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Influence of herbicides and seed rates on growth and yield for bread wheat and associated weed[1]

AMMAR SALAH AL-JADDIR
SALIM H. ANTAR
Field Crops Department, College of Agriculture and Forestry
University of Mosul

Abstract

The experiment was carried out in season (2022-2023) in Nineveh Governorate at two locations, first location was in Al-Hamdaniya District, (Al-Nimrud), and the second location was in Talkif District, (Talkif). The experiment included two factors: first factor was chemical herbicides (Navigator, Timeline Trio) at the recommended concentrations, in addition to the control treatment (weedy) and the second factor was seeding rates (140, and 160 kg. ha^{-1}). The seeds were planted on (22 and 25 /11//2022) for both locations respectively, using the wheat variety (Babel 113), approved by the Ministry of Agriculture. The experiment was applied as factorial experiment using a split-block experimental design, with complete randomization of treatments (RCBD), with three replicates. Where the main plots included chemical herbicides, while the sub-plots included seeding rates.

The results showed that herbicides were surpassed in reducing the number of narrow and broad-leaves weeds and their dry weights over the unweeded treatment in both locations, Furthermore, the herbicide "Timeline Trio" surpassed on the herbicide "Tarzek" in terms of grain yield, reaching (558.333 g. m^{-2}) in (Al-Nimrud) location, while in (Talkif) location surpassed on the herbicide "Tarzek" in trait of grain yield, reaching (334.467 g. m^{-2}), comparison the weedy treatment recorded the lowest yield, reaching (306.667 and 191.492 g .m^{-2}) for both locations respectively. The seeding rate of (40 kg. ha^{-1}) surpassed on the seeding rate of (35 kg. ha^{-1}) in reducing the number and dry weights of narrow and broad-leaves weeds, which positively reflected on the increase in yield for both locations.

Keywords: Wheat, weed control, Herbicides, Seeding rates, Tarzek, Timeline Trio.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most widely cultivated cereal crops and a staple food for many countries in the world, characterized by for its ability to adapt to a wide range of agricultural climates. Wheat ranks second in terms of production area in the world and provides about 20% of the total human dietary calories (Fazily**,** 2021), it has a strategic role in achieving food security.

The cultivation of wheat in large quantities contributes to the provision of basic food and the achievement of food supplies. In addition, bread made from wheat is a staple food for most people and is an important source of nutrition in areas with rapid population growth (Conab, 2018).

Weeds are an important biological factor that affects agricultural production and causes losses in the yield of various crops around the world (Anthimidou, 2020),

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they are one of the most important competitors of wheat crops because they lead to a reduction in the quality of crops and also some of them pose a danger to human and animal health, there are different types of weeds associated with wheat crops that grow at high density with crop plants (Khan, 2007). Weed control using chemical herbicides is considered the preferred method for farmers due to its high effectiveness, in addition to its low costs **(**Rana *et al*., 2017)

The seeding rate is one of the main factors among many other factors that enhance the growth and productivity of wheat crops, the random use of seeding rates not only leads to an increase in production costs, but also leads to a decrease in crop productivity (Fazily**,** 2021). The goal of this study to knowledge the response of growth and yield of wheat and associated weeds by using chemical herbicides and seeding rates.

MATERIAL & METHODS

A field experiment was conducted in one of the farmers' fields during the winter agricultural season (2022-2023) in Nineveh Governorate, in two locations: Al-Hamdaniya district, (Al-Nimrud), and Talkif district, (Talkif). The experiment included two factors: chemical herbicides "Tarzek, and Timeline Trio" at their recommended concentrations as listed in Table *(1)*, in addition to the control treatment (weedy) and seeding rates (140 and 160 kg. ha^{-1}). The aim was to knowledge the response of growth and yield of wheat and associated weeds by using chemical herbicides and seeding rates in two different environments. the seeds were planted at (22 and 25 /11/2022) for the two locations respectively, the variety *(*Babel 113) registered by the Iraqi Ministry of Agriculture approved by the Ministry of Agriculture, for the respective locations. The experiment was applied as factorial experiment using the Split-Block design within a Randomized Complete Block Design (RCBD) with three replications. the experimental plot size was (12 m^2). the main plots included the chemical herbicides for weed control, while the sub-plots included seeding rates. Compound fertilizer was applied once at sowing at a rate of (200 kg. ha^{-1}), and N.P.K. ha^{-1} fertilizer was applied in two splits at a quantity of (240 kg. ha^{-1}). The experiment was irrigated using fixed sprinklers, and harvesting was conducted on May (24 and 26 / 5/ 2023), for the respective locations. Samples of the narrow and broad-leafed weeds were taken in the month of April and dried in an oven at (70°C) for (72 hours) until a constant weight was achieved. Data on the following traits were collected: number of narrow and broad-leaves weeds, dry weight (g. m^{-2}), plant height (cm), length of spike (cm), No. of spike (spike .m^{-2}), weight of 1000 grain (g. m^{-2}), and grain yield (g. m^{-2}). Data were analyzed according to the method of the used design, and the differences between the means of each factor and their combinations compared by Duncan Multiple Range Test. Different letters were assigned to denote significant differences at a 5% probability level, regardless of the calculated (F) significance, as mentioned by (Al-Rawi and Abdul Aziz, 2000). The statistical analysis was performed using SAS (Statistical Analysis System) software version 9 (V9).

Table (1) shows the trade name, active ingredient, application rate for herbicides.

Trade name	Active ingredient	Dose
Tarzek	Pyroxsulam + Halauxifen-methyl	75-90 gm+ 500-750 ml dispersible
Timeline Trio	Pinoxaden + Clodinafop-Propargyl+Florasulam	1.25 L.400 L. of water. ha^{-1}

RESULTS AND DISCUSSION

1- **Effect of herbicides on study traits**:

The results of Table (2) indicate that the herbicides treatments used in the experiment led to a significant decrease in the number of plants of both narrow and broad-leaves weeds in both study locations, this decrease was more severe when using the "Timeline Trio" herbicide. The treatment with the "Timeline Trio" herbicide was surpassed in reducing the number of plants of narrow-leaves weeds and their dry weights, recording the lowest rate for the trait, which reached (4.5, 5.0 weed. m^{-2}) in both study locations respectively, and a dry weight of (1.292, 1.4 g. m^{-2}) in both study locations, respectively. However, it did not reach the level of significance with the treatment with the "Tarzek" herbicide in (Al-Nimrud) location, which recorded a trait rate of (4.833 weed. m^{-2}, 1.417 g. m^{-2}) respectively. In the Talkif location, the treatment with the "Tarzek" herbicide recorded a trait rate of (14.333 weed. m^{-2}, 4.013 g. m^{-2}) respectively. The weedy treatment recorded the highest trait rate of (14.167 weed. m^{-2}, 3.925 g. m^{-2}) respectively in (Al-Nimrud) location, and (42.0 weeds. m-2, 13.175 g. m-2) respectively, in (Talkif) location. On the other hand, the treatment with the "Timeline Trio" herbicide surpassed significantly in reducing the number of broad-leaves weeds and their dry weights in both study locations compared to the weedy treatment, where it recorded the lowest trait rate of (13.333 weed. m^{-2}, 9.14 g. m^{-2}) respectively in (Al-Nimrud) location, and (44.333 weed. m^{-2}, 114.506 g. m^{-2}) respectively, compared to the weedy treatment that recorded the highest trait rate of (60.667, 96.667 weed. m^{-2}, 47.107, 259.583 g. m^{-2}) for both locations respectively. While the treatment with the "Tarzek" herbicide recorded a trait rate of (26.0, 56.0 weed. m^{-2}, 56.0, 153.75 g. m^{-2}) for both locations respectively. The reason due to for the decrease in the number of narrow and broad-leaves weeds is attributed to the effectiveness of the chemical herbicides used in inhibiting the enzymatic activities, including the inhibition of the **ALS** (Aceto lactate synthase) enzyme, this enzyme is responsible for the synthesis of essential amino acid chains required for cell division, leading to the death of weed plants (Hasson, 2013), it also reduced the weight of the weeds that grew after spraying the herbicide, which indicates that the herbicide entered through the root and spread throughout the plant and reduced its growth and weight. This is consistent with (Al-Hayali *et al*., 2018; Al-Ziady *et al*.,2019). The same table shows that there are significant differences in plant height in both study locations, the weedy treatment gave the highest trait rate of (108.167, 103.498 cm) for both locations, respectively.

The herbicides treatments "Tarzek, Timeline Trio" recorded a trait rate of (98.567, 98.875 cm) respectively in Al-Nimrud location and (101.968, 100.325 cm) respectively in Talkif location, this is due to the ability of weeds to compete with wheat plants for light, which is one of the most important growth requirements. This is consistent with (Al-Salmani *et al*.,2016; Aljuburi and Anter, 2021; Mutlag *et al*., 2023**)**. All the results obtained from Table (2) indicate significant differences between the herbicides used compared to the weedy treatment in traits of grain number per spike, number of spikes per square meter, weight of 1000 grains, and grain yield in both study locations. The treatment with "Timeline Trio" herbicide showed a significant surpassed on the other treatments, recording the highest rate for the grain number per spike, reaching (47.100 grain. $spike^{-1}$) compared to the weedy treatment, which recorded the lowest rate of the trait, reaching (36.250 grain. $spike^{-1}$), while the treatment with "Tarzek" herbicide recorded a rate of (44.408 grain. $spike^{-1}$), in the (Al-Nimrud) location. As for the (Talkif) location, the treatment with "Tarzek" herbicide showed a significant

surpassed on the other treatments, recording the highest rate for the trait, reaching (58.942 grain. spike^{-1}), compared to the weedy treatment, which recorded the lowest rate of the trait, reaching (45.475 grain. spike^{-1}), the treatment with "Timeline Trio" herbicide recorded rate of (53.700 grain. spike^{-1}), this can be attributed to the increased efficiency of the photosynthesis process and its direction towards increasing the number of grains per spike, these results are consistent with (Feyisa *et al*., 2023; Jalal and Naby, 2023).

The number of spikes per square meter, the treatment with "Timeline Trio" herbicide showed a significant surpassed the other treatments in both study locations, recording the highest rate for the trait, reaching (530.333, 307.833 spikes. m^{-2}) for both locations respectively. The treatment with "Tarzek" herbicide treatment recorded rate of (493.083, 284.667 spikes. m^{-2}) for both locations respectively, while the weedy treatment recorded the lowest rate for the trait, reaching (326.667, 228.833 spikes. m^{-2}) for both locations respectively, this is due to the ability of the pesticides to reduce and inhibit the number and weight of weeds, which allows the crop to grow without competition for growth requirements such as light, water, and nutrients. This leads to an increase in the efficiency of the photosynthesis process and its productivity, resulting in an increase in the number of spikes in the plants. These results are consistent with (Safi, 2016; Kumar *et al*., 2019**)**. The treatment with "Timeline Trio" herbicide showed a significant surpassed on the other treatments in both study locations in trait of the weight of 1000 grains, it recorded the highest rate for the trait, reaching (40.265, 35.508 g) for both locations respectively, compared to the weedy treatment, which recorded the lowest rate of the trait, reaching (33.183, 24.702 g), the treatment with "Tarzek" herbicide recorded a rate of (38.773, 31.190 g) for both locations respectively. This can be attributed to the effectiveness of the herbicides used in killing and inhibiting weed plants, which increases the efficiency of the photosynthesis process and the production and transfer of materials to the grains. These results are consistent with previous studies (Al-Salmani *et al*., 2016; Al-Khafji *et al*., 2020).

From the same table, it is evident that the herbicides used showed a significant surpassed on the weedy treatment in terms of grain yield, which is determined by its components such as the number of grains per spike, the number of spikes per square meter, and the weight of 1000 grains, the use of herbicides had a positive effect on grain yield, in the (Al-Nimrud) location, the treatment with "Timeline Trio" herbicide recorded the highest rate for the trait, reaching (558.333 g. m^{-2}), compared to the weedy treatment, which recorded the lowest rate of the trait, reaching (306.667 g. m^{-2}), the treatment with " Tarzek" herbicide recorded a rate of (447.917 g. m^{-2}). In the (Talkif) location, the treatment with "Tarzek" herbicide showed a significant surpassed, which recording the highest rate for the trait, reaching (334.467 g. m^{-2}), compared to the weedy treatment, which recorded the lowest rate of the trait, reaching (191.492 g. m^{-2}), The treatment with "Timeline Trio" herbicide recorded a rate of (285.655 g.m^{-2}). This can be attributed to the effectiveness of the herbicides used in reducing the impact of weed plants, allowing the crop plants to carry out their biological activities without competition for growth requirements. This leads to an increase in the efficiency of the photosynthesis process and the accumulation of manufactured materials, which positively affects grain yield. These results are consistent with (Al-mashhadany, 2020; Jalal and Naby, 2023; Al-Khafji *et al*., 2020; Brejea *et al*., 2020; Aljuburi and Anter, 2021)

2- Effect of seeding rates on study traits:

Table (3) shows significant differences between the seeding rates used in the experiment for the studied traits in both study locations, the treatment with a seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (140 kg. ha^{-1}), as it reduced the number of narrow and broad-leaves weeds plants and their dry weights in both locations. In the (Al-Nimrud) location, it recorded the lowest rate for the traits of the number of narrow and broad-leaves weeds plants, reaching (5.556, 27.556 weed. m^{-2}) respectively, and for dry weight, reaching (1.389, 19.822 g. m^{-2}) respectively, similarly, in the (Talkif) location, it recorded the lowest rate for the trait of the number of narrow and broad-leaves plants, reaching (14.444, 59.556 weed. m^{-2}) respectively, and for dry weight, reaching (4.494, 145.368 g. m^{-2}) respectively, this can be attributed to the fact that increasing the seeding rates leads to an increase in the number of plants per unit area, which results in shading of the plants and a reduction in the penetration of sunlight. Consequently, this negatively affects the efficiency of the photosynthesis process and the acquisition of growth requirements, ultimately leading to the death of weed plants. These findings are consistent with (Riya *et al*., 2017; Jalal and Naby, 2023; Shoaib *et al.*, 2022), which found that increasing the seeding rate led to a reduction in the number of tall and broad-leaved plants and their dry weights.

As indicated by the same table, there are significant differences in the traits of plant height, grain number per spike, number of spikes per square meter, weight of 1000 grains, and grain yield, the seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (140 kg. ha^{-1}), recording the highest plant height in both study locations, reaching (104.383, 105.327 cm) respectively, the seeding rate of (140 kg. ha^{-1}) recorded an average height of (99.365, 98.533 cm) respectively in both locations. This can be attributed to the increased competitive ability of the crop plants for growth requirements, especially light, which leads to plant elongation. These findings are consistent with (Jalal and Naby, 2023; Safi, 2016; Kumari and Kataria, 2023). In terms of grain number per spike, the seeding rate of (140 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (160 kg. ha^{-1}) in both study locations, it recorded an average of (44.494, 56.006 grain. $spike^{-1}$) respectively, while the seeding rate of (160 kg. ha^{-1}) recorded an average of (40.678, 49.406 grain. $spike^{-1}$) respectively in both locations. These findings are consistent with (Al-mashhadany, 2020; Choudhary *et al.*, 2023; Feyisa, 2023) which found that increasing the seeding rate led to an increase in grain number per spike. The seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (140 kg. ha^{-1}) in the trait of number of spikes per square meter, it recorded a rate of (469.333, 286.556 spikes. m^{-2}) respectively, while the seeding rate of (140 kg. ha^{-1}) recorded a rate of (430.722, 286.556 spikes. m^{-2}) respectively in both locations. This can be attributed to the increase in the number of plants per unit area resulting from increasing the seeding rate, which in turn leads to an increase in the number of spikes per square meter. This is consistent with (Jalal and Naby, 2023; Conab, 2018).

The seeding rate of (140 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (160 kg. ha^{-1}) in traits of the weight of 1000 seeds in both study locations, which recorded for this trait was (38.337, 31.663 g), respectively. On the other hand, the seeding rate of (160 kg. ha^{-1}) recorded in a rate of (36.451, 29.270 g) in both study locations, respectively. Increasing the seeding rates led to an increase in grain yield. The seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the seeding rate of (140 kg. ha^{-1}), with a higher average weight of (481.111, 308.008 g. m^{-2}) in both study locations, respectively. While, the seeding rate of (140 kg. ha^{-1}) recorded a rate

(349.167 and 239.735 g. m^{-2}) in both study locations, respectively. The reason for this due to attributed to the increased plant density per unit area, which in turn positively affected the number of grains per square meter and consequently the grain yield. This finding is consistent with (Al-mashhadany, 2020; Dong *et al.*, 2022; Megerssa *et al.*, 2023).

3- Effect of combination between herbicides and seeding rates on study traits:

All the results obtained from Table (4) indicate significant differences between the herbicides used and seeding rates in reducing the number of narrow and broad-leaves weeds plants and their dry weights in both study locations. In (Al-Nimrud) location, the treatment with "Tarzek" herbicide at a seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the other treatments in terms of the number of narrow weeds and their dry weights, except for the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}), which recorded the lowest rate for this trait (1.333 weed. m^{-2}, 0.333 g. m^{-2}) respectively, Meanwhile, the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}) recorded a rate for this trait (2.333 weed. m^{-2}, 0.583 g. m^{-2}) respectively, compared to the weedy treatment at a seeding rate of (140 kg. ha^{-1}), which recorded the highest rate for this trait (15.333 weed. m^{-2}, 4.600 g .m^{-2}) respectively. As for the trait of the number of broad-leaves weeds plants and their dry weights, the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}) recorded the lowest rate for this trait (9.333 weed. m^{-2}, 5.973 g. m^{-2}) respectively, While the weedy treatment recorded the highest rate for this trait (66.667 weed. m^{-2}, 52.667 g. m^{-2}) respectively. As for in the (Talkif) location, the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}) recorded the lowest rate for the trait of the number of narrow and broad-leaves weeds plants and their dry weights, with a rate of (0.000, 40.667 weed. m^{-2}) respectively, and a dry weight of (0.000, 96.751 g. m^{-2}) respectively. Compared to the weedy treatment, which recorded the highest rate for the trait of the number of narrow and broad-leaves weeds plants, with a rate of (44.000, 103.333 weed. m^{-2}) respectively, and a dry weight of (13.803, 312.389 g. m^{-2}) respectively.

The same table indicates that the weedy treatment at a seeding rate of (160 kg. ha^{-1}) recorded the lowest rate for the plant height in both study locations, with a height of (96.200 cm) in the (Al-Nimrud) location, which did not differ significantly from the other treatments, in the (Talkif) location, the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}) recorded the lowest rate for the plant height, with a height of (98.517 cm). As for the trait of the number of grains per spike, the treatment with "Timeline Trio" herbicide at a seeding rate of (140 kg. ha^{-1}) showed a significant surpassed on the (Al-Nimrud) location, recording the highest rate for this trait at (48.967 grain. $spike^{-1}$). In the (Talkif) location, the treatment with "Tarzek" herbicide at a seeding rate of (140 kg. ha^{-1}) showed a significant surpassed it recording the highest rate for this trait at (36.800 grain. $spike^{-1}$). Meanwhile, the weedy treatment at a seeding rate of (160 kg. ha^{-1}) recorded the lowest rate for this trait in both locations, with rates of (34.250, 43.633 grain. $spike^{-1}$) respectively. The treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}) showed a significant surpassed on the other treatments in both locations in terms of the trait of grain yield, recording the highest rate at (561.333, 331.000 g. m^{-2}) respectively, Compared to the control treatment at a seeding rate of (140 kg. ha^{-1}), which recorded the lowest rate for this trait at (319.000, 224.667 g. m^{-2}) respectively. In the (Talkif) location, the treatment

with "Timeline Trio" herbicide at a seeding rate of (140 kg. ha^{-1}) showed a significant surpassed on the other treatments, recording the highest rate for the trait of weight of 1000 grains (40.943 g), compared to the weedy treatment at a seeding rate of (140 kg. ha^{-1}), which recorded the lowest rate for this trait at (33.990 g) in (Al-Nimrud) location. In (Talkif) location, the treatment with "Timeline Trio" herbicide at a seeding rate of (140 kg. ha^{-1}) exhibited the same behavior, showing a significant surpassed on the other treatments, except for the treatment with "Timeline Trio" herbicide at a seeding rate of (160 kg. ha^{-1}), which did not reach significance. The treatment with "Timeline Trio" herbicide at a seeding rate of (140 kg. ha^{-1}) recorded the highest rate for grain yield at (641.667 g. m^{-2}), while the weedy treatment at a seeding rate of (140 kg. ha^{-1}) recorded the lowest rate for this trait at (290.000 g. m^{-2}) in (Al-Nimrud) location. In the (Talkif) location, the treatment with the "Tarzek" herbicide at a seeding rate of (160 kg. ha^{-1}) showed a significant surpassed it recording the highest rate for grain yield at (401.622 g. m^{-2}), compared to the weedy treatment at a seeding rate of (140kg. ha^{-1}) recorded the lowest rate for this trait at (185.013 g. m^{-2}).

Table (*2*) Effect of Herbicides on Weed, growth and yield traits in both locations (Al-Nimrud & Talkif).

Herbicides	Narrow Leaves Weed No. m^{-2}	Narrow Leaves Weed weight ($g.m^{-2}$)	Broad Leaves Weed No. m^{-2}	Broad Leaves Weed Weight ($g.m^{-2}$)	Plant Hight (cm)	Grains. $Spike^{-1}$	Spikes $No.m^{-2}$	1000Grain weight (g)	Grain $Yield.m^{-2}$ (g)
	Al-Nimrud								
weedy	14.167 a	3.925 a	60.667 a	47.107 a	108.167 a	36.250 c	326.667 c	33.183 c	306.667 c
Tarzek	4.833 b	1.417 b	26.0 b	17.807 b	98.567 b	44.408 b	493.083 b	38.733 b	447.917 b
Timelintiro	4.5 b	1.292 b	13.333 c	9.14 c	98.875 b	47.100 a	530.333 a	40.265 a	558.333 a
	Talkif								
weedy	42.0 a	13.175 a	96.667 a	259.583 a	103.498 a	45.475 c	228.833 c	24.702 c	191.492 c
Tarzek	14.333 b	4.013 b	56.0 b	153.75 b	101.968 b	58.942 a	284.667 b	31.190 b	344.467 a
Timelintiro	5.0 c	1.4 c	44.333 c	114.506 c	100.325 c	53.700 b	307.833 a	35.508 a	285.655 b

The same letters mean there are no significant among means for each column at 5%.

Table (*3*) Effect of Seeding rates on Weed, growth, and yield traits in both locations (Al-Nimrud & Talkif).

Seeding rates kg. ha^{-1}	Narrow Leaves Weed No. m^{-2}	Narrow Leaves Weed weight ($g.m^{-2}$)	Broad Leaves Weed No. m^{-2}	Broad Leaves Weed Weight ($g.m^{-2}$)	Plant Hight (cm)	Grains. $Spike^{-1}$	Spikes $No.m^{-2}$	1000 Grain weight (g)	Grain $Yield.m^{-2}$ (g)
	Al-Nimrud								
140	10.111 a	3.033 a	39.111 a	29.547 a	99.356 b	44.494 a	430.722 b	38.337 a	394.167 b
160	5.556 b	1.389 b	27.556 b	19.822 b	104.383 a	40.678 b	469.333 a	36.451 b	481.111 a
	Talkif								
140	26.444 a	7.899 a	71.778 a	206.525 a	98.533 b	56.006 a	261.000 b	31.663 a	239.735 b
160	14.444 b	4.494 b	59.556 b	145.368 b	105.327 a	49.406 b	286.556 a	29.270 b	308.008 a

The same letters mean there are no significant among means for each column at 5%.

Table (*4*) Effect of interaction between Herbicides and Seeding rates on weed, growth, and yield traits in both locations (Al-Nimrud & Talkif).

Herbicides	Al-Nimrud										
	Seeding rates kg. ha^{-1}	Narrow Leaves Weed No.	Narrow Leaves Weed weight ($g.m^{-2}$)	Broad Leaves Weed No.	Broad Leaves Weed Weight ($g.m^{-2}$)	Plant Hight (cm)	Grains. $Spike^{-1}$	Spikes $No.m^{-2}$	1000 Grain weight (g)	Grain $Yield.m^{-2}$ (g)
weedy	140	15.333 a	4.600 a	66.667 a	52.667 a	104.667 ab	38.250 d	319.000 f	33.990 d	290.000 e
	160	13.000 b	3.250 b	54.667 b	41.547 b	111.667 a	34.250 e	334.333 e	32.377 e	323.333 d
Tarzek	140	8.333 c	2.500 c	33.333 c	23.667 c	96.200 b	46.267 b	473.833 d	40.077 b	417.50 c
	160	1.333 d	0.333 d	18.667 d	11.947 d	100.933 b	42.550 c	512.333 b	37.390 c	478.333 b
Timelintiro	140	6.667 c	2.000 c	17.333 d	12.307 d	97.200 b	48.967 a	499.333 c	40.943 a	475.000 b
	160	2.333 d	0.583 d	9.333 e	5.973 e	100.550 b	45.233 b	561.333 a	39.587 b	641.667 a
	Talkif									
weedy	140	44.000 a	13.803 a	103.333 a	312.389 a	99.367 d	47.317 e	224.667 c	26.477 d	185.013 e
	160	40.000 b	12.548 b	90.000 b	206.777 b	107.630 a	43.633 f	233.000 c	22.927 e	197.972 e
Tarzek	140	25.333 c	7.093 c	64.000 c	174.925 b	98.517 d	63.800 a	273.667 b	32.260 b	287.311 c
	160	3.333 e	0.933 e	48.000 d	132.576 c	105.418 b	54.083 c	295.667 b	30.120 c	401.622 a
Timelintiro	140	10.000 d	2.800 d	48.000 d	132.262 c	97.717 d	56.900 b	284.667 b	36.253 a	246.881 d
	160	0.000 e	0.000 e	40.667 e	96.751 c	102.933 c	50.500 d	331.000 a	34.763 a	324.429 b

The same letters mean there are no significant among means for each column at 5%.

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