833.2a
Sergipana	3830.6b	8238.3a	8982.4a	14445.0a	5009.4a	2543.3a	1586.5a	1665.9ab
	Shoot dry mass (g plant ⁻¹)				Shoot dry mass (g plant ⁻¹)			
	30 DAP	60 DAP	90 AP	120DAP	30 DAP	60 DAP	90 DAP	120DAP
Clone 6	51.2b	55.3b	112.0a	56.7b	23.4a	26.3a	27.0a	13.5b
Clone 14	62.5a	61.5b	54.0b	44.7b	29.8a	27.1a	19.8a	21.7b
Sergipana	45.3b	85.0a	109.0a	81.8a	28.7a	34.1a	28.5a	44.5a

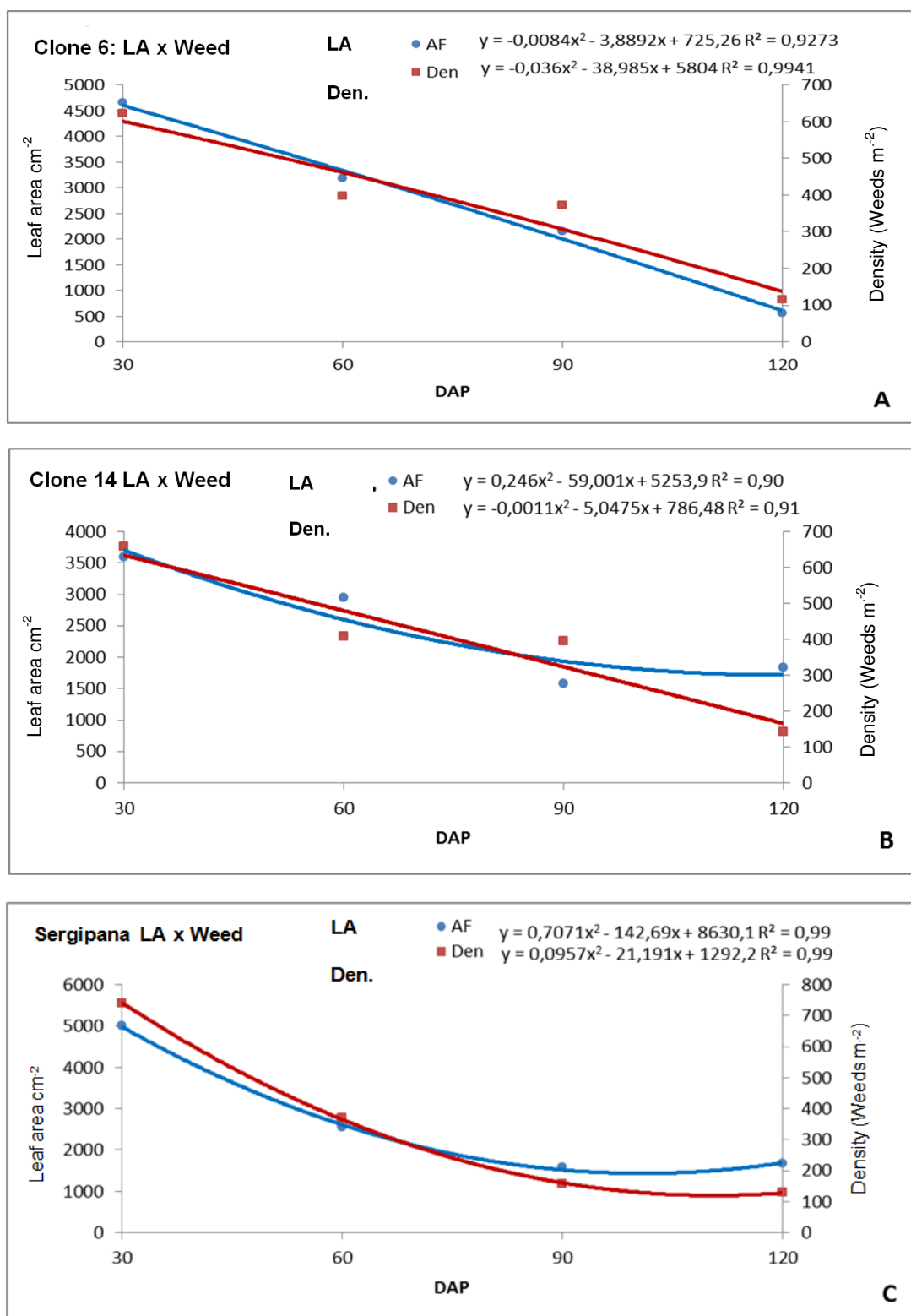


Fig. 1. (A, B and C) – Leaf area (cm²) of the sweet potato genotypes (A) Clone 6, (B) Clone 14, and (C) Sergipana variety x Weed coexistence. CECA-UFAL, Rio Largo-AL, 2013

Absolute growth rate (AGR) for weed control showed a high speed up to 90 DAP, with $1.89 \text{ g plant}^{-1} \text{ day}^{-1}$ for Clone 6, further decreasing until the end of the cycle to $-1.84 \text{ g plant}^{-1} \text{ day}^{-1}$; whereas Sergipana variety reached a value of 1.32 at 60 DAP. From there, it decreased to $-0.91 \text{ g plant}^{-1} \text{ day}^{-1}$ at 120 DAP. These characteristics were presented by Clone 14, with a rate of $-0.03 \text{ g plant}^{-1} \text{ day}^{-1}$ being observed at 60 DAP, followed by decreases reaching $-0.91 \text{ g plant}^{-1} \text{ day}^{-1}$ at 120 DAP. In general, AGR took the lowest value for Clone 6 at 120 DAP, while for clone 14 and Seringa variety, the highest reduction occurred at 90 DAP with values of -0.24 and $-0.19 \text{ g plant}^{-1} \text{ day}^{-1}$, respectively (Table 3A).

In the system coexisting with weeds, the interference imposed on sweet potato genotypes kept the AGR at deficient levels. This behaviour, according to [22], is mainly due to competition for light, since sweet potato culture presents a slow growth rate, being shaded by weeds of higher build (Table 3 B).

Regarding the relative growth rate (RGR), which is weed control during the whole cycle of sweet potato genotypes, Sergipana variety showed a rise up to 60 DAP with $0.021 \text{ g g day}^{-1}$, which is normal since, from that period, the formation of tuberous roots starts, where the photoassimilates are conducted for the development of these structures. Therefore, this decrease goes until the end of the cycle at 120 DAP. Clone 6 has a dramatic increase in RGR up to 90 DAP with $0.024 \text{ g g day}^{-1}$, since it is an early material, and may have already directed photoassimilates for the formation of its tuberous roots. As for Clone 14, a decreasing RGR is observed throughout the cycle, with a value of -0.010 g g^{-1} at 120 DAP. From this period, the plant starts to destine a large part of the photoassimilates for the production of the tuberous roots and maintenance of the already formed structures (Table 3A).

For [23], this continuous reduction of AGR can be explained by the increase in respiratory activity and by self-shading, whose importance increases with plant age. In research developed by [20], also working with two sweet potato cultivars, both presented decreasing AGR.

It was verified that, from 60 to 120 DAP, in the cultivation in coexistence with weeds, Clone 6 presents decreasing AGR values during the experiment, when an amount of $-0.023 \text{ g g day}^{-1}$ was found in the last evaluation, reflecting a low

accumulation of dry mass presented in this treatment. The other genotypes showed a decrease down to 90 DAP, which is a period of tuberous root formation, with subsequent growth, reaching values of 0.003 and $0.015 \text{ g g day}^{-1}$ for clone 14 and Sergipana at 120 DAP, respectively (Table 3 B).

Net assimilation rate (NAR) in weed control was negative for Clone 14 in all periods, but mainly at 90 DAP, when this rate reached $-0.00006 \text{ g m}^{-2} \text{ day}$. This decrease is probably associated with a low increase in leaf area throughout the cycle unlike Clone 6, which showed increasing behaviour until 90 DAP, with a subsequent reduction until the end of the cycle with $-0.00001 \text{ g m}^{-2} \text{ day}$; whereas Sergipana variety presents an initially high rate up to 60 DAP. From this period, there were decreases, when, at the end of the crop cycle, a rate of $0.00008 \text{ g m}^{-2} \text{ day}$ was observed, demonstrating a greater capacity of dry mass accumulation per unit of leaf area in early stages of development (Table 3A).

In the coexistence with weeds, a decrease was observed in all genotypes until 90 DAP, in which Sergipana, Clone 14, and clone 6 had a net assimilation rate of -0.00010 , -0.00011 , and $0.00001 \text{ g m}^{-2} \text{ day}$, respectively. For Clone 6, this decrease continued until 120 DAP, since its rate was $-0.00040 \text{ g m}^{-2} \text{ day}$, being this behavior attributed to the characteristics of its leaf, which is formed by leaf limbs with very deep lobes, and due to the maintenance of already built structures. At 120 DAP, Sergipana and Clone 14 varieties showed growth for this variable, since they accumulated 0.00033 and $0.00004 \text{ g m}^{-2} \text{ day}$, respectively (Table 3 B).

According to [24], sweet potato has high photosynthetic affinity per unit of leaf area, but mutual shading occurs because of the leaf arrangement that leads to reduced light penetration in the canopy. Therefore, net assimilation rate decreases with the increase in leaf area index under field conditions.

3.3 Evaluation of Variables Related to Tuberous Roots of Sweet Potato Genotypes Concerning Weed Coexistence Periods

Table 3 shows the mean values of the production components of sweet potato genotypes as a function of weed coexistence periods, where factor interaction (Genotypes vs. Interference Periods) is observed.

Table 3. (A and B). Mean values of the absolute growth rate (AGR), relative growth rate (RGR), and net assimilation rate (NAR) of the sweet potato genotypes according to the control periods (A) and weed coexistence (B). Rio Largo-AL, CECA-UFAL, 2013

Weed control (a)				Weed coexistence (b)		
AGR – Absolute growth rate (g plant ⁻¹ day ⁻¹)				AGR – Absolute growth rate (g plant ⁻¹ day ⁻¹)		
Genotypes	60 DAP	90 DAP	120 DAP	60 DAP	90 DAP	120 DAP
Clone 6	0.14 b	1.89 a	-1.84 b	0.09 a	0.02 a	-0.45 c
Clone 14	-0.03 b	-0.25 c	-0.31 a	-0.09 a	-0.24 a	0.06 b
Sergipana	1.32 a	0.80 b	-0.91 a	0.18 a	-0.19 a	0.53 a
RGR- Relative growth rate (g g ⁻¹ day ⁻¹)				RGR- Relative growth rate (g g ⁻¹ day ⁻¹)		
Genotypes	60 DAP	90 DAP	120 DAP	60 DAP	90 DAP	120 DAP
Clone 6	0.003 b	0.024 a	-0.023 b	0.004 a	0.001 a	-0.023 b
Clone 14	-0.001 b	-0.004 c	-0.006 a	-0.003 a	-0.010 a	0.003 a
Sergipana	0.021 a	0.008 b	-0.010 a	0.006 a	-0.006 a	0.015 a
NAR – Net assimilation rate (g m ⁻² day ⁻¹)				NAR – Net assimilation rate (g m ⁻² day ⁻¹)		
Genotypes	60 DAP	90 DAP	120 DAP	60 DAP	90 DAP	120 DAP
Clone 6	0.00002 b	0.00023 a	-0.00029 b	0.00003 a	0.00001 a	-0.00040 c
Clone 14	-0.00001 b	-0.00006 c	-0.00001 a	-0.00003 a	-0.00011 a	0.00004 b
Sergipana	0.00023 a	0.00009 b	-0.00008 a	0.00005 a	-0.00010 a	0.00033 a

1/ Means followed by the same letter in the columns do not differ between each other by the Tukey test at 5% probability level

Analyzing the genotype breakdown within weed coexistence periods, for the commercial root yield variable (CRY), when the sweet potato genotypes remained throughout their growing cycle in competition with weeds, Clone 6 and Sergipana did not show significant differences between them, with yields of 10.93 and 9.28 t ha⁻¹, respectively. This, in turn, differed statistically from Clone 14, which yielded 5.98 t ha⁻¹.

In the treatment where the coexistence of sweet potato genotypes with weeds started at 10 DAP, Sergipana and Clone 6 varieties showed no significant differences between them, presenting yields of 15.13 and 13.71 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 10.46 t ha⁻¹.

In the treatment in which the coexistence of sweet potato genotypes with weeds started only at 20 DAP, Sergipana and Clone 6 varieties also did not present significant differences between them, having yields of 20.19 and 18.19 t ha⁻¹, respectively, which in turn also differed from Clone 14, yielding 14.78 t ha⁻¹.

The treatment in which coexistence of sweet potato genotypes and weeds started only at 30

DAP, Sergipana and Clone 6 varieties also did not present significant differences between them, offering yields of 23.34 and 21.66 t ha⁻¹, respectively, which, in turn, also differed from Clone 14, yielding 16.36 t ha⁻¹.

When the sweet potato genotypes coexisted with weeds from 40 DAP, Sergipana and Clone 6 did not present significant differences between them, obtaining yields of 25.49 and 25.04 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 19.12 t ha⁻¹.

In the treatment where the sweet potato genotypes remained in the presence of weeds from 50 DAP, Sergipana and Clone 6 varieties showed no significant differences between them, obtaining yields of 26.33 and 25.27 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 21.24 t ha⁻¹.

Finally, when the sweet potato genotypes remained throughout their growing cycle without competing with weeds, Sergipana and Clone 6 varieties also did not show significant differences between them, obtaining yields of 26.15 and 25.47 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 22.03 t ha⁻¹.

Table 4. Mean values of the commercial root yield (CRY), and total root yield (TRY). Rio Largo-AL, CECA-UFAL, 2013

Genotypes	Coexistence periods (DAP)						
	130	10-130	20-130	30-130	40-130	50-130	60-130
CRY – Commercial root yield (t ha⁻¹)							
Sergipana	9.28 a	15.13 a	20.19 a	23.34 a	25.49 a	26.33 a	26.15 a
Clone 6	10.93 a	13.71 a	18.19 a	21.66 a	25.04 a	25.27 a	25.47 a
Clone 14	5.98 b	10.46 b	14.78 b	16.36 b	19.12 b	21.24 b	22.03 b
TRY - Total root yield (t ha⁻¹)							
Sergipana	11.13 a	16.22 a	20.74 a	24.27 a	26.54 a	26.85 a	26.64 a
Clone 6	11.85 a	14.37 a	20.54 a	22.95 a	26.32 a	26.69 a	26.69 a
Clone 14	7.23 b	11.09 b	16.73 b	17.61 b	20.40 b	22.96 b	23.86 a

1 / Means followed by the same letter in the columns do not differ between each other by the Tukey test at 5% probability level

For the variable total root yield (TRY), where the sweet potato genotypes coexisted with weeds during their whole cycle, Clone 6 and Sergipana did not present significant differences between them, yielding yields of 11.85 and 11.13 t ha⁻¹, respectively, which, in turn, differed statistically from Clone 14, which attained a return of 7.23 t ha⁻¹.

In the treatment where the coexistence of sweet potato genotypes and weeds started at 10 DAP, Sergipana and Clone 6 varieties did not show significant differences between them, obtaining yields of 16.22 and 14.37 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 11.09 t ha⁻¹.

For the treatment where coexistence of sweet potato genotypes with weeds started only at 20 DAP, Sergipana and Clone 6 varieties also did not present significant differences between them, having yields of 20.74 and 20.54 t ha⁻¹, respectively, which, in turn, also differed from Clone 14, yielding 16.73 t ha⁻¹.

The treatment in which coexistence of sweet potato genotypes and weeds started only at 30 DAP, Sergipana and Clone 6 varieties also did not present significant differences between them, presenting yields of 24.27 and 22.95 t ha⁻¹, respectively, which, in turn, also differed from Clone 14, yielding 17.61 t ha⁻¹.

When sweet potato genotypes coexisted with weeds from 40 DAP, Sergipana and Clone 6 did not show significant differences between them, obtaining yields of 26.54 and 26.32 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 20.40 t ha⁻¹.

In the treatment where sweet potato genotypes remained in the presence of weeds from 50 DAP, Sergipana and Clone 6 did not show significant differences between them, obtaining yields of 26.85 and 26.69 t ha⁻¹, respectively, which, in turn, differed from Clone 14, yielding 22.96 t ha⁻¹.

In the treatment in which sweet potato genotypes remained throughout their cycle without competing with weeds, there was no significant difference between them, which obtained an average value of 25.73 t ha⁻¹.

4. CONCLUSION

Thus, the present study allowed concluding that sweet potato genotypes, when cultivated in conditions of competition with weeds, present a significant reduction in the growth rates, where this effect was evidenced, mainly in the initial stages of the culture.

Sweet potato genotypes presented a decrease in the production rates of tuberous roots when in competition with weeds, with the most significant reductions in clone 14.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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