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المجلة العراقية لبحوث السوق وحماية المستهلك

EFFECT OF INHIBITION OF WEEDS DRY WEIGHT ON WHEAT GROWTH INDICATORS

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ABSTRACT

The experiment was carried out in the experimental field during the winter season of the year 2021-2022. The current study was carried out with the aim of evaluating the efficiency of the herbicide H-199 and comparing it with some herbicides used in the control of companion weeds with three cultivars of wheat and its effect on some growth characteristics. The experiment was applied according to the randomized complete block design (RCBD) with split plot arrangement by four replicates. Cultivars (IPA 99, Sham 6, and Rasheed) represent the main plots, while control treatments (H-199, Chevalier, Pallas, Atlantis, and weedy) represent the sub plots. The results showed the superiority of Pallas herbicide by contributing the lowest dry weight of weeds of 0.8 g, the highest inhibition ratio of weeds dry weight of 99.67%, the highest flag leaf area of 48.63 cm^2, the highest number of tillers 374.9 tiller/m^2. Besides, the highest biological yield of 14.207 ton/ha, compared with the comparison treatment that gave the highest weed dry weight of (223.8 g/m^2). This treatment recorded the lowest inhibition ratio for the dry weight (0.00%), the lowest flag leaf area (40.33 cm^2), the lowest number of tillers (178.6 tiller/m^2), and the lowest biological yield (4.805 ton/ha). The results also showed the superiority of the Sham 6 cultivar, as it gave the lowest weed dry weight amounted to 29.7 g, the highest dry weight inhibition ratio amounted to 78.96%. Along with, the highest plant height reached 105.16 cm, the highest flag leaf area reached 50.27 cm^2, the highest number of tillers reached 353.6 tiller/m^2, and the highest biological yield reached 13,727 ton/ha. The interaction had a significant effect, as the treatment with H-199 with the cultivar Rasheed and the treatment with Pallas with the cultivar Sham 6. Plus, the treatment Pallas with the cultivar IPA 99, and the treatment with Chevalier with the cultivar IPA 99 gave the lowest dry weight of 0.0, 0.0, 0.0, and 0.0 g, respectively. Treatment Pallas herbicide with Sham 6 cultivar gave the highest inhibition ratio reached 100.00%, the highest plant height reached 110.22 cm, the highest flag leaf area reached 56.16 cm^2, the highest number of tillers reached 408.7 tiller/m^2, and the highest biological yield reached 18.615 ton/ha.

Key words: Herbicides, *Triticum aestivum* L., Weeds, Wheat

تأثير تثبيط وزن الادغال الجاف في مؤشرات نمو الحنطة

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الخلاصة

نفذت التجربة في الحقل لكلية علوم الهندسة الزراعية /جامعة بغداد الجادرية خلال الموسم الشتوي للعام 2022-2021 بهدف تقيم كفاءة مبيد الادغال H- 199 ومقارنته مع بعض المبيدات المستخدمة في مكافحة الادغال المرافقة لثلاث اصناف من الحنطة واثر ذلك في بعض مؤشرات النمو ، طبقت التجربة وفق تصميم القطاعات الكاملة

المعشاة بترتيب الألواح المنشقة وباربعة مكررات، إذ احتلت الأصناف (IPA 99 وSham 6 وRasheed) الألواح الرئيسية بينما احتلت معاملات المكافحة (H- 199 و Chevalier و Pallas و Atlantis والمعاملة المدغلة) الألواح الثانوية.

أظهرت النتائج تفوق المبيد Pallas بأعطاء افضل النتائج. أذ اعطى المبيد Pallas اقل وزن جاف بلغ 0.8 غم واعلى نسبة تثبيط للوزن الجاف بلغ 99.67% وأعلى مساحة ورقة علم بلغت 48.63 سم^2 وأعلى عدد للأشطاء بلغ 374.9 شطأ/م^2 واعلى حاصل بايلوجي بلغ 14.207 طن/هـ قياسا مع معالة المقارنة التي اعطت اعلى وزن جاف للأدغال (223.8 غم/م^2) واقل نسبة تثبيط للوزن الجاف (0.00%) واقل مساحة ورقة علم (40.33 سم^2) واقل عدد أشطاء (178.6 شطأ/م^2) واقل حاصل بايلوجي (4.805 طن/هـ). واعطى المبيد H-199 اعلى ارتفاع نبات بلغ 98.80 سم قياسا مع معاملة المقارنة التي اعطت اقل ارتفاع نبات (89.07 سم).

كذلك أظهرت النتائج تفوق الصنف Sham 6 أذ أعطى اقل وزن جاف للأدغال بلغ 29.7 غم وأعلى نسبة تثبيط للوزن الجاف بلغت 78.96% واعلى ارتفاع نبات بلغ 105.16 سم واعلى مساحة لورقة العلم بلغت 50.27 سم^2 واعلى عدد أشطاء بلغ 353.6 شطأ/م^2 واعلى حاصل بايلوجي بلغ 13.727 طن/هـ.

كان للتداخل تأثير معنوي أذ اعطت المعاملة بمبيد H-199 مع الصنف Rasheed والمعاملة بمبيد Pallas مع الصنف Sham 6 والمعاملة بمبيد Pallas مع الصنف IPA 99 والمعاملة بمبيد Chevalier مع الصنف IPA 99 اقل وزن جاف بلغ 0.0 و 0.0 و 0.0 و 0.0 غم على التوالي واعطت المعاملة بمبيد Pallas مع الصنف Sham 6 اعلى نسبة تثبيط مئويه بلغت 100.00% واعلى ارتفاع نبات بلغ 110.22 سم واعلى مساحة ورقة علم بلغت 56.16 سم^2 واعلى عدد أشطاء بلغ 408.7 شطأ/م^2 واعلى حاصل بايلوجي بلغ 18.615 طن/هـ.

الكلمات المفتاحية: مبيدات الادغال، *Triticum aestivum* L. ، الادغال، الحنطة.

INTRODUCTION

The method of controlling weeds with chemical herbicides is one of the modern agricultural technologies, as herbicide manufacturing companies annually produce large numbers of herbicides. Although, reducing the problem of weed competition is still below the required level, which prompted manufacturers to continue producing new herbicides that may be successful alternatives to recommended herbicides. The spread of weed in wheat field caused significant yield losses that could reach 50% **(Singh *et al.*, 2020)**. In addition to yield losses, weeds cause other problems during harvesting and marketing. They are also a host for insects and other pests, in addition to increasing production costs and lowering profit for the product **(Galon *et al.*, 2019)**. The important crop is the wheat, as it is the first human food source because it contains 60-90% of starch, protein (16.5-11%), fats (1.5-2%), non-mineral materials (2-1.5%) and vitamins **(Ali *et al.*, 2014)**. Therefore, it required work by all means to raise production to meet the shortfall, as cultivars are an important factor that affects productivity, but they face biotic and abiotic factors that affect that, and weeds are a major obstacle to abundant production **(Hammood & safi, 2018)**. Therefore, it was necessary to use cultivars that have the high competitiveness of the weeds and choose cultivars suitable for the prevailing environmental conditions as well as to maintain the increase in production. The Iraq cultivar gave the lowest average weed dry weight amounted to 33.70 g/m^2 compared to the Abu Ghraib-3 cultivar, which gave the highest average weed dry weight amounted to 44.40 g/m^2 . The cultivars also differed in the characteristic of height, as the cultivar Iraq gave the highest average for this characteristic amounted to 103.69 cm. This treatment did not differ significantly from the cultivar Rasheed, which gave an average height of 100.82 cm, while the cultivar IPA 99 gave the lowest average for this characteristic amounted to 92.86 cm. The cultivars also differed significantly among themselves in the flag leaf area, the IPA 99 gave the highest average for this characteristic amounted to 45.66 cm^2, which did not differ significantly from the cultivar Abu Ghraib-3, which gave 44.84 cm^2. However, the cultivar Iraq recorded the lowest average amounted to 34.85 cm^2, while the cultivars Tahadi, Rasheed and Fateh gave averages reached 41.18, 37.44, and 37.36 cm^2, respectively **(Mohammed *et al.*, 2016)**. Tahadi

cultivar achieved the lowest average weed dry weight, which amounted to 24.09 g/m^2 and the highest average number of tillers amounted to 459.63 tiller/m^2. In comparison the cultivar IPA 99 gave the highest average weed dry weight amounted to 34.22 g/m^2 and the cultivar IPA 95 gave the lowest average number of tillers reached 394.0 tiller/m^2. Furthermore, the cultivar IPA 99 gave the lowest average plant height of 88.79 cm and the highest average biological yield amounted to 2048.7 kg/dunum, compared to cultivar IPA 95, which gave the highest average plant height of 93.33 cm, and the cultivar Tamoz 2, which gave the lowest average biological yield amounted to 1511.5 kg/dunum. The use of Pallas herbicide at a concentration of 500 cm^3/ha with Lancelot herbicide at a concentration of 16 g/ha gave the highest biological yield of 2112.4 kg/dunum, compared with the comparison treatment that gave the lowest average biological yield of 540.7 kg/ha **(Hasoon, 2013)**. The use of herbicides also achieved good results in reducing the number of weeds and their dry weight, which was reflected in the growth indicators. The application of Chevalier herbicide at a concentration of 320 g/ha reduced the dry weight of broad and narrow-leaf weeds for the two study seasons, as it reached 16.6, 10.5, 17.6, and 9.6 g/m^2 respectively. In contrast, the comparison treatment gave the highest mean for this characteristic, which reached 176.5, 116.5, 181.4, and 123.7 g/m^2 , respectively. Thus, this herbicide inhibited the weed dry weight in the two seasons by 90.6%, 91.0%, 90.3%, and 92.2%, respectively, and application of Topic at a concentration of 600 cm^3/ha to control the narrow-leaf weeds resulted in inhibiting the dry weight of them by 94.7% and 93.3%, respectively. Moreover, Logran application with a concentration of 240 g/ha on broad-leaf weeds resulted in inhibiting dry weight by 94.1% and 93.7%, respectively. Chevalier application with a concentration of 320 g/ha and Topic herbicide with a concentration of 600 cm^3/ha and Logran herbicide with a concentration of 240 g/ha gave an average plant height in the first season was 103.7, 97.6, 96.2 cm, respectively, Then, it gave an average of plant height of 105.8, 98.5, 98.0 cm, respectively, compared with the comparison treatment, which gave the lowest average plant height for the two seasons, which was 91.3 and 92.6 cm, respectively. The herbicide gave an average number of tillers for the first season amounted to 474.6, 412.5, 427.7 tiller/m^2 respectively, and gave an average number of tillers for the second season amounted to 486.5, 427.6, 441.7 tiller/m^2 respectively. In comparison, the weedy treatment, which gave the lowest average number of tillers for the two seasons amounted to 385.6, 391.2 tiller/m^2 **(Safi, 2016)**. Sulfosulfuron herbicide at a concentration of 30 g active substance/ha was used with Metsulfuron at a concentration of 2 g active substance/ha it gave the lowest weed dry weight amounted to 4.62 g/m^2 . In contrast, the comparison treatment that gave a weed dry weight of 16.90 g/m^2 and it gave the highest plant height that reached 90.40 cm and the highest number of tillers reached 427 tiller/m^2 and the highest leaf area reached 5.79 cm^2, compared with the comparison treatment that gave the lowest plant height reached 70.60 cm and the lowest number of tillers reached 255 tiller/m^2 and the lowest leaf area reached 4.39 cm^2 **(Singh *et al*., 2020). Bari *et al*.(2020)** found that the use of Alymax (Iodosulfuron + Mesosulfuron) gave the highest average number of tillers of 270.50 tiller/m^2 compared with the comparison treatment that gave the lowest average number of tillers of 180.33 tiller/m^2. In a study conducted by **Shivran *et al*.,(2020)** it was noted that the use of a combination of Halauxifen with Florasulam with Polyglycol at a concentration of 12.76 g/ha after 60 and 90 days. Then, at harvest gave the highest plant height and the highest biological yield reached 41.33 cm, 84.27 cm, 89.47 cm and 12415 kg/ha respectively, compared with the weeds treatment, which gave the lowest plant height of 33.60, 76.00 and 79.53 cm, respectively, and the lowest biological yield amounted to 10438 kg/ha. The use of a combination of Fenoxaprop at a concentration of 100 g/ha with Carfentrazone at a

concentration of 10 g/ha and its combination of Fenoxaprop at a concentration of 100 g/ha with Metsulfuron-methyl at a concentration of 4 g/ha Coupled with Pendimethalin at a concentration of 1 kg/ha gave a biological yield of 11.38 f. 11.01 and 10.56 ton/ha, respectively, compared with the comparison treatment that gave the lowest biological yield of 7.82 ton/ha **(Kumar *et al*., 2020)**. Based on the foregoing, the research idea aimed to evaluating the efficiency of the H-199 herbicide under field test. Besided, comparing it with some herbicides used in controlling companion weeds with some wheat cultivars and the extent of this reflection in some indicators of bread wheat growth.

MATERIALS AND METHODS

A field experiment was carried out in the experimental field of the Department of Field Crops / College of Agricultural Engineering Sciences / University of Baghdad (Al-Jadriya) during the winter season of the year 2021-2022. The efficiency evaluation the of the weed herbicide H-199 was investigated in this study and comparing it with selected herbicides used in reducing the dry weight of the companion weeds with three cultivars of Wheat and its effect on some growth characteristics. The experiment was applied according to the (RCBD) with split plot arrangement by four replicates, as cultivars (IPA 99, Sham 6, and Rasheed) represented the main plots, while control treatments (H-199, Chevalier, Pallas, Atlantis, and weedy) represented the sub plots with the concentrations of herbicides listed in (Table 1).

Table (1): the selected herbicides used in this study

Herbicides	Concentrations	Active substance
H-199	400 g/ha	Clodinafop-propargyl + Metribuzin
Chevalier	300 g/ha	Iodosulfuron-methyl Sodium + Mesosulfuron –methyl
Pallas	500 mL/ha	Pyroxsulam
Atlantis active	270 g/ha	Mesosulfuron-methyl + Idosulfron-methyl – sodium + Mefepyre-diethyl+ Thincobzone methyl
Weedy	0.0	-

Soil service operations were carried out by plowing, harrowing, leveling, dividing and fertilizing according to the recommendations

The following was studied characteristics:

The weed dry weight (g/m^2)

Inhibition ratio (%):

inhibition ratio was calculated according to the following equation **(Al-Chalabi, 2003)**.

$$\text{Inhibition ratio } (\%) = 100 - \frac{A}{B} \times 100$$

Where :

A = weed dry weight in the control treatment

B = weed dry weight in weedy treatment

Growth characteristics:

1. Plant height (cm)
2. Total number of tillers ($tiller/m^2$).
3. The flag leaf area (cm^2)

according to the following equation:

$$\text{The flag leaf area } (cm^2) = \text{lraf length} \times \text{width at the middle leaf} \times 0.95$$

(Thomas, 1975).

4. Biological yield: A random sample of 1 square meter was harvested from each experimental unit and studied immediately upon harvest, then the sample was weighed (straw + seeds).

Statistical Analysis

The data were analyzed using the statistical software GENSTAT , where the arithmetic means were compared using the least significant difference L.S.D method at the Probability level of 5%. The method of analysis of variance for the randomized complete block Design with a split-plot arrangement according **(Gomez & Gomez, 1984)**.

RESULTS AND DISCUSSION

The effect of cultivars and herbicides on the weed dry weight and the inhibition ratio %

The results of (Table 2) indicate that there is a significant effect of the herbicides on the weed dry weight and the inhibition ratio, as the Pallas treatment gave the lowest weed dry weight amounted to 0.8 g/m^2, which did not differ significantly from the rest of the herbicides. However, the comparison treatment gave the highest weed dry weight amounted to 223.8 g/m^2. Also, the treatment with Pallas herbicide gave the highest inhibition ratio amounted to 99.67%, which did not differ significantly from the treatment with Chevalier herbicide. H-199 herbicide gave an inhibition ratio of 99.29% and 98.83%, respectively, compared with the comparison treatment, which gave the lowest inhibition ratio of 0.00%. The reason for giving treatment with herbicides the best average of inhibition ratio due to its efficiency in reducing the weed dry weight (Table 2), which reflected positively on the inhibition ratio. This result agreed with **Safi (2016) ; Singh *et al*.(2020)** who indicated that the use of herbicides reduced the weed dry weight and increased the inhibition ratio in the weed dry weight. The results of (Table 2) indicated that the Sham 6 cultivar gave the lowest dry weight of 29.4 g/m^2 compared to cultivar IPA 99, which gave the highest dry weight of 59.2 g/m^2, which was not significantly different from the Rasheed cultivar, which gave a dry weight of 52.5. g/m^2. This difference between the cultivars in their ability to reduce the weed dry weight may be one of the variation indicators of wheat cultivars in their ability to compete with the weeds. This result agreed with **Mohammed *et al*.(2016)** who indicated that wheat cultivars differed in their ability to reduce weed dry weight. Though, the cultivars did not differ significantly among themselves in terms of the inhibition ratio. The same Table also indicates that there is a significant effect of the interaction between herbicides and cultivars on the weed dry weight. Treatment with Pallas herbicide and Sham 6, Pallas with IPA 99, Chevalier with IPA 99, and H-199 with Rasheed gave less dry weight amounted to 0.0, 0.0, 0.0 and 0.0 g/m^2 respectively. In comparison, the cultivar IPA 99 with the weedy treatment gave the highest weed dry weight amounted to 283.7 g/m^2. The treatment with Pallas and Sham 6 gave the highest inhibition ratio amounted to 100.00%, compared with the weedy treatment and for all cultivars which amounted to 0.0%.

Table (2): Effect of herbicides and wheat cultivars on weed dry weight and inhibition ratio

Cultivars and herbicides		Weed dry weight g/m2	Inhibition %
H-199		3.6	98.83
Chevalier		1.3	99.29
Pallas		0.8	99.67
Atlantis		5.7	97.18
Weedy		223.8	0.00
L.S.D. (P=0.05)		11.36	1.595
Rasheed		52.5	78.83
IPA 99		59.2	79.19
Sham 6		29.4	78.96
L.S.D. (P=0.05)		12.06	N.S
Rasheed	H-199	0.0	100.00
	Chevalier	2.5	98.97
	Pallas	2.5	99.00
	Atlantis	9.6	96.15
	Weedy	247.9	0.00
IPA 99	H-199	10.9	100.00
	Chevalier	0.0	98.97
	Pallas	0.0	99.00
	Atlantis	1.7	96.15
	Weedy	283.7	0.00
Sham 6	H-199	0.0	92.16
	Chevalier	1.5	98.88
	Pallas	0.0	100.00
	Atlantis	5.6	95.92
	Weedy	139.7	0.00
L.S.D. (P=0.05)		20.20	2.676

Effect of herbicides and cultivars on growth indicators and biological yield

The results of (Table 3) indicate that there are significant differences with the effect of herbicides and cultivars on some growth characteristics and biological yield. The herbicide H-199 gave the highest plant height of 98.80 cm, which did not differ significantly from the rest of the herbicides, and the herbicide Pallas gave the highest leaf area of 48.63 cm^2. Pallas also gave the highest number of tillers of 374.9 tiller/m^2, which did not differ significantly from Chevalier and Atlantis, as they gave a number of tillers of 364.5 and 367.3 tiller/m^2, respectively. Pallas gave the highest biological yield of 14.207 ton/ha, while the comparison

treatment gave the lowest plant height of 89.07 cm, the lowest flag leaf area (40.33 cm^2), the lowest number of tillers (178.6 tiller/m^2), and the lowest biological yield (4.805 ton/ha).

The reason for giving herbicide treatments the best averages because these herbicides reduced the weed dry weight and increased the inhibition ratio in it (Table 2), this mean, the absence of the weed competition for growth requirements, which allowed the crop to make maximum use of light, water, Nutrients and the place which led to an increase in the efficiency of the leaves in intercepting the light, that increased its vegetative growth and thus increased its height, the flag leaf area and the number of tillers, which was positively reflected in the increase in the biological yield. This result agreed with **Safi (2016); Singh *et al*.(2020); Shivran *et al*.(2020)** who indicated that the use of herbicides in wheat weed control led to an increase in plant height. Also with what was found by **Mohammed *et al*.(2016)** who indicated that the use of herbicides on the companion weeds to the wheat crop led to an increase in the flag leaf area and agreed with what was reached by **Bari *et al*.(2020)** who indicated that the use of herbicides led to an increase in the tillers efficiency in the plant. Moreover, this results consistent what was found by **Hasson (2013)** who indicated that the use of Pallas on the companion weeds with the wheat crop increased the biological yield, and with what was found by **Kumar *et al*. (2020)** who indicated that the use of herbicides led to an increase in the biological yield. The results of (Table 3) also indicate that the Sham 6 cultivar gave the highest plant height of 105.16 cm, compared to the IPA 99 cultivar, which gave the lowest plant height of 90.67 cm. This result may be attributed to the genetic nature of these cultivars and the difference between them in the number of nodes and the internodes length. Especially, the upper internode, which is one of the important characteristics that distinguish the cultivars, as well as the difference in the content of the hormones auxin and gibberellin, which are responsible for the elongation and expansion of cells, which has a significant impact on plant height **(Al Baldawi, 2006).** The Sham 6 cultivar also gave the highest flag leaf area of 50.27 cm^2 compared to the Rasheed cultivar, which gave the lowest flag leaf area of 41.87 cm^2, and the Sham 6 cultivar gave the highest number of tillers amounting to 353.6 tiller/m^2 compared to the IPA 99 cultivar, which gave the lowest number of tillers of 306.0 tiller/m^2. However Sham 6 cultivar gave the highest biological yield of 13.727 ton/ha, compared to the Rasheed cultivar, which gave the lowest biological yield of 10.121 ton/ha. This is consistent with **Hasson (2013)**; **Said & Jaff (2020)**, who indicated that wheat cultivars differ among themselves in of leaf area and number of tillers. The results showed that there were significant differences between cultivars and herbicides, as the Pallas herbicide treatment with the Sham 6 cultivar gave the highest plant height of 110.22 cm, and the highest flag leaf area of 56.16 cm^2. Besides, the highest number of tillers of 408.7 tiller/m^2, and the highest biological yield of 18.615 ton/ha. In contrast, the comparison treatment of the IPA 99 cultivar gave the lowest plant height of 87.87 cm, and the comparison treatment of the Sham 6 cultivar gave the lowest flag leaf area of 38.55 $cm^{2.}$ Similarly, the comparison treatment of Rasheed cultivar, which gave the lowest number of tillers of 156.3 tiller/m^2, and the comparison treatment of the IPA 99 cultivar, which gave The lowest biological yield was 4.474 ton/ha.

Table (3): Effect of herbicides and cultivars on growth indicators and biological yield

Herbicides and cultivars		Plant height (cm)	Flag leaf area (cm^2)	Number of tillers (tiller/m^2)	Biological Yield (ton/ha)
H-199		98.80	46.83	324.7	11.788
Chevalier		97.37	47.03	364.5	13.216
Pallas		98.33	48.63	374.9	14.207
Atlantis		97.40	46.56	367.3	13.201
Weedy		89.07	40.33	178.6	4.805
L.S.D.(P=0.05)		3.766	0.991	24.73	0.6317
Rasheed		92.75	41.87	306.4	10.121
IPA 99		90.67	45.48	306.0	10.482
Sham 6		105.16	50.27	353.6	13.727
L.S.D.(P=0.05)		4.737	0.873	24.73	0.6716
Rasheed	H-199	93.75	42.69	283.5	9.877
	Chevalier	93.00	41.67	363.6	12.186
	Pallas	93.12	41.91	389.1	11.715
	Atlantis	94.26	41.53	339.6	11.696
	Weedy	89.62	41.59	156.3	5.130
IPA 99	H-199	92.45	43.87	288.7	11.546
	Chevalier	91.70	47.72	330.7	12.877
	Pallas	91.65	47.82	327.0	12.291
	Atlantis	89.67	47.13	373.8	11.222
	Weedy	87.87	40.86	209.7	4.474
Sham 6	H-199	110.20	53.95	402.0	13.942
	Chevalier	107.40	51.69	399.1	14.585
	Pallas	110.22	56.16	408.7	18.615
	Atlantis	108.27	51.00	388.5	16.683
	Weedy	89.72	38.55	169.8	4.810
L.S.D.(P=0.05)		7.046	1.689	24.73	1.1232

CONCLUSION

The treatment with chemical herbicides achieved the best results and for all characteristics compared to the comparison treatment, which gave the lowest averages. This result was achieved as a result to what it recorded in reducing the weed dry weight and thus increasing the inhibition ratio. Regarding of herbicides, Pallas achieved the best results for most of the characteristics. Regarding cultivars, the sham 6 cultivar achieved the best averages. Likewise, the interaction treatment between sham 6 and Pallas gave the best averages for all characteristics.

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