# Impact of Seeding Rate and Herbicides on Growth and Yield of Bread Wheat (*Triticum aestivum*) and Associated Weeds

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## Abstract

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The experiment was conducted in two locations during the 2022-2023 season, the first in the Al-Balwat village, and the second in the Hammam Al-Alil district, Nineveh Governorate, Iraq. The study aimed to determine the optimum concentration of chemical herbicides and the optimum seeding rate, and to assess their effects on growth traits, grain yield of bread wheat, and associated weed flora. The experiment comprised two factors: (i) seeding rates (120, 140, and 160 kg ha$^{-1}$) for the bread wheat cultivar Babylon-113, and (ii) different herbicides applied at varying concentrations, in addition to an untreated control (no herbicide). The measured parameters were: total weed density (weeds m$^{-2}$), total weed dry biomass (g m$^{-2}$), plant height (cm), flag leaf area (cm$^2$), spike density (spikes m$^{-2}$), number of grains per spike, 1000-grain weight (g), and grain yield (g m$^{-2}$). The results obtained indicated that the herbicide Traxos R.C. and Discipline R.C. were the most efficient in reducing the weeds density and dry weight at both locations of Al-Balawat and Hammam Al-Alil, with a control efficiency that reached 58.75, 63.77, 60.53 and 57% for both herbicides and locations, respectively. The herbicide Discipline R.C. had a significant effect on the number of spikes and grain yield at both locations. The seeding rate of 160 kg/ha was better than the other seeding rates in reducing weeds and increasing yield. Grain yield at this seeding rate was higher by 24.05 and 24.90% than the yield of the seeding rate of 120 kg/ha at the two locations, respectively.

**Keywords:** Herbicides, seeding rates, weeds, Discipline-OD, Traxos, *Triticum aestivum* L.

## Introduction

Bread wheat, *Triticum aestivum* L. is one of the most important food crops in the world. However, yield could be increased up to 11-fold if highly productive varieties are adopted with optimal use of irrigation, fertilizers, and herbicides (Wahab & Aljuburi, 2023a). Wheat production in Iraq reached 4248k tons for the 2023 season, an increase of 53.6% over the previous year's production. Nineveh Governorate was ranked first in terms of production in Iraq (ASGIS, 2023). The competition among weeds and wheat plants depends on many factors including weed density and the competitive ability of the wheat crop. Increasing seeding-rate is a tool to reduce the spread of weeds, and consequently, increase wheat grain yield (Riya *et al*., 2017). Many farmers prefer to control weeds using chemical methods due to their effectiveness at a lower cost and effort with less mechanical damage to the crop that happens during manual weeding (Aljuburi & Anter, 2021; Mohammadi & Ismail, 2018). Furthermore, the reduction of weeds dry weight and their growth inhibition by herbicides within the wheat crop can be achieved using a mixture of herbicides (Al-Mutrifi *et al.,* 2014). In addition, some manufacturers add substances known as "Safaner" to weed killers to protect crops from damage caused by selective herbicides after spraying operations without compromising weed control effectiveness (Aljuburi & Anter, 2021).

Seeding rate is one important method that significantly affects the grain quality and productivity of the wheat crop (Batool *et al.,* 2022). Determining the optimal seeding rate is an important factor for obtaining a high yield of quality grains (Megerssa *et al*., 2023). This study aimed to determine the optimum seeding rate and the best chemical herbicides concentration to be used to get the best wheat grain yield and the best control of the associated weeds.

## Materials and Methods

An experiment was carried out for the 2022-2023 season in two locations, the first in the Al-Balwat village of the Hamdaniya district, 39 km southeast of the Mosul city-Nineveh Governorate-Iraq, and the second location at Hammam Al-Alil district, 49 km south of Mosul city-Nineveh Governorate- Iraq, with different soil textures to find out the effect of the optimal seeding rate and the best concentration of chemical herbicides used with their effect on the growth, and yield of bread-wheat and associated weeds observed at both locations (Table 1).

**Table 1.** Weeds observed at the two experimental locations.

| Weeds scientific name | Plant family |
|---|---|
| *Hordeum glaucum* L., *Bromus* spp., *Lolium rigidum* L., *Avena fatua* L. | Poaceae |
| *Raphanus raphanistrun* L., *Brassica arvensis, Capsella bursa-postoria L.* | Brassicaceae |
| *Silydum marinum* L., *Carthamus oxyacanthus M.B.,* | Asteraceae |
| *Malva rotundifolia* L. | Malvaceae |

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**Seeding rates and herbicides used**
Three seeding rates were tested (120, 140, and 160 kg/ha), and two herbicides [Traxos one (Navigator) and Discipline-OD] (Table 2) were used at 3 concentrations [recommended concentration (R.C.), 25% less than the R.C. (-25), and 25% higher than the R.C. (+25)], and negative control (no herbicide).

**Experiment design and statistical analysis**
The experiment was designed following the randomized complete block design (RCBD] with the split-block system, with the seeding rates placed in the main plot, and chemical herbicide concentrations were placed in the sub-plot. SAS program was used for data analysis. The Duncan multi-range test was used to determine the significance between means at P=0.05 (Al-Rawi & Khalafallah, 2000).

**Agricultural practices**
The experiment field was prepared, plowed and the soil was smoothed and the seeds were sown (Babylon-113) cultivar on 25$^{th}$ Nov. 2022 at the Al-Balawat location, and on 26$^{th}$ Nov. 2022 at the Hammam Al-Alil location. The experimental unit area (24 $m^2$). DAP [di-ammonium phosphate] fertilizer was added at 50 kg/dunum, and the urea fertilizer at 30 kg/dunum, applied at two stages, at planting and at the tillering stage. Herbicides spray was carried out at the weeds 3-5 leaves stage. Wheat grains were harvested on 29$^{th}$ May 2023 at the Al-Balwat location and on 30$^{th}$ May 2023 at the Hammam Al-Alil location.

**Traits studied**
The following traits were assessed: weeds number (weeds/$m^2$); weeds dry weight (g/$m^2$); plant height (cm); flag leaf area ($cm^2$) by using the following equation: Flag leaf area [FLA] ($cm^2$) = length×maximum width×0.95 (Thomas, 1975); spikes number/$m^2$; grains number/spike; 1000 grains weight (g); and Grain yield (g/$m^2$).

## Results

**Effect of herbicides and wheat seeding rate on weeds density**
Results obtained (Table 3) at Al-Balwat location the herbicides Discipline R.C. and Traxos R.C., produced the highest effect in reducing weed density (6.661 and 6.25 weeds/$m^2$, respectively), as compared to the negative control treatment (no herbicide) which produced the highest weed density (19.194 weeds/$m^2$). At the Hammam Al-Alil location, the same treatments also excelled significantly (5.0 and 5.33 weeds/$m^2$) compared to the negative control treatment (15.33 weeds/$m^2$).

At the Al-Balwat location, the seeding rate of 160 kg/ha, produced significantly the lowest weed density (8.333 weeds/$m^2$), whereas the seeding rate of 120 kg/ha produced 14.755 weeds/$m^2$. At the Hammam Al-Alil location, the same two seeding rates had more or less a similar effect on weeds density (6.66 and 11.81 weeds/$m^2$, respectively) (Table 4).

At the Al-Balwat location, the weed density following Discipline R.C. and Traxos R.C. herbicides treatments at a seeding rate of 160 kg/ha reached 3.783 and 4.567 weeds/$m^2$, respectively, whereas the weed density for the no-herbicide treatment at the seeding rate of 120 kg/ha reached 25.05 weeds/$m^2$. At the Hammam Al-Alil location, the seed density following the Discipline R.C. and Traxos R.C. herbicides treatment at a seeding rate of 160 kg/ha reached 3.0 and 3.66 weeds/$m^2$, respectively, whereas the weed density at the no-herbicide treatment with seeding-rate of 120 kg/ha reached 20.0 weeds/$m^2$ (Table 5).

**Effect of herbicides and wheat seeding rate on weeds dry weight**
The weeds dry weight at the Al-Balwat location following the herbicide Discipline +25, Discipline R.C., and Traxos R.C. treatments reached 7.187, 7.531, and 8.184 g/$m^2$, respectively, whereas weeds dry weight following the no-herbicide treatment reached 19.842 g/$m^2$. At the Hammam Al-Alil location, the weeds dry weight following the use of the same herbicides reached 4.599, 4.821, and 5.258 g/$m^2$, respectively, compared to 12.761 g/$m^2$ for the no-herbicide treatment (Table 3).

At Al-Balwat location, weeds dry weight following the seeding rate of 160 kg/ha reached 5.939 g/$m^2$, whereas following the seeding rate of 120 kg/ha reached 17.92 g/$m^2$. In the Hammam Al-Alil location, weeds dry weight following the seeding rate of 160 kg/ha reached 3.789 g/$m^2$, whereas following seeding rate of 120 kg/ha it reached 11.45 g/$m^2$ (Table 4).

**Table 2.** Herbicides used and their properties.

| Trade Name | Active substance | Chemical Group | Application rate | Target weeds |
|---|---|---|---|---|
| Traxos one (Navigator) | 30g/L of Pinoxaden, 30g/L of Clodinafop-propargyl, 7.5 g/L of Florasulam, 7.5g/L of Cloquitocet-mexyl | Phenylpyrazoline | 1 L/ha | Broad and narrow-leaved weeds in wheat. |
| Discipline-OD | Diflufenican 5% w/v, Mesosulfuron Methyl 0.75% w/v, Iodosulfuron-Methyl 0.25% w/v, Mefenpyer-Diethyl 2.25% w/v | Sullfonylurea | 1.25 L/ha | Broad and narrow-leaved weeds in wheat. |

At the Al-Balwat location following the use of the Discipline R.C. herbicide at the seeding-rate of 160 kg/ha, the weeds dry weight reached 3.075 g.m$^2$), whereas with the no-herbicide treatment with 120 kg/ha seeding rate it reached 30.587 g/m$^2$. At the Hammam Al-Alil location, the weeds dry weight following the same treatment reached 1.963g/m$^2$ compared to 19.633 g/m$^2$ for the no-herbicide treatment with seeding rate of 120 kg/ha (Table 5).

**Effect of herbicides and wheat seeding rate on weeds plant height**

Weeds plant height with no-herbicide treatment reached 106.261 cm at the Al-Balwat location and 101.76 cm at the Hammam Al-Alil location, and was significantly higher than all other treatments (Table 3).

Weeds plant height at Al-Balwat location with wheat seeding rate of 160 kg/ha reached 100.702 cm, and with wheat seeding rates of 120 and 140 kg/ha reached 97.073 and 98.743 cm, respectively. As for the Hammam Al-Alil location, weeds plant weight with wheat seeding rates of 120, 140 and 160 kg/ha reached 50.643, 46.891 and 46.511 cm, respectively (Table 4).

Weeds plant height at Al-Balwat location with no-herbicide treatment and wheat seeding rate of 160 kg/ha reached 111.667 cm, whereas when the herbicides Traxos-25, Traxos R.C. and Traxos +25 were used with wheat seeding rate of 120 kg/ha, it reached 95.493, 95.133 and 94.833 cm, respectively. At the Hammam Al-Alil location, the no-herbicide treatment with 120 kg/ha, weeds plant height reached 107.33 cm, whereas it reached 87.16 cm when the herbicide Discipline +25 was used with wheat seeding rate of 120 kg/ha (Table 5).

**Effect of herbicides and wheat seeding rate on wheat flag leaf area**

At the Al-Balwat location, following the application of the herbicides Traxos+25, Discipline R.C. and Discipline +25, the wheat flag leaf area reached 39.466, 39.597 and 39.244 cm$^2$, respectively. On other hand, with no-herbicide treatment, the wheat flag leaf area reached 34.474 cm$^2$. At the Hammam Al-Alil location, the wheat flag leaf area following the use of the herbicide Traxos R.C. reached 45.732 cm$^2$, and reached 38.727 cm$^2$ in the non-herbicide treatment (Table 3).

At the Al-Balwat location with wheat seeding rate of 120 kg/ha, the wheat flag leaf area reached 42.618 cm$^2$, whereas in the wheat seeding rate of 160 kg/ha treatment the wheat flag leaf area reached 33.020 cm$^2$. At the Hammam Al-Alil location, there was no significant differences in the wheat flag leaf area between the different wheat seeding rates used (Table 4).

At the Al-Balwat location, when the different herbicides with seeding rate 120 kg/ha at Traxos +25. Discipline R.C. and Discipline +25 were used with wheat seeding rate of 120 kg/ha, the wheat flag leaf area reached 44.100, 44.300 and 44.920 cm$^2$, respectively. However, with no-herbicide treatment and wheat seeding rate of 160 kg/ha, the wheat flag leaf reached 29.672 cm$^2$. At the Hammam Al-Alil location, the use of Traxos R.C. herbicide with wheat seeding rate of 120 kg/ha, the wheat flag leaf area reached 49.518 cm$^2$, whereas with no-herbicide treatment and wheat seeding rate of 160 kg/ha, the flag leaf area reached 35.993 cm$^{-2}$ (Table 5).

**Effect of herbicides and wheat seeding rate on number of wheat grains per spike**

The number of wheat grains at the Al-Balwat location in response to using the herbicide Discipline R.C reached 48.494 grains/spike, compared to 37.522 grains/spike for the no-herbicide treatment. At the Hammam Al-Alil location, the number of wheat grains following the application of Discipline R.C. and Discipline +25 herbicides reached 42.347 and 42.688 grains/spike, respectively. The application of Traxos R.C. herbicide led to the production of 41.562 wheat grains/spike, whereas the no-herbicide treatment produced 35.476 grains/spike (Table 3).

At the Al-Balwat location and by using a wheat seeding rate of 120 kg/ha, wheat grains/spike reached 46.94, whereas at seeding rate of 160 kg/ha, it reached 42.343 grains/spike. In the Hammam Al-Alil location, at seeding rates of 140 and 120 kg/ha, the number of wheat grains/spike reached 41.517 and 41.109, respectively, compared to 39.135 grains/spike when the wheat seeding rate of 160 kg/ha was used (Table 4).

At the Al-Balwat location, the use of the herbicide Discipline R.C. at a wheat seeding rate of 120 kg/ha produced 51.283 grains/spike, whereas the seeding rate of 160 kg/ha with no-herbicide treatment led to the production of 34.25 grains/spike. At Hammam Al-Alil location, the use of the herbicide Discipline + 25 with a seeding rate of 140 kg/ha led to the production of 43.752 wheat grains/spike, compared to the control (no herbicide) at seeding rate of 160 kg/ha which produced 32.707 grains/spike) (Table 5).

**Effect of herbicides and wheat seeding rate on spikes density per unit area**

At the Al-Balwat location, the wheat spikes density per unit area following the use of the herbicide treatments Discipline R.C. and Discipline +25] reached 426.8 and 427.3 spike/m$^2$, respectively, however following the Traxos R.C. herbicide treatment, it reached 403.4 spikes/m$^2$, compared to 318.6 spikes/m$^2$ for the no-herbicide treatment. Similar results were obtained at the Hammam Al-Alil location (Table 3).

At the Al-Balwat location, the wheat spikes density per unit area following the seeding rate of 160 kg/ha reached 441.3 spikes/m$^2$, whereas following seeding rate of 120 kg/ha, it reached 304.3 spikes/m$^{/2}$. As for the Hammam Al-Alil location, and at seeding rate of 160 kg/ha, the wheat spikes density reached 436.60 spikes/m$^{/2}$, and at seeding rate of 120 kg/ha, it reached 296.70 spikes/m$^{/2}$ (Table 4).

At Al-Balwat location, the combined effect of herbicides Discipline R.C. and Discipline +25 treatments with seeding rate of 160 kg/ha, the wheat spikes density reached 473.3 and 483.6 spike/m$^2$, respectively, compared to 266.0 spikes/m2 for the no-herbicide treatment at seeding rate of 120 kg/ha. At the Hammam Al-Alil location, similar results were obtained (Table 5).

**Effect of herbicides and wheat seeding rate on 1000 grains weight**

At the Al-Balwat location, the 1000 wheat grains weight following the herbicides Discipline -25, Discipline R.C. and

Discipline +25 treatments reached 32.889, 33.211 and 33.049 g, respectively, compared to 27.278 g for the no-herbicide treatment. Likewise, at the Hammam Al-Alil location, similar results were obtained (Table 3).

Using the seeding rate of 120 kg/ha at the Al-Balwat location, the 1000 grains weight reached 33.165 g, whereas at 160 kg/ha seeding rate, it reached 30.002 g. Similar results were obtained at the Hammam Al-Alil location. (Table 4).

At Al-Balwat location, the combined effect of Discipline R.C. herbicide and 120 kg/ha seeding rate produced a 1000 grains weight of 35.208 g, compared to 25.901 g for the no-herbicide with 160 kg/ha seeding rate. Comparable results were obtained at Hammam Al-Alil location (Table 5).

**Effect of herbicides and wheat seeding rate on grain yield**

At the Al-Balwat location, the wheat grain yield following the Discipline+25, Discipline R.C. and Traxos R.C. herbicide treatments reached 579.70, 576.84 and 551.47 g/m$^2$, respectively, whereas the no-herbicide treatment produced 349.32 g/m$^2$. More or less, similar results were obtained at the Hammam Al-Alil location (Table 3).

At the Al-Balwat location, with the seeding rate of 160 kg/ha, the grain yield reached 568.43 g/m, whereas with seeding rate of 120 kg/ha, it reached 421.68 g/m. Similar results were obtained at Hamam Al-Alil location (Table 4).

At Al-Balwat location, the combined effect of Discipline +25 herbicide treatment with the seeding rate of 160 kg/ha produced a grain yield of 653.52 g/m$^2$, whereas the no-herbicide treatment with 120 kg/ha seeding rate produced a grain yield of 304.38 g/m. Similar results were obtained at the Hammam Al-Alil location (Table 5).

**Table 3.** Effect of chemical herbicides on growth, and yield of wheat and associated weeds during 2022/2023 season at two locations in Ninevah Governorate, Iraq.

| Herbicide treatments | No. of weeds (weed/m$^2$) | Weed dry weight (g/m$^2$) | Plant height (cm) | Flag leave area (cm$^2$) | Spike grains No. | Spikes No. (m$^2$) | 1000 grains weight (g) | Grain yield (g/m$^2$) |
|---|---|---|---|---|---|---|---|---|
| **Al-Balwat** | | | | | | | | |
| Traxos -25 | 14.567 b | 15.902 b | 98.12 b | 37.850 b | 45.322 cd | 343.6 c | 31.404 b | 440.73 d |
| Traxos R.C. | 6.25 d | 8.184 d | 96.489 b | 38.294 ab | 46.117 c | 403.4 ab | 31.82 b | 551.47 ab |
| Traxos +25 | 9.439 c | 9.566 cd | 96.644 b | 39.466 a | 44.689 d | 386.2 b | 31.484 b | 529.53 bc |
| Discipline -25 | 14.422 b | 11.322 c | 98.273 b | 38.611 ab | 45.956 c | 387.7 b | 32.889 a | 511.39 c |
| Discipline R.C. | 6.661 d | 7.187 d | 98.011 b | 39.597 a | 48.494 a | 426.8 a | 33.211 a | 576.84 a |
| Discipline+25 | 8.856 c | 7.531 d | 98.078 b | 39.244 a | 47.022 b | 427.3 a | 33.049 a | 579.70 a |
| No treatment | 19.194 a | 19.842 a | 106.261 a | 34.474 c | 37.522 e | 318.6 d | 27.278 c | 349.32 e |
| **Hammam Al-Alil** | | | | | | | | |
| Traxos -25 | 11.66 b | 10.192 b | 95.94 b | 41.08 b | 40.014 c | 381.78 b | 32.126 b | 489.709 b |
| Traxos R.C. | 5.0 d | 5.258 d | 94.75 b | 45.732 a | 41.562 ab | 422.34 a | 32.504 ab | 568.31 a |
| Traxos +25 | 7.55 c | 6.106 cd | 94.82 b | 41.071 b | 41.207 b | 424.56 a | 32.446 ab | 566.152 a |
| Discipline -25 | 11.55 b | 7.229 c | 94.12 b | 41.043 b | 40.837 bc | 387.76 b | 32.378 ab | 511.395 b |
| Discipline R.C. | 5.33 d | 4.599 d | 90.84 b | 40.513 bc | 42.347 a | 426.84 a | 32.651 ab | 587.952 a |
| Discipline+25 | 7.11 c | 4.821 d | 90.68 b | 40.464 bc | 42.668 a | 427.38 a | 32.832 a | 597.483 a |
| No treatment | 15.33 a | 12.671 a | 101.76 a | 38.727 c | 35.476 d | 336.44 c | 30.932 c | 366.322 c |

Values followed by the same letters in the same column in each location are not significantly different based on Duncan's multiple range test at P=0.05.

**Table 4.** Effect of seeding rate on growth and yield of wheat and associated weeds during 2022-2023 season.

| Seeding rates (Kg/ha) | No. of weeds (weed/m$^2$) | Weed dry weight (g/m$^2$) | Plant height (cm) | Flag leave area (cm$^2$) | Spike grains No. | Spikes No. (m$^2$) | 1000 grains weight (g) | Grain yield (g/m$^2$) |
|---|---|---|---|---|---|---|---|---|
| **Al-Balwat** | | | | | | | | |
| 120 | 14.755 a | 17.92 a | 97.073 b | 42.618 a | 46.94 a | 304.3 c | 33.165 a | 421.68 c |
| 140 | 10.936 b | 10.228 b | 98.743 b | 39.020 b | 45.769 b | 408.8 b | 31.605 b | 526.60 b |
| 160 | 8.333 c | 5.939 c | 100.702 a | 33.020 c | 42.343 c | 441.3 a | 30.002 c | 568.43 a |
| **Hammam Al-Alil** | | | | | | | | |
| 120 | 11.81 a | 11.45 a | 92.85 ab | 50.643 a | 41.517 a | 319.43 c | 32.561 a | 434.846 b |
| 140 | 8.76 b | 6.55 b | 95.04 ab | 46.891 b | 41.109 a | 427.16 b | 32.047 a | 566.367 a |
| 160 | 6.66 c | 3.79 c | 96.29 a | 46.511 b | 39.135 b | 456.45 a | 32.193 a | 579.068 a |

Values followed by the same letters in the same column in each location are not significantly different based on Duncan's multiple range test at P=0.05.

**Table 5.** Effect of seeding rates and herbicides on growth, and wheat yield and associated weeds during the 2022-2023 season.

| Seeding rates (Kg/ha) | Herbicides | No. of weeds (weed/m²) | Weed dry weight (g/m²) | Plant height (cm) | Flag leave area (cm²) | Spike grains No. | Spikes No. (m²) | 1000 grains weight (g) | Grain yield (g/m²) |
|---|---|---|---|---|---|---|---|---|---|
| **Al-Balwat** | | | | | | | | | |
| 120 | Traxos -25 | 18.767 bc | 23.069 b | 95.493 e | 41.185 bc | 47.90 bc | 266.4 i | 32.987 de | 349.10 ij |
| | Traxos R.C. | 8.733 g-j | 13.163 de | 95.133 e | 43.300 ab | 49.533 b | 310.5 f-i | 33.488 bc | 462.55 f |
| | Traxos +25 | 13.733 de | 18.722 c | 94.833 e | 44.100 a | 46.067 d | 295.3 hi | 33.013 de | 449.04 fg |
| | Discipline -25 | 16.233 cd | 15.284 cde | 97.07 de | 43.233 ab | 45.267 d | 300.9 ghi | 34.133 bc | 402.96 gh |
| | Discipline R.C. | 9.583 f-i | 12.94 de | 97.167 de | 44.300 a | 51.283 a | 350.8 ef | 35.208 a | 500.77 def |
| | Discipline+25 | 11.183 e-h | 11.672 of | 97.367 de | 44.900 a | 48.467 bc | 340.4 efg | 34.587 ab | 482.94 ef |
| | No treatment | 25.05 a | 30.587 a | 102.45 bc | 37.311 ef | 40.067 f | 266.0 i | 28.741 j | 304.38 j |
| 140 | Traxos -25 | 13.733 de | 16.679 cd | 98.267 cde | 38.53 def | 45.333 d | 359.4 de | 31.92 gh | 471.73 f |
| | Traxos R.C. | 5.45 jk | 7.668 f-i | 97.2 de | 38.597 def | 46.267 d | 437.6 abc | 32.061 fgh | 582.05 bc |
| | Traxos +25 | 7.517 h-k | 5.208 hi | 97.5 de | 39.900 cd | 45.833 d | 420.06 bc | 31.813 h | 547.33 cd |
| | Discipline -25 | 13.667 de | 11.663 ef | 97.2 de | 39.366 cde | 47.90 bc | 401.3 cd | 32.88 de | 529.94 de |
| | Discipline R.C. | 6.617 ijk | 5.546 hi | 98.00 de | 40.736 cd | 48.967 bc | 456.3 ab | 32.755 def | 597.31 bc |
| | Discipline+25 | 9.567 f-i | 6.958 ghi | 98.367 cde | 39.566 cde | 47.833 c | 458.0 ab | 32.613 efg | 602.64 ab |
| | No treatment | 20.00 b | 17.873 c | 104.667 b | 36.440 fg | 38.25 g | 328.8 e-h | 27.192 k | 355.23 hi |
| 160 | Traxos -25 | 11.2 e-h | 7.959 efg | 100.6 cd | 33.830 h | 42.733 e | 405.0 c | 29.307 ij | 501.37 def |
| | Traxos R.C. | 4.567 k | 3.72 hi | 97.133 de | 32.98 h | 42.55 e | 462.4 ab | 29.912 i | 609.82 ab |
| | Traxos +25 | 7.067 ijk | 4.768 hi | 97.6 de | 34.400 gh | 42.167 e | 443.3 abc | 29.627 i | 592.23 bc |
| | Discipline -25 | 13.367 def | 7.02 ghi | 100.55 cd | 33.233 h | 44.70 d | 461.0 ab | 31.653 h | 601.26 ab |
| | Discipline R.C. | 3.783 k | 3.075 i | 98.867 cde | 33.755 h | 45.233 d | 473.3 a | 31.669 h | 632.43 ab |
| | Discipline+25 | 2.817 ijk | 3.96 hi | 98.5 cde | 33.266 h | 44.767 d | 483.6 a | 31.947 gh | 653.52 a |
| | No treatment | 12.533 d-g | 11.067 efg | 111.66 a | 29.671 i | 34.25 h | 361.1 ed | 25.901 l | 388.34 hi |
| **Hammam Al-Alil** | | | | | | | | | |
| 120 | Traxos -25 | 15.0 bc | 14.763 b | 94.00 b-e | 41.838 b-e | 40.624 def | 296.02 fg | 32.109 ab | 387.896 e |
| | Traxos R.C. | 7.0 g-j | 8.37 de | 92.46 b-e | 49.518 a | 42.987 abc | 337.69 def | 32.779 a | 476.907 d |
| | Traxos +25 | 11.0 de | 11.897 c | 90.33 cde | 38.238 fg | 42.211 a-d | 344.02 cde | 32.752 a | 476.713 d |
| | Discipline -25 | 13.0 cd | 9.76 cde | 90.5 cde | 39.197 d-g | 41.059 cde | 300.96 efg | 32.643 ab | 402.969 e |
| | Discipline R.C. | 7.66 f-i | 8.273 de | 88.16 de | 39.159 d-g | 43.205 ab | 350.86 cd | 33.048 a | 500.774 cd |
| | Discipline+25 | 9.0 e-h | 7.45 ef | 87.16 e | 38.618 efg | 43.096 abc | 340.48 def | 32.915 a | 482.945 d |
| | No treatment | 20.0 a | 19.633 a | 107.33 a | 40.839 c-f | 37.44 gh | 266.0 g | 31.683 a | 315.718 f |
| 140 | Traxos -25 | 11.0 de | 10.66 cd | 97.83 bcd | 40.999 c-f | 40.741 def | 399.33 b | 32.24 ab | 524.146 cd |
| | Traxos R.C. | 4.33 jk | 5.023 fgh | 96.4 b-e | 45.044 b | 41.952 a-d | 460.33 a | 32.159 ab | 620.806 ab |
| | Traxos +25 | 6.0 h-k | 3.403 hi | 98.13 bc | 43.478 bc | 41.005 cde | 459.33 a | 32.296 ab | 608.149 b |
| | Discipline -25 | 11.0 de | 7.44 ef | 95.36 b-e | 42.067 b-e | 41.027 cde | 401.33 b | 32.211 ab | 529.945 cd |
| | Discipline R.C. | 5.33 ijk | 3.56 hi | 89.86 cde | 39.242 d-g | 43.008 abc | 456.33 a | 32.157 ab | 630.643 a |
| | Discipline+25 | 7.66 f-i | 4.47 ghi | 90.4 cde | 39.299 d-g | 43.752 a | 458.0 a | 32.749 a | 655.976 a |
| | No treatment | 16.0 b | 11.337 c | 97.3 bcd | 39.348 d-g | 36.28 h | 355.5 cd | 30.52 c | 394.901 e |
| 160 | Traxos -25 | 9.0 e-h | 5.153 fgh | 95.04 a | 40.404 c-f | 38.677 fg | 450.0 a | 32.029 ab | 557.086 bc |
| | Traxos R.C. | 3.66 k | 2.38 hi | 96.0 b-e | 42.635 bcd | 39.747 ef | 469.0 a | 32.576 ab | 607.216 ab |
| | Traxos +25 | 5.66 ijk | 3.017 hi | 95.7 b-e | 41.496 c-f | 40.405 def | 470.33 a | 32.291 ab | 613.594 ab |
| | Discipline -25 | 10.66 def | 4.487 ghi | 96.0 b-e | 41.867 b-e | 40.427 def | 461.0 a | 32.28 ab | 601.269 ab |
| | Discipline R.C. | 3.0 k | 1.963 i | 96.5 b-e | 43.14 bc | 40.827 de | 473.33 a | 32.748 a | 632.439 a |
| | Discipline+25 | 4.66 ijk | 2.543 hi | 94.5 b-e | 43.476 be | 41.157 b-e | 483.33 a | 32.832 ab | 653.527 a |
| | No treatment | 10.0 d-g | 7.043 efg | 100.66 ab | 35.993 g | 32.707 j | 387.83 b | 30.595 c | 388.347 e |

Values followed by the same letters in the same column in each location are not significantly different based on Duncan's multiple range test at P=0.05.

## Discussion

Significant effect was obtained for using the herbicides Discipline R.C., and Traxos R.C. on weeds density and growth in wheat plots, which is in agreement with previous reports (Aljuburi & Anter, 2021; Wahab & Aljuburi, 2023a). Likewise, the seeding rate of 160 kg/ha significantly depressed weeds growth, compared to lower seeding rates, which could be due to reduced sunlight and nutrients that reached the weed plants (Al-Mashhadani, 2020).

The significant positive effect of the herbicides used (Discipline+25, and Discipline R.C] on weeds dry weight was likely due to their ability to reduce the number of weeds and thus reducing their dry weight (Wahab & Aljuburi, 2023b). The combined effect of herbicides plus high seeding rate was instrumental in weed control improvement (Singh *et al* 2017; Wahab & Aljuburi, 2023a).

The positive effects of using herbicides on the wheat flag leaf area could be due to the decrease in the weeds number which allowed the crop plants to make optimal use of the growth requirements such as water, nutrients, and light, which led to increased photosynthetic efficiency and consequently increased yield (Al-Mashhadani, 2020; Al-Salmani *et al* 2016; Saleh, 2018).

On the other hand, the superiority of seeding rate of 120 kg/ha over the 160 kg/ha,is due to the decrease in the number of grains per spike with the increase in seeding rate, as a consequence of increased plant density per unit area, which increased the intensity of competition between the spikes for photosynthesized carbohydrates during the stage of grain filling, and this led to a decrease in the number of grains per spike, as reported earlier (Mohamed & Murshid, 2018).

The positive effect of herbicides treatment on 1000 grains weight is due to their effectiveness in reducing the growth and number of weeds and allowed the wheat crop to better exploit growth factors, which led to increased grain yield (Al-Salmani *et al* 2016; Razaq, 2017; Safi, 2016). Furthermore, the positive effect of using the seeding rate of 160 kg/ha at the Hammam Al-Alil location, is likely due the increase in plant density, which increased the number of fertile tillers carrying spikes, thus increasing the spikes number per unit area, which positively reflected on the increase in grain yield (Abdul Karim *et al.,* 2015; Ali & Abood, 2015).


## الملخص

**الجبوري، ضياء فتحي. 2026. تأثير معدل البذار ومبيدات الأعشاب في نمو وحاصل القمح الطري/قمح الخبز (*Triticum aestivum*) والأعشاب المرافقة. مجلة وقاية النبات العربية، 44(1):103−109.** https://doi.org/10.22268/AJPP-001365

أجريت التجربة في موقعين خلال الموسم الزراعي 2022−2023، الأول في قرية البلوات، محافظة نينوى، والآخر في قضاء حمام العليل، محافظة نينوى، العراق، لمعرفة تأثير أفضل تركيز لمبيدات الأدغال/الأعشاب الكيميائية ومعدل البذار الأمثل وتأثيراتها في صفات النمو، والحاصل لقمح الخبز والأعشاب الضارة/الأدغال المرافقة. تضمنت التجربة عاملين: العامل الأول، معدلات البذر (120، 140 و 160 كغ/هكتار) لصنف Babylon-113، أما العامل الثاني، فهو مبيدات الأدغال المختلفة وبتراكيز مختلفة، بالإضافة لمعاملة الشاهد (بدون مبيد). كانت الصفات المدروسة كما يلي: عدد الأدغال الكلي (دغل/م$^2$)، الوزن الجاف للأدغال الكلي (غ/م$^2$)، ارتفاع النبات (سم)، مساحة ورق العلم (سم$^2$)، كثافة السنابل (سنبلة/م$^2$)، عدد الحبوب/السنبلة، وزن الـ 1000 حبة (غ)، وحاصل الحبوب (غ/م$^2$). أوضحت النتائج لكل الصفات المدروسة أن المبيدين Traxos R.C. و Discipline R.C. قد سجلا أفضل كفاءة في خفض كثافة الأدغال وأوزانها الجافة في موقع البلاوات وحمام العليل وبنسبة مكافحة بلغت 58.75، 63.77، 60.53 و 57% لكلا المبيدين والموقعين، على التوالي. تفوق المبيدان Discipline R.C. و Discipline +25 في صفة عدد السنابل وحاصل الحبوب وفي الموقعين كليهما، وكان استخدام معدل البذار 160 كغ/هكتار أفضل من بقية معدلات البذار في خفض الأدغال وكذلك صفات الحاصل، حيث سجل نسبة زيادة في حاصل الحبوب بلغت 24.05 و 24.90%، للموقعين، على التوالي، بالمقارنة مع معدل بذار 120 كغ/هكتار.



**كلمات مفتاحية:** مبيدات، أعشاب ضارة، معدلات البذار، *Triticum aestivum* L.، Traxos، Discipline-OD.



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