Comparison of the effect of four types of herbicides on the growth traits of wheat and weed-associated

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Abstract

A field experiment was conducted during the 2023-2024 season to study the effect of four different types of selective herbicide, namely Prince, Weather, Axial and Atlantis, on some growth traits and yields of two cultivars of wheat plants, the Wafia and Ozkan cultivar, as well as to study the effect of these Herbicide on the traits of weeds growing with wheat plants. In two locations, the first location is in Wana district, and the second location is in Al- Abbasiya area on the outskirts of Mosul. The field was prepared in both locations by conducting the necessary agricultural operations, and the experiment was designed according to the RCBD design, where the field was divided into three replicates, and one replicate was divided into 10 experimental units. The data was statistically analyzed using the (GenStat) program and using the Duncan test. The results of the discussion showed that the Prince treatment was excelled and gave the highest value amounting to 3 weed m^2 - in the first location. As for the second location, the Axial treatment was excelled and gave a value amounting to 0.50 weed. m^2 . As for the dry mass of the thin weed was excelled to both the Prince Weather treatment and gave the highest value of 2. 46 and 46.3 $g.m^2$ - respectively, in the first location. The Axial treatment was excelled in the second location and gave the highest value of 8.82 weeds. In the second location, the herbicide Weather also excelled and recorded a value of $1.g.m^{-1}$. As for the mass of dry broadleaf weeds in the first location, the herbicide Axial excelled and gave the highest value of 61.10 g . As for the second location, the Prince herbicide was recorded and gave the highest value amounting to 29.10 gm. As for the growth traits and yield, it was shown that the plant height traits did not differ significantly in the first location. As for the second location, it also showed that there were no significant differences, and the biological yield traits showed that it was excelled in the first location. The Axial herbicide gave the lowest value, amounting to 1545.00 g. As for the second location, the Axial herbicide also gave the highest value, amounting to 1412.50 g.

introduction

Bread wheat (*Triticum estivual* L.) is considered one of the most important crops belonging to the Poaceae family. It is considered one of the first cereal crops that humans cultivated and improved from thousands of years ago until the present day. It is also considered one of the most abundant cereal plants in the world. However, this increase in Wheat production increased more than 11-fold, mainly due to the adoption of high-yield wheat crop cultivars and increased use of fertilizers, irrigation, and herbicide [12] .Wheat occupies first place in terms of the agricultural areas it occupies, as the area exploited by wheat cultivation during the agricultural season (2021-2022) was estimated at approximately 222.19 million hectares, with a yield rate of 3.1 tons per hectare, and a productivity of 779.24 million tons. The countries are Europe, India, Russia, China, Canada, and America. Australia is one of the largest wheat producing countries[11].(The competition between the plant and its accompanying weeds for the most important growth factors, especially in the critical stages of growth, results in a clear decline in the

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grain yield of field crops, especially wheat, as it has a weak weed climate compared to other crops, as the growth of thin and wide weeds leads to a reduction in the productivity of the wheat crop and a deterioration in its quality. The continuous use of Herbicide, including herbicide, causes another problem known as weed control, which is the development of resistance of the weeds of the same target weed to the herbicide during its acquisition of resistance or through an increase in the number of genotypes to the herbicide belonging to the same targeted plant species[6].

Materials and methods

The study experiment was conducted in the winter season 2022-2023 in two different locations, the first location in Wana area, and the second location in Abbasiya area on the outskirts of the city of Mosul. Agricultural operations were carried out, including plowing, smoothing and leveling the soil. The experiment was designed according to the RCBD design, where the field was divided into three replicates and each sector was divided into (10) experimental units, each of which had an area of (6) m^2. Planting was done in the form of lines, and the distance between one line and another was 20 cm and between one replicate and another 2 meters, with a seed rate of 35 kg $dunam^{-1}$ on 11/29/2022 for the first location (Wana) and on 11/30/2022 for the second location (Abbasiya). Dab fertilizer was added, and harvesting took place at both locations on 5/28/2023. Means were tested using Duncan's test. A comprehensive survey of the thin and broad-leaved weeds present in the two experimental fields and their density was conducted on 4/1/2023 for the Wana location and on 4/4. 6/2023 for the Abbasiya location, that is, about 40 days after spraying the chemical Herbicide, the weeds were placed in paper bags for the purpose of drying, then they were transported to the laboratory and dried in the oven at a temperature of 72% until the weight was stable, and the following traits were studied:

1- weeds traits

Density of fine-leaved weeds

Dry mass of fine-leaved weed

Density of broadleaf weeds

Dry mass of broad-leaved weed

2- Growth traits and yield of wheat

Plant height

Biological yield

Statistical analysis

The data were analyzed statistically using the Gen Stat program according to the RCBD design and using Duncan's multiple range test to compare the means at the probability level (5%), which indicates that the means followed by the same letters are not significantly different from each other. While the means followed by different letters differ significantly from each other[3] .

Results and discussion

Density of fine-leaved weeds

a. The first location (Wana)

The results obtained from Table (1) indicate that there is a significant effect in reducing the density of fine-leaved weeds if the Prince herbicide treatment was significantly excelled on the herbicide Axial and Atlantis, and control treatment without herbicide did not differ significantly from the Weather herbicide, as it gave a weed density of (3)

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weeds.m. $^{-2}$ The efficiency of the herbicide in reducing weeds was (88%). This result indicates the efficiency of the Prince herbicide or the efficiency of the selective Herbicide in reducing weeds compared to the control treatment, and this is consistent with what was stated by[7] that the use of herbicide leads to reducing the density of weeds. The results presented in Table (1) also showed that there was no significant effect of the rate of cultivars on the density of fine-leaved weeds, although the density of weeds in the Wafa cultivar was less than that of the Ozkan cultivar, as the weed density in it reached (8.87) weed.m-2, and this is consistent with What he stated is consistent with the results of[9] .

Table (1) Effect of chemical Herbicide and cultivars on the density of fine-leaved weeds for the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
c 3.00	d 2.66	d c 3.33	Prince
c b 5.00	d c 3.66	d c 6.33	Weather
b 5.83	d c 5.66	d c 6.00	Axial
b 6.33	c 7.33	d c 5.33	Atlantis
a 25.83	a 28.33	b 23.33	without Herbicide
9.20	a 9.53	a 8.87	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
c 1.66	c 2.00	d c 1.33	Prince
d 1.00	c 2.00	e 0.00	Weather
d 0.50	e 0.00	d 1.00	Axial
b 4.00	b 4.00	b 4.00	Atlantis
a 5.16	a 5.00	a 5.33	without Herbicide
2.46	a 2.66	b 2.33	average

Note: Values with similar letters indicate that there is no significant difference between them B. The second location (Abbasiya):

The results obtained from Table (1) indicate that there is a significant effect of Herbicide in reducing the density of fine-leaved weeds, as the herbicide Axial excelled in providing the lowest density of fine-leaved weeds, amounting to (0.50) weed.m-2, with an efficiency rate of (86%), which did not differ. Significantly higher than the herbicide Weather, which gave (1.00) d.m-2, and this is attributed to the efficiency of the weeds herbicide Axial in reducing the density of fine-leaved weeds, and this is consistent with what was indicated by[4] that spraying the herbicide Weathers on the weeds accompanying the

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wheat crop has reduced the density. weeds.As indicated that there were significant differences between the cultivars in their ability to reduce the density of fine-leaved weeds, as the wheat cultivar Wafa excelled and achieved the lowest value for the weeds density rate, amounting to (2.33) weed.m-2, and it did not differ significantly from the Ozkan wheat cultivar, which gave (2.60) DGL.M-2. The variation in the effect of for the cultivars, the results cultivars on weed density may be due to the difference in the ability of cultivars to compete with weeds and to the nature of the growth of the accompanying weeds and their life cycle. This result is consistent with what was found by[9] who confirmed the variation of cultivars in competition with weeds.

Dry mass of fine-leaved weed.

a. The first location (Wana).

The results obtained from Table (2) indicate that there is a significant effect of the Herbicide in reducing the dry mass of fine-leaved weeds, where both the Prince herbicide and the Weather herbicide were significantly excelled on the Axial and Atlantis Herbicide and control treatment to give them the lowest average dry mass of the fine-leaved weed, amounting to (46.2, 46.3). gm^{-2}, respectively, as the efficiency of the Prince herbicide in reducing the mass of weeds reached (70%) compared to control treatment, which amounted to (157.6) gm^{-2}, and this is due to the efficiency of these two Herbicide in inhibiting weeds and agreed with the results of [1] who indicated that the use of herbicide reduced the dry mass of weeds.As for the cultivars, the results obtained from Table (2) indicate that there is no significant effect of the cultivars in reducing the dry mass of the fine-leaved weed, as the cultivar Wafa and Ozcan recorded (80.5 and 79.5) gm^{-2}, respectively.

B: The second location, Abbasiya

The results shown in Table (2) indicate that there is a significant effect of Herbicide in reducing the dry mass of fine-leaved weeds, as the Axial herbicide was significantly excelled on the Prince and Atlantis herbicide by giving it the lowest dry mass of (8.82) gm^{-2}, with an efficiency rate of (81%) and no It differs significantly with the Weather herbicide, which recorded (9.65) gm-2 compared to control treatment, which gave the highest dry mass of (48.50) gm^{-2}. This is attributed to the high efficiency of the herbicide Axial in reducing the dry mass of the weed compared to control treatment, its weak growth and decreased Its metabolic rate increases, and thus its dry mass decreases. This result is consistent with what was found by[5] who indicated that the use of herbicide leads to a reduction in the dry mass of the weed. As for the cultivars, the results showed a significant effect of the cultivars in reducing the dry mass of the fine-leaved weed, as the Wafia cultivar excelled and gave the lowest average dry mass of the weed, amounting to (26.77) gm^{-2}, compared to the Ozkan cultivar, which gave the highest average dry mass of the weed, amounting to (28.88). GM-2 The reason for this may be due to the efficiency of the cultivar in its competitive ability, which led to a weak weed mass[8].

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Table 2: Effect of chemical Herbicide and cultivars on the mass of fine-leaved weeds for the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
d 46.2	f 35.93	e 56.50	Prince
d 46.3	f 36.93	e 55.60	Weather
b 88.5	c 96.60	e 80.47	Axial
b 61.30	e 61.30	e 61.40	Atlantis
a 157.6	a 166.63	b 148.60	without Herbicide
80.0	a 79.5	a 80.5	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
c 26.22	c 29.97	d 22.47	Prince
d 9.65	e 19.30	f 0.00	Weather
d 8.82	f 0.00	e 17.63	Axial
b 45.93	b a 46.93	b 44.93	Atlantis
a 48.50	a 48.20	a 48.80	without Herbicide
27.82	a 28.88	b 26.77	average

Note: Values with similar edges indicate that there is no significant difference between them

Density of broadleaf weeds.

a. The first location.

The results obtained from Table (3) indicate that there is a significant effect of Herbicide in reducing the density of broadleaf weeds, if the herbicide Weather was significantly excelled on all other control treatments and control treatment and recorded a lower density of weeds of (5.17) plants.m2 - with an efficiency rate of (74%).) for the indoor treatment that recorded the highest average for the trait, amounting to (20.00) plants.m^2 - This is due to the efficiency of the herbicide in eliminating or reducing the presence of broad-leaved weeds.As for the cultivars, there were no significant effects of the cultivars on the density of broadleaf weeds, as the cultivar recorded loyalty and weights of (10.67, 10.80) plants.m2, respectively.

B. The second location

The results obtained from Table (3) indicate the presence of a significant effect of the Herbicide, as the herbicide Weather was excelled to the rest of the other treatments and control treatment significantly, and it did not differ significantly with the herbicide Prince, as the herbicide Weather was given the lowest density of broad weeds (1.50) plants.m2 - with an efficiency rate of (86%) The reason is due to the efficiency of this herbicide in reducing the presence of weeds and weakening their growth, and this agrees with what was mentioned by some researchers working in the field of selective Herbicide [6] .As for the cultivars, the Wafaa cultivar excelled on the Ozkan cultivar in this location and recorded the highest average of (5.7) plants.m2. This is

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due to the differences in the cultivars in their ability to compete with weeds, especially broad-leaved ones.

Table (3) Effect of chemical Herbicide and cultivars on the density of broadleaf weeds for the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
c 9.33	f e 8.00	c 10.67	Prince
e 5.17	g 5.00	g 5.33	Weather
d 7.33	e d 8.67	g f 6.00	Axial
b 11.83	c 11.00	c 12.67	Atlantis
a 20.00	a 21.30	b 18.67	without Herbicide
10.73	a 10.80	a 10.67	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
d 2.50	d c 2.66	d 2.33	Prince
d 1.50	d 1.33	d 1.66	Weather
c 5.00	b 6.00	c 4.00	Axial
b 7.00	b 7.33	b 6.66	Atlantis
a 11.33	a 12.00	a 10.66	without Herbicide
5.47	a 5.87	b 5.07	average

Note: Values with similar edges indicate that there is no significant difference between them
Dry mass of broad-leaved weed.

A. The first location

The results of Table (4) showed that there was a significant effect of Herbicide on the mass of broad-leaved weeds, as the herbicide Axial excelled and recorded the lowest dry mass for broad-leaved weeds, amounting to (61.10) gm2 - a control efficiency of (67%) compared to control treatment, which recorded the highest. The dry mass of the weed amounted to (190.10) gm2. The difference in the dry mass of the weed is due to the difference in the density of weeds per unit area (Table 6). This is consistent with the findings of[2] who noticed a decrease in the mass of broad-leaved weeds. When using chemical Herbicide on henbane plants With regard to the cultivars, the results shown in Table (4) showed that the wheat cultivars differed significantly in their ability to reduce the dry mass of broad-leaved weeds, as the cultivar gave the lowest average mass weights of (88.80) gm^{-2}. The difference between the cultivars is in their ability to reduce Weed dry weights are one of the indicators of the variation of wheat cultivars in their ability to compete with weeds.

B . Second location

The results in Table (4) indicate the superiority of the herbicide Prince over the rest of the treatments, as it recorded the lowest dry mass of the broad-leaved weed (29.10)

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gm-2, with an equivalent control rate of (86%) compared to control treatment, which recorded the highest dry mass of the broad-leaved weed of (29.10) gm-2. (222.80) gm^{-2},.As for the cultivars, the results showed that there were no significant differences between them, as the Wafiyah and Ozkan cultivar recorded (116.60, 112.20) g. $m^{-2.}$

Table (4) Effect of chemical Herbicide and cultivars on the mass of broadleaf weeds for the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
b 99.60	c 95.90	c 103.40	Prince
c 74.00	c 94.80	d 53.30	Weather
c 61.10	c 86.60	d 35.50	Axial
a 100.80	c 108.40	c 93.30	Atlantis
a 190.10	a 221.50	b 158.60	without Herbicide
105.10	a 121.40	b 88.80	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
e 29.10	e 23.60	e 34.60	Prince
c 82.80	c 79.00	c 86.70	Weather
d 56.20	d 55.30	d 57.10	Axial
b 181.10	b 78.40	b 183.90	Atlantis
a 222.80	a 224.60	a 220.90	without Herbicide
114.40	a 112.20	a 116.60	average

Note: Values with similar edges indicate that there is no significant difference between them
Traits of growth and yield.

Plant height (cm).

a. The first location.

The results obtained from Table (5) indicate that plant height was not significantly affected by the control treatments, as the control treatment without herbicide was excelled to some herbicide treatments because the wheat plants grown in the domesticated treatment competed with the weeds for the nutrients available in the soil, but the weeds were It is more efficient in obtaining these elements and less equipped with the elements for wheat plants, thus affecting their height.

The cultivars also did not differ significantly among themselves in plant height, as the two cultivars were good cultivars with a good growth rate and high growth efficiency.

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Table (5) Effect of chemical Herbicide and cultivars on plant height for the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
b a 81.10	c b a 81.60	c b a 80.65	Prince
b 74.70	c b 75.00	c b 74.47	Weather
b a 82.10	c b a 79.67	b a 84.53	Axial
b 78.20	c 71.27	b a 85.10	Atlantis
a 88.20	a 87.87	a 88.57	without Herbicide
80.90	a 79.10	a 82.70	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
a 80.60	c b a 81.30	c b a 80.00	Prince
b 72.80	c b a 74.10	c b 71.47	Weather
b a 77.30	c b a 78.33	c b a 76.33	Axial
b a 76.50	c 70.40	b a 82.53	Atlantis
a 82.00	c b a 80.10	a 83.83	without Herbicide
77.80	a 76.80	a 78.80	average

Note: Values with similar letters indicate that there is no significant difference between them
B. The second location.

The table results obtained from Table (5) also showed that there was no significant effect of the control treatments on plant height, as control treatment excelled on the other herbicide treatments due to the competition that also occurred between the plant and the weeds. As for the cultivars, they did not differ from each other significantly because the two cultivars were from Good cultivars with good growth rate and high growth efficiency

Biological yield (gm^{-2})

a. The first location

The results of Table (6) showed that there were significant differences in the first location, as the herbicide Axial excelled and gave the highest average for the biological yield, amounting to (1545.00) gm-2, with an efficiency rate of (22%) compared to control treatment, which gave the lowest average for the trait, amounting to (1195.00). gm-2. The reason for the increase in biological yield when treated with Axial herbicide may be attributed to the lack of weeds competing with the plant for growth factors. As for the cultivars, there are no significant differences, although the Wafa cultivar gave the highest average biological yield, amounting to (1405.00) gm. -2.

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Table (5) Effect of chemical Herbicide and types on the biological yield of the two experimental locations.

first location			
cultivars			Herbicide
average	Ozcan	wafia	
b a 1433.00	b a 1393.00	b a 1473.00	Prince
b a 1422.00	b a 1400.00	b a 1443.00	Weather
a 1545.00	a 1543.00	a 1547.00	Axial
b 1343.00	c b 1327.00	c b a 1360.00	Atlantis
c 1195.00	c 1190.00	c 1200.00	without Herbicide
1388.00	a 1371.00	a 1405.00	average
second location			
cultivars			Herbicide
average	Ozcan	wafia	
a 1383.30	c b a 1353.00	b a 1413.00	Prince
b a 1361.70	c b a 1357.00	c b a 1367.00	Weather
a 1412.50	c b a 1375.00	a 1450.00	Axial
b 1315.00	d c 1313.00	d c b 1317.00	Atlantis
c 1216.70	e 1197.00	e d 1237.00	without Herbicide
1337.80	b 1319.00	a 1356.7.00	average

Note: Values with similar letters indicate that there is no significant difference between them
Second location

The results of Table (5) showed that the use of chemical Herbicide led to significant differences in the average biological yield in the second location, as the Axial herbicide also excelled in the second location and gave the highest average for the trait amounting to (1412.50) gm-2, with an increase rate of (13%) compared to With control treatment, which gave the lowest average of (1216.70) gm-2

As for the cultivars, the Wafaa cultivar gave the highest average for the biological yield trait, amounting to (13567.00) gm-2. The reason is due to the efficiency of the cultivar and its ability to compete with weeds by increasing the plant height, the number of shoots, and the number of ears, which increased the biological yield.

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