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Effect of using Agricultural Methods on the Growth and Yield of Three Types of Barley and Associated Weeds

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Annotation: Research was conducted at the Rashidia Research Station with three main factors: first was three varieties of barley (Amal, Rehan and Samir), second was planting distances between lines (15, 30) cm, and third was seed rate (120, 160) kg. ha^{-1}. Urea fertilizer was added at a rate of 240 kg. ha^{-1} In two batches, the research was carried out according to the global experiments system, in three sectors, and with a completely randomized block design. The data was analyzed using a computer and SAS program, with the Duncan multiple range test being employed for comparison means with different letters of the alphabet. The results were as follows: The variety Rehan outperformed the two varieties Samir and Amal are the most common species in terms of total weeds.m^{-2}. Samir cultivar outperformed Rehan and Amal cultivars in terms of plant height, spike number m^{-2}, and grain yield. Distance (30) cm is superior to distance (40) cm in the average characteristics of number of total weeds, and distance (15) cm is superior to

distance (30) cm.. Study focuses on the average characteristics of plant height, number of spikes, and grain yield. Seed rate (120) kg.ha^{-1} was superior to the average (160) kg.ha^{-1}. Average characteristic of total number of weeds is a crucial factor to consider, seed rate (160) kg.ha^{-1} was superior to average (120) kg.ha^{-1} in average. Average characteristic of total number of weeds is a crucial factor to consider. Interaction between barley variety Samir and the distance (30 cm) and rate (120) kg.ha^{-1} achieved highest yield, while lowest yield was when the interaction between variety Amal and distance (30 cm) and rate (120 kg.ha^{-1}).

Keywords: barley varieties, planting distances and seed rate.

Introduction

Barley (*Hordeum vulgare*) is one of most important multi-use strategic crops. It is used making bread can be made from wheat when mixed with it, and can also be used as concentrated fodder after grinding. It is a crucial crop for green fodder production., in addition to the fact that it can be presented as hay or silage. It may also be used in the industry (Asnawi et al., 2021). Developing improved varieties with high productivity that are suitable for environmental conditions in which they will be grown can be considered one of the most important methods used to increase production in quantity and quality (Soleymani et al., 2011), as barley varieties can vary in their ability to grow and tolerate drought in areas that are described as limited. Rain (Hayawi et al., 2021). Field crop fields are usually spread with many companion weeds, which are either thin or broad-leaved, resulting in competition for growth components, including moisture, which is the determining factor for growth in areas of perennial agriculture (Khan et al., 2007). Therefore, the use of agricultural methods, including planting distances, can be considered one of important methods in reducing growth and spread weeds in the fields (Hayawi, 2015). Al-Haidari, (2009) mentioned that the amount of light penetrating the plants and the heat available to it are among the factors that can be affected by the distance between the lines agriculture. Batool et al., (2022) pointed out during study of wheat crop that seed rate is one of the most important factors that has clear and significant impact on the crop's productivity and quality, and that failure to pay attention to this factor may cause high production costs, as well as a decrease in yield and poor quality. Optimal seed rate is one of the important things to obtain the highest yield of high-quality seeds (Megerssa et al., 2023). Tigabu and Asfaw (2016) stated that farmers in developing countries prefer to use high seeding rates (higher than recommended) as it is a good way to limit the growth and spread of weeds in the fields, despite the negative impact that accompanies increasing the seeding rate, especially the size and weight of the seeds. The aim of research is to determine best distance and seed rate for each variety under study.

Materials and Methods

Research was conducted at Rashidieh Research Station during agricultural season (2023/2024) on (11/30/2023), after plowing land and preparing it for agriculture. Seed viability was examined by examining the germination of seeds of the three varieties under study, and the percentage was 100%. Compound fertilizer DAP (200 kg. ha^{-1}) all at once. Research was carried out with three main factors. First factor included three varieties of barley, namely (Amal, Rehan, Samir). Second factor included (15, 30) cm. between lines. Third factor included seed rate (120, 160 kg. ha^{-1}). Urea was added at (240 kg. ha^{-1}) in two stages, first in the tiller stage and second in the elongation

stage. Research was carried out according to the global experimental system, in three sectors, and with a completely randomized design (Al-Rawi, 2000). Each sector included (12) experimental units, each of which had an area of (2 m^2). Study examined the end of season characteristics such as total weeds, plant height, spikes.m^{-2}, and grain yield. Data were collected and analyzed by computer and according to SAS program. Duncan's (1955) multiple range test was utilized to compare means in alphabetical letters at 5% probability level (Saleh and Hussein 2020; Alrawi and Ahmed 2024).

Results and discussion

Total weeds. m^{-2}:

Table (1) shows a significant reduction in the total number of weeds for the two barley varieties Samir and Amal compared to barley variety Reyhan, as the number of weeds for the three barley varieties reached (64.8, 80.3, and 68.3), reason for this can be attributed to different nature of antibiotic substances possessed by these different species (Al-Taie, 1995). Study indicates that the crop lines are closely spaced was accompanied by total weeds has significantly decreased compared to the previous year wide distance, number weeds at two distances reached (50.2 and 92.0). m^{-2}. In general, wide distance the crop lines are 30 cm apart. gives a greater opportunity for the growth of weed or to reduce state of competition between the weed and economic crop plants, especially when humidity is determining factor for growth and productivity of the crop, and it also gives more room for lighting, especially in late stages of weed growth (Ahmad et al., 2003), while in the narrow distance (15) cm between planting lines, small number of weed plants may be due to increase in plant density per unit area, which makes crop plants compete with weed plants (Khan, 2002 and Hayawi, 2015). Increasing seed rate to (160) kg.ha^{-1} was accompanied by a significant decrease in the average number of total weeds per unit area compared to seed rate (120) kg. ha^{-1}, as number of weeds at the seeding rates reached (78.9 and 63.3) weeds, respectively, reason for the higher seed rate may be (160) kg. ha^{-1} increases competitive ability of crop plants when their density increases, so that jungle plants compete for environmental factors, including nutrients, humidity, and sunlight, and thus work to hinder growth of jungle plants and then their death, and this result was consistent with what was obtained (Al-Ziady et al., 2019 and Al-Mashhadani, 2020). Results of interaction between barley varieties and planting distances indicate a significant decrease in the number of total weeds at the distance (15) cm. between planting lines compared to distance (30) cm under the three barley varieties included in the study, and that interaction between barley variety Amal and distance (15) cm., the lowest number of weeds was recorded, reaching (40.0) weeds. m^{-2}, while interaction between barley variety Samir and distance (30) cm. recorded the largest number of weed plants, reaching (93.3) weeds. m^{-2}, which did not differ from overlap between the two types of barley (Rehan and Amal) and the distance (30) cm between the lines. The lowest number of weeds was achieved when interaction between barley variety Amal and seed rate was (160) kg. ha^{-1} reached (50.8) weed. m^{-2}, which did not differ significantly from interaction between barley variety Samir and seed rate (160) kg. ha^{-1}, which amounted to (54.1) weed. m^{-2}. While notes that there is an increase in number of total weeds for all types of barley under seed rate of (120) kg. $ha^{-1.}$ Overlap between distance (15) cm. between planting lines and seed rate is (120) kg. ha^{-1} achieved a significant decrease in number of total weeds. m^{-2} compared to rest of overlaps and reached (49.0) weeds. m^{-2}, while the largest number of weeds was achieved when the distance between (30) cm and seed rate (120) kg.ha^{-1}, which amounted to (109.0) weeds. m^{-2}. As for the results of triple interaction between factors, table shows that treating the three varieties at the distance of (30) cm. between planting lines ensures seed rate of (120) kg. ha^{-1} resulted in recording the highest number of weeds per unit area, and triple interaction between Samir variety, distance (30) cm, and seed rate (120) kg. ha^{-1} achieved the highest number of weeds, reaching (112.3) weeds. m^{-2},while the lowest number of weeds was (31.3) weeds. m^{-2} when overlap between Amal variety and distance is (15) cm within seed rate (160) kg. ha^{-1}, which did not differ significantly from interaction treatment between Samir variety and distance (15) cm. within seed rate (160) kg. ha^{-1} reached (34.0 weeds. m^{-2}.

Table (1) Effect of varieties, planting distances, seed rate and interaction amonge them on total weeds.m^{-2}

Planting distances (cm.)	Seed rate kg.ha^{-1}	Barley varieties			Distances× seed rate	Effect of seed rate (kg.ha^{-1})	Effect of distances (cm.)
		Samir	Rehan	Amal			
15	120	52.6 cde	45.6 de	48.6 de	49.0 c		50.2 b
	160	34.0 e	89.3 ab	31.3 e	51.5 c		
30	120	112.3 a	105.6 a	109.0 a	109.0 a		92.0 a
	160	74.3 bc	80.6 b	70.3 bcd	75.1 b		
varieties × distances	15	43.3 c	67.5 b	40.0 c			
	30	93.3 a	93.1 a	89.6 a			
varieties× seed rate	120	82.5 a	75.6 a	78.8 a		78.9 a	
	160	54.1 b	85.0 a	50.8 b		63.3 b	
Effect of varieties		68.3 b	80.3 a	64.8 b			

Plant height (cm.):

Table (2) reveals that Samir barley variety outperforms other two barley varieties (Rehan and Amal) in average plant height, as the average height of three plants reached (108.9, 98.0, and 99.0) cm., respectively with a percentage increase of (11.12 and 10.00) %. Reason for this may be due to genetic differences structures amonge three barley varieties, which led to this discrepancy in the average height of the plants (Al-Dulaimi, 2015). Distance between planting lines, role of this in various growth and yield characteristics is crucial, including height of plants. Table's results indicate that the distance the measurement of (15) cm. was found to be significantly superior to distance (30) cm. in average plant height, as height reached (103. 101.0 cm for two distances respectively. Increase in crop plant per unit area and decrease in weed plant number at planting line distances (15) cm. and (30) cm. may be attributed to these factors. Result aligned with findings of (Al-Anbari et al., 2011, Hayawi, 2015). Difference in seed rate was accompanied by a difference in average plant height, as amount of seed exceeded (160 kg. ha^{-1}) significantly depends on quantity (120 kg. ha^{-1}) in average plant height. Increase in plant numbers may be reason for this per unit area at a high seeding rate, which increase in competition between plants for the essentials of life, such as water and nutrients (Hayawi, 2015). In addition to the misguidance that will occur to the plants, this statement leads to an increase in auxins, which work to elongate internodes and increase the growth of plant stems. This result was consistent with what was obtained by (Kumari and Kataria, 2023). Study examines correlation between barley varieties and planting distances show that interaction between barley variety Samir and the distance (15) cm. between planting lines caused the highest average height to be recorded, reaching (114.1) cm., thus significantly exceeding all interactions, while the lowest average height was (94.5) cm. When overlap between barley variety Amal and distance (15) cm. between planting lines, which did not differ from overlap between barley variety Reyhan and the distance (30) cm, it reached (95.6) cm. Study indicates that interaction between barley varieties Samir and seed rate is (160 kg. ha^{-1}) achieved the highest plant height, reaching (114.5) cm., thus significantly superior to all interactions, while interaction between the barley variety Rehan and seed rate was (120) kg. ha^{-1}, the lowest height was (96.0) cm., which did not differ significantly from interaction between barley variety Amal and seed rate (30) kg. ha^{-1}, which amounted to (97.8) cm. overlap between distance is (15) cm and seed rate is (160 kg. ha^{-1}) significantly outperformed rest of the interactions in terms of the average plant height, reaching (106.3 cm.), while interaction between distance (30) cm and seed rate caused (120) kg. ha^{-1} recorded the lowest plant height as it reached (98.4) cm., which did not differ significantly from interaction between distance (15) cm. and seed rate (120) kg. ha^{-1}, which reached (99.6) cm. Interaction was recorded amonge barley variety Samir, distance (15) cm between planting lines, and seed rate (160) kg. ha^{-1} had highest height of plants, which reached (122.3) cm. This result made this interaction significantly superior to all interactions, and interaction amonge barley variety Reyhan and distance (30) cm. between planting lines and seed

rate was (120 kg. ha^{-1}) achieved lowest plant height as it reached measurement of (92.0) cm. did not significantly differ from triple interaction amonge barley variety Amal, distance (15) cm. between planting lines, and seed rate (120 kg.ha^{-1}), which reached (93.0 cm.)

Table (2) Effect of varieties, planting distances, seed rate and interaction amonge them on plant height (cm.)

Planting distances (cm.)	Seed rate kg.ha^{-1}	Barley varieties			Distances× seed rate	Effect seed rate (kg.ha^{-1})	Effect distances (cm.)
		Samir	Rehan	Amal			
15	120	106.0 b	100.0 de	93.0 f	99.6 c		103.0 a
	160	122.3 a	100.6 cd	96.0 ef	106.3 a		
30	120	100.6 cd	92.0 f	102.6 bcd	98.4 c		101.0 b
	160	106.6 b	99.3 de	104.6 bc	103.5 b		
varieties × distances	15	114.1 a	100.3 c	94.5 d			
	30	103.6 b	95.6 d	103.6 b			
varieties× seed rate	120	103.3 b	96.0 d	97.8 cd		99.0 b	
	160	114.5 a	100.0 c	100.3 c		104.9 a	
Effect varieties		108.9 a	98.0 b	99.0 b			

Spikes. m^{-2}:

Data from Table (3) indicate that barley variety Samir was statement is significantly superior to two varieties Reyhan, Amal in average number of spike. m^{-2}. Likewise, barley variety Reyhan was significantly superior to variety Amal in the same trait, as average of this trait among three varieties reached (415.6, 390.0, and 366.3) spike. m^{-2}, respectively. This may be due to difference in genetic structure between varieties, which led to appearance of this average difference in this trait, and these results agreed with what was reached (Ahmed et al., 2012). Distance between planting lines has a major role in number of spikes per unit area when seed rate is constant, as results of statistical analysis (table 3) show that is a difference in number of spikes when planting distances differ. Notice that distance there is a distance of (15) cm. between planting lines. significantly exceeded distance (30) cm. Average characteristic of number of spikes is m^{-2}. number of spikes under two distances reached (395.3 and 386) spike. m^{-2}, with an increase rate of (2.40)%. This could be due to absence of competition between crop plants and accompanying weeds at a distance of (15) cm. compared to a distance of (30) cm. (table1), as well as an increase in number of plants per unit area at a distance of (15) cm. between planting lines compared to one in distance is (30) cm., (Hayawi, 2015). This result was consistent with many researchers in this field (Al-Anbari et al., 2011). Seed rate is (160 kg. ha^{-1}) significantly exceeds the average (120) kg.ha^{-1} in average characteristic number of spike. m^{-2}, with increase rate of (14.32)%. Reason for this is higher seed rate (160) kg. ha^{-1} on average (120) kg. ha^{-1} increases plant density per unit area, which is directly proportional to number of effective tillers bearing spikes, which in turn leads the number of spikes per unit area has increased. (Al-Muaini et al., 2017), and this result agreed with what was mentioned by (Al-Mashhadani, 2020). Results of bilateral interaction between barley varieties, planting distances show that interaction between barley variety Samir, planting lines with a distance of (15) cm. had the highest average number of spikes per m^{-2}, resulting in(424.6) spikes. m^{-2}. thus significantly superior to all interactions. Lowest number of spikes was (363.5) spike. m^{-2} when interfering between the barley variety Amal and distance (30) cm. between planting lines. Results of interaction between barley varieties and seed rate indicate that interaction between barley variety Samir and seed rate is (160) kg. ha^{-1} resulted in highest number of spikes recorded. m^{-2}, as it reached (449.5) spikes and thus was significantly superior to all the interventions. As for lowest number of spikes, it was (343.5) spike. m^{-2} when interfering between barley variety Amal and seed rate (120) kg. ha^{-1}. Overlap between distance is (30) cm. and seed rate is (160) kg. ha^{-1} recorded the highest number of spike. m^{-2}, thus significantly superior to rest of interactions in average of this trait, as it reached (419.5) spike, while interaction between the distance (30) cm.

and the seed rate (120) kg. ha^{-1} recorded the lowest number of spike. m^{-2}, which reached (352.4) spikes. m^{-2}. It is also clear from table that triple overlap between barley variety Samir, distance (15) cm. between planting lines, and seed rate is (160) kg. ha^{-1} caused highest number of spikes to be recorded, as number of ears reached (454.3) spike. m^{-2}, thus significantly superior to all three-way interactions. Lowest number of spike. m^{-2}, so it was (332.6) spikes. m^{-2} at triple overlap between barley variety Amal, distance is (30) cm., and seed rate is (120 kg.ha^{-1}).

Table (3) Effect of varieties, planting distances, seed rate and interaction amonge them on spike.m^{-2} Grain yield: (g. m^{-2})

Planting distances (cm.)	Seed rate kg.ha^{-1}	Barley varieties			Distances× seed rate	Effect seed rate (kg.ha^{-1})	Effect distances (cm.)
		Samir	Rehan	Amal			
15	120	395.0 e	380.6 f	354.3 h	376.6 c		395.3 a
	160	454.3 a	403.6 d	384.0 f	414.0 b		
30	120	368.6 g	356.0 h	332.6 i	352.4 d		386.0 b
	160	444.6 b	419.6 c	394.3 e	419.5 a		
varieties × distances	15	424.6 a	392.1 c	369.1 e			
	30	406.6 b	387.8 d	363.5 f			
varieties× seed rate	120	381.8 d	368.3 e	343.5 f		364.5 b	
	160	449.5 a	411.6 b	389.1 c		416.7 a	
Effect varieties		415.6 a	390.0 b	366.3 c			

Table (4) presents data significant superiority of barley variety Samir over both varieties Reyhan and Amal in average grain yield trait, in addition to the moral superiority of barley variety Reyhan over variety Amal in same characteristic, as yield for three varieties reached (419.7, 409.8 and 309.8) g. m^{-2}, respectively. Reason for this may be attributed to relationship of this trait to number of spike (table of spikes), in addition to difference in genetic composition of these varieties (Ahmed et al., 2012). Distance between planting lines significantly impacts growth of weed plants and thus increasing yield when seed rate is constant, as results of table (4) indicate that distance (15) cm. is significantly superior to distance (30) cm. in average grain yield by increase of (10.70)%. Reason for this increase may be attributed to smaller number of weed plants, planting lines were planted at a distance of (15) cm., compared to those at a distance of 30 cm. (table 1), and this result agreed with many researchers in this field (Al-Anbari et al., 2011 and Hayawi, 2015). Table's results showed a significant superiority of seed rate (160 kg. ha^{-1}) over rate (120) kg.ha^{-1} in average grain yield characteristic with an increase of (2.10)%. This could be attributed to the increase in number of plants in Unit area when seed rate is increased, as well as a decrease in the average number of weed plants when seed rate is increased (weed table), and this result is similar to what was reached by (Amina et al., 2019; Shoaib et al., 2022; Feyisa et al., 2023). Results of interaction between barley varieties, study reveals that interaction between the planting distances and barley variety Reyhan achieved a distance of (15) cm. between planting lines highest yield, reaching (436.6) g. m^{-2} was therefore significantly superior to all interactions, while the lowest result was (281.6) g. m^{-2} at the overlap between barley variety Amal and distance (30) cm. between planting lines. Results of interaction between barley varieties and seed rate indicate that interaction between barley variety Samir and seed rate is (120) kg. ha^{-1} resulted in highest yield being recorded, reaching (433.1) g. m^{-2} was thus significantly superior to all interactions, while lowest result was (296.1) g. m^{-2} when interfering between barley variety Amal and seed rate (120) kg. ha^{-1}. Overlap between distance is (15) cm. and seed rate is (160) kg. ha^{-1} recorded the highest yield, reaching (414.5) g. m^{-2} and thus significantly superior to rest of interactions in average of this trait, while interaction between distance (30) cm. and seed rate (160) kg. ha^{-1} recorded lowest yield, reaching (352.8) g. m^{-2}. It is also clear from table that triple overlap between barley variety Samir, distance (30) cm. between planting lines, and seed rate is (120) kg. ha^{-1}. Resulted in highest yield being recorded, reaching (458.0) g. m^{-2}, thus significantly superior to all three-way interactions. Lowest yield was (272.0) g. m^{-2} at the triple overlap between barley variety Amal,

distance is (30) cm., and seed rate is (120) kg. ha^{-1}

The table (4) reveals the impact of various varieties, planting distances, seed rate, and their interaction on grain yield ($g.m^{-2}$).

Planting distances (cm.)	Seed rate $kg.ha^{-1}$	Barley varieties			Distances× seed rate	Effect seed rate ($kg.ha^{-1}$)	Effect distances (cm.)
		Samir	Rehan	Amal			
15	120	408.3 e	422.3 d	320.3 i	383.6 b		399.1 a
	160	437.0 c	451.0 b	355.6 h	414.5 a		
30	120	458.0 a	374.3 g	272.0 k	368.1 c		360.5 b
	160	375.6 g	391.6 f	291.3 j	352.8 d		
varieties × distances	15	422.6 b	436.6 a	338.0 e			
	30	416.8 c	383.0 d	281.6 f			
varieties× seed rate	120	433.1 a	398.3 d	296.1 f		375.8 b	
	160	406.3 c	421.3 b	323.5 e		383.7 a	
Effect varieties		419.7 a	409.8 b	309.8 c			

Similar letters are not significantly different from each other at a probability of 5%

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