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USER PRE-EMERGING HERBICIDES ASSOCIATED WITH IRRIGATION INTERVAL IN THE CONTROL OF *Momordica charantia* L

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ABSTRACT

Weeds impair the productive efficiency of agricultural crops, a species that has shown an increase in occurrence is the melon-de-são-caetano *(Momordica charantia* L.*),* and this causes losses due to competition for water, light, nutrients and space. Therefore, a treatment with an effective herbicide to control this species is of utmost importance for the reduction of the damage caused. Therefore, the present work aimed to evaluate different herbicide molecules associated with irrigation intervals in the control of são caetano melon (*Mormodica charantia* L.). The experiment was conducted at the Agricultural Engineering and Sciences Campus of the Federal University of Alagoas (CECA / UFAL). The design used was completely randomized in a 5x5 factorial scheme, with three replications. The study species *Mormodica charantia* was subjected to four combinations of herbicides [alion + jump, alion + sencor, alion + ametrina, alion + boral, being represented by H1 H2 H3 H4, respectively and a control without herbicide (H5)] associated with five irrigation intervals [0, 7, 14, 21 and 28 days after application (DAA)]. The treatments H1, H2 and H4 were combated 100% of *Mormodica charantia* in all the analyzed irrigation intervals, showing to be efficient in the control of this species.

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INTRODUCTION

Momordica charantia popularly known as são caetano melon belongs to the cucurbitaceae family and is originally from Asia, in which it was dissipated for many regions of tropical and subtropical climates (KISSMAN and GROTH, 1999). This weed has ruderal characteristics and is widespread for its use in medicine as well as in cooking (LENZI *et al.,* 2005), however, it has become a weed that can cause various damages to cultivated plants, as it has a growth habit climber, it is trapped by tendrils between obstacles or neighboring plants (ROBINSON; DECKER-WALTERS, 1997). There is a great advance in the occurrence of são caetano melon (*Momordica charantia* L.) in cultivated areas, especially with sugarcane, which is extremely harmful to agricultural crops, as this weed species causes damage due to competition for light, nutrient and space, and in the case of sugarcane, there is still interference in mechanized harvesting, with losses in the performance of the machines and in the quality of the harvested product (CORREIA and ZEITOUM, 2010). Lorenzi (2014) has an estimate that losses in productivity in areas of sugarcane with weeds are around 15 to 30%. However, depending on the level of weed infestation, losses in this and other agricultural crops can reach 100% if there is no form of control. The use of herbicides points out as one of the most effective and economical control alternatives, mainly in large plantation areas that have high weed infestations, even during rainy periods or under irrigation, since other methods have a low efficiency in the control of these plants when applied to large production scales (KUVA et al. 2008). However, there is

a problem in the control of são caetano melon, because unlike other weed species, there are no herbicides registered for this species, thus making control difficult. For this reason, it is extremely important to determine which herbicides or combinations are efficient in controlling this weed, in order to increase the agricultural performance of the crops. Therefore, the present work aimed to evaluate different herbicide molecules associated with irrigation intervals in the control of são caetano melon *(Mormodica charantia* L.*)*

MATERIALS AND METHODS

The experiment was carried out at the Campus of Engineering and Agricultural Sciences of the Federal University of Alagoas (CECA / UFAL), in the municipality of Rio Largo, AL, whose geographical coordinates are: 09 ° 28'02 "S and 35 ° 49'43" W, 127 m altitude, coastal tableland region. The climate of this region is characterized, with classification of thornthwaite and mather, described as humid, megathermic (hot), with moderate water deficiency in summer and large excess water in winter. The average annual rainfall is 1,818 mm, with minimum (41 mm) in January and maximum (294 mm) in July. The air temperature ranges from 19.3 ° C in August to 31.7 ° C in January, with annual average of 25.4 ° C and relative humidity of the monthly average above 70% (SOUZA *et al.,* 2004). The seeds used were obtained from fruits of *Momordica charantia* L. collected manually in the municipality of Rio Largo, Al. After collecting the ripe (open) fruits, the seeds, about 200 g, were dried in the shade to remove the aril that covers them. The prepared seeds were placed in paper bags and stored in an environment protected from temperature and humidity variations. Its use occurred 10 days after its storage, and no seed treatment was performed before its use. The germination test of the seeds was carried out, in a Gerbox box, with self-cleaved filter paper (substrate) containing 25 seeds of melon-de-caetano. The boxes were placed in a BOD type germination chamber with a photo period of 14h white light / 10h dark absolute, with temperature adjusted to 30/20 ° C respectively, daily counts of germinated seeds (radicle greater than 2 mm) were performed (GOMES *et al.,* 2001). The soil used is classified as a cohesive yellow latosol with a clayey medium texture, with a humidity of 0.24 m^3 m^{-3}, it has field capacity (θ Cc) and 0.14 m^3 m^{-3}, at the point of permanent wilt (θ Pmp). The density of the soil is 1.50 Kg dm^{-3}, the total porosity is 0.42 m^3 m^{-3} and the basic infiltration speed (VIB) is 52 mm h^{-1} (CARVALHO, 2003). In which it was initially dried in the shade for a period of 48 hours. Soon after, the soil was sieved with a 2 mm thick sieve. Then, it was placed in 1L pots, sowing with the species of são caetano melon (*Momordica charantia* L). The statistical design used was completely randomized in a factorial scheme (5x5), combinations of herbicides and irrigation intervals, with 3 replications (Table 1). The active ingredients of the herbicides used are shown in Table 2.

Table 1. Description of treatments used

TRATAMENTS			
FACTOR 1 - Combinations of herbicides		FACTOR 2 – irrigation intervals (days after aplication	
Alion (0,65ml) + Jump (10g)	H1	0	I1
Alion (0,65ml) + Sencor (15 ml)	H2	7	I2
Alion (0,65ml) +Ametrina (15ml)	H3	14	I3
Alion (0,65ml) + Boral (8ml)	H4	21	I4
Control without herbicide	H5	28	I4

Table 2. Trade name and active ingredients of herbicides used

TRADE NAME	ACTIVE INGREDIENT
Alion	Indaziflam
Ametryn	Ametrina
Sencor	Metribuzim
Jump	Diurom e Hexazinona
Boral	Sulfentrazona e Tebutiurom

For a used application, use a backpack sprayer with the aid of a bar with two flat jet nozzles ("fan") 11002, spaced between 0.5 m, with a constant pressure (maintained by compressed CO_2) of 2.0 $kgf.^{-2}$, providing a spray volume of 200 $L.ha^{-1}$. During the application, the plots were protected and at the time of application they were separated, to prevent the drift of the sprayed syrup came into contact with the other experimental plots. Then the plants were transferred to the greenhouse, where they remained until the end of the study. For the treatments of irrigation intervals, only a 20 mm water layer was applied in the respective intervals (Table 1). To obtain the data, the green mass of all treatments was collected by means of the harvest, at 28 days after sowing, which were weighed with a precision scale. After this evaluation, the dry mass was determined, where the samples of each repetition were placed in paper bags and taken to dry. The data were submitted to analysis of variance (F test), the means being compared by the Tukey test at 5% probability.

RESULTS AND DISCUSSION

When analyzing Table 3, it is observed that there was a significant difference in the level of 1% of probability by the F test, in the interaction of herbicide combinations and irrigation intervals for the variables green and dry mass.

Table 3. Analysis of variance with the values of the average squares of the green and dry mass of the species (*Momordica charantia* L), as a function of herbicide combinations and irrigation intervals, in the region of Rio Largo, AL

Sources of Variation	[1]GL	Average Square Values	
		Green mass	Dry mass
Herbicide combinations (CH)	4	47,429975**	10,917952**
Irrigation intervals (II)	4	1,295809*	0,364899*
CH x II	16	1,241890**	0,485163**
Erro	50	0,434340	0,141465
[2]CV (%)		26.98	19.04

[1]Degrees of freedom; 2 Variation coefficient; ** significant at the 1% probability level; * significant at the 5% probability level; ns not significant by the F test.

Na Tabela 4, shows the combinations between the herbicides and the irrigation intervals, and it is observed that in the irrigation interval by planting (I1) there was no significant difference between herbicide combinations, when compared to the control treatment, for green and dry mass. In the same irrigation interval, the control had a dry and green mass of 5.17 and 0.68 g, respectively, while the combinations of herbicides H1, H2 and H4 did not obtain green and dry mass, as no plants emerged. H3, with the combination of alion + ametrine, was the only one that did not have a significant difference in relation to the control in the irrigation intervals (I1 and I2). This treatment when compared with the herbicides H1, H2, H4 there was a significant difference, resulting in a higher percentage of emergence of são caetano melon in all intervals, obtaining a green mass of 0.04, 4.07, 1.34, 0.21, 0.16 g and dry mass of 0.21, 2.22, 0.49, 0.13, 0.03 g, respectively in the

irrigation intervals 0, 7, 14, 21, 28 days after application (Table 4), showing that this combination was not efficient in controlling this species. Souza et al (2014) verified that the occurrence of rains 12 and 24 hours after the application of clomazone + ametrina weed emergence rates of 80.00 and 80.80%. According to Monquero et al. (2008), the mixture clomazone + ametrina presents little stability in different types of soil when applied in dry season, the same authors verified that there was leaching of the mixture of ametrina + clomazone along the clayey soil profile, and this effect was more profound as the amount of simulated rain increased. What can be related to this emergence of plants and consequently accumulation of green and dry mass, is that these herbicide molecules may have adsorbed to soil colloids and organic matter as well as leaching to deeper layers of soil, and so it did not act directly on the plant, causing escape (MARTINI e DURIGAN, 2004). According to Velini (1992), leaching shows two important aspects; it is indispensable for superficial incorporation in most herbicides, affecting seeds or germinating plants, however, when in excess, it can carry them to deeper layers of the soil, reducing their action and may even contaminate the water table.

Table 4. Production of green mass and dry mass of São-de-caetano melon as a function of herbicide combinations and irrigation intervals

GREEN MASS					
Herbicides	Irrigtion Intervals				
	0	7	14	21	28
H1	0,00 aA	0,00aA	0.00aA	0,00aA	0.00aA
H2	0,00aA	0,71aA	0.00aA	0,00aA	0,00aA
H3	0,04bA	4,07abA	1,34bA	0,21bA	0,16bA
H4	0,00aA	0.00aA	0,00aA	0,00aA	0.00aA
Control without herbicide	5,17bB	18,90bB	22,78cB	24,80cB	22,00cB
DRY MASS					
Herbicides	Irrigation Intervals				
	0	7	14	21	28
H1	0,00aA	0,00aA	0,00aA	0,00aA	0,00aA
H2	0,00aA	0,05aA	0,00aA	0,00aA	0,00aA
H3	0,21bAB	2.22bB	0,49bAB	0,13bA	0,03bAB
H4	0,00aA	0,00aA	0,00aA	0,00aA	0,00aA
Control without herbicide	0,68bA	3,65bB	4,85cB	6,11cB	7,26cB

Straight averages of the same lowercase letter in the column and uppercase in the row do not differ statistically from each other by the Tukey test ($p < 0.05$)

In the irrigation interval after the seventh day of application (I2), the combinations of herbicides H1, H2 and H4 were efficient in controlling *Momordica charantia*, and differed statistically from the witness. The green and dry weight of the control was 18.9 and 3.65 g, respectively (Table 4). The combinations of herbicides H1 and H4 did not present green and dry matter, showing that these combinations are efficient in controlling this species. H2 did not differ statistically from the other herbicide combinations, but it had a dry and green mass of 0.71 and 0.05 g, respectively, this may have occurred due to reduced mobility of the sencor herbicide in the soil, because this is affected by the organic matter content of the soil, particle size distribution, porosity, rainfall intensity and application rates (EXTOXNET, 1996). At 14 and 21 days after application, the herbicide combinations H1, H2 and H4 were efficient, in that they did not present any plant emergence and did not differ statistically from each other, but differed in relation to the control and H3. The control obtained a green mass of 22.78 and 24.80 g and a dry mass of 4.85, 6.11 g respectively for the intervals of 14 and 21 days. Studies carried out with other species such as: *Ipomoea grandifolia*, *I. hederifoliae Merremia cissoides* have also demonstrated the effectiveness of pre-emergence application of tebuthiuron and sulfentrazone for the control of these weed species (PALHANO *et al.,* 2010). The last irrigation interval analyzed (I5), maintained the same trend as the other intervals, in which the combinations of herbicides H1, H2 and H4 controlled 100% of *Momordica charantia*, differing statistically from the control and from H3, (Table 4). According to Blanco and Velini, (2005) the boral herbicide has long residual activity in the soil. In a study by Vivian et al. (2006), working with red-yellow argisol, in evaluations greater than 180 after application, analyzed that the majority of boral residues was detected at a depth of 0-0.10 m, with low leaching in soil. Rossi et al. (2005) also detected low boral mobility in the soil profile, remaining in the surface layer of a red latosol, regardless of precipitation. The low mobility of boral, especially in more clayey soils, linked to the vulnerability of weeds to the product helps in understanding the results, even if there is rain. According to Souza et al (2014) studying the effect of low soil moisture on the effectiveness of herbicide application tebuthiuron in pre-emergence, verified that the treatments the tebuthiuron obtained 100% control of the weeds.

Conclusion

The combinations of the herbicides alion + jump, alion + sencor and alion + boral, controlled 100% of the species *Momordica charantia* in all irrigation intervals analyzed. The combination of the herbicides alion + ametrine, on the other hand, showed the emergence of *Momordica charantia*, thus not being indicated for the control of this species.

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