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EFFECT OF SEEDING RATES ON THE YIELD AND QUALITY OF SEVERAL CULTIVARS OF SESAME (*SESAMUM INDICUM* L)

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Abstract

A field experiment was conducted in the spring season of 2017 in the two locations: the first location in Bideat Al - Musayyib area, Great Al-Musayyib Project, Babylon Province and the second location in Al-daghara, Diwaniyah province.For the purpose of knowing the effect of seeding rates on the yield and quality of several cultivars of sesame (*Sesamum indicum* L). A factorial experiment was used according to Randomized Complete Blocks Design (R.C.B.D) in the implementation of the experiment, with three sectors. The experiment included two factors: The first factor included three seeding rates (6, 8, 10 kg.ha^{-1}), which is symbolized by (R_1, R_2, R_3),respectively.The second factor includes three cultivars (Wadae, Rafedeen and local). The results of the study are summarized below.

1. Rafedeen cultivar is excelled in the trait of the weight of 1000 seed (4.50, 4.37 g) and the total yield trait (1092.83, 1094.50 kg.ha^{-1}), respectively for the two locations.
2. Wadae and Rafedeen cultivars are excelled in the trait of seed numbers / packet (60.83, 66.10 seed) and the percentage of protein (26.41, 26.85%), respectively of the two locations.
3. The seeding rate (6 kg.ha^{-1}) is excelled in the trait of the number of seed / packet (60.39, 66.79) and the percentage of protein (27.34 and 26.71%), respectively.

The seeding rate (10 kg.ha^{-1}) is excelled in the trait of the weight of 1000 seed (4.54, 4.43 g), and the total yield (1064.56, 1088.78 kg.ha-1), respectively. The interaction between cultivars and seeding rates has impacted in most of the studied traits of both locations.

Key words : Sesame cultivars, seeding rates.

Introduction

Sesame (*Sesamum indicum* L.) belongs to the Pedaliaceae family; it is an oily crop in many countries with hot, semi-hot and temperate regions. Its seeds contain a high percentage of oil ranging between 50-60%. In addition, its oil is characterized by keeping its taste and quality for a long time;this is due to non-oxidation because it contains Sesamolin. It also contains another substance called Sesamin. The sesame is introduced in the food industry as it is in the manufacture of cakes, sweets and some Pastries. It is very nutritious because it contains 25.3% protein and 15% carbohydrate. In addition to oil. Meal is added to livestock and poultry rations because it contains protein and nutrients such as phosphorus and calcium (Razak and Hikmar, 1982). The cultivated area of sesame in Iraq reached (8400) thousand dunums, with a production rate of (234 kg.dunum^{-1}) in 2015 (CSO, 2012). Agricultural policy should focus on increasing crop productivity in the unit area by following available and appropriate methods. The control of seeding rates is considered the most important and inexpensive means to raise the productivity of crops reaching to a good plant density in the unit area with achieving high productivity. The aim of the study is to determine the best seeding quantity to produce seed yield and good quality.

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Materials and Methods

A field experiment was conducted in the spring season of 2017 in the two locations: the first location in Bideat Al-Musayyib area, Great Al-Musayyib Project, Babylon Province and the second location in Al-Daghara,

Diwaniyah province.For the purpose of knowing the effect of seeding rates on the yield and quality of several cultivars of sesame (*Sesamum indicum* L). A factorial experiment was used according to Randomized Complete Blocks Design (R.C.B.D) in the implementation of the experiment, with three sectors. The experiment included two factors: The first factor included three seeding rates (6, 8, 10 kg.ha^{-1}), which is symbolized by (R_1, R_2, R_3), respectively. The second factor includes three cultivars (Wadae, Rafedeen and local). The last two cultivars were derived from the Seed Technology Research Center belongs to the Ministry of Science and Technology (Al-Janabi and Hassan, 1992). The field soil was analyzed to study some physical and chemical soil properties by taking random samples for the two locations at a depth of 0-30 cm prior to cultivating; the analysis was conducted in the Soil Department, Al-Musayyib Technical Institute. The experimental land was prepared such: plowing, smoothing and settling, and divided into three replicates, the length of the experimental unit 2 × 2 m where each experimental unit contains four lines, the distance between the line and other 50 cm. seed was planted in the lines where the seeds mixed with a part of soil for the homogeneous distribution, with depth of 2 cm. It was covered with small amount of soils for easy seedling emergence, the soil of the experiment was fertilized with nitrogen fertilizer (120 kg N.ha^{-1}) and (80 kg.ha^{-1}) P_2O_5 added when soil preparation (Sifr, 1990). The two locations were cultivated in (5/4/2017) for the first location and (6/4/2017) for the second location. The experiment soil was immediately irrigated after cultivating to ensure germination and then irrigation whenever needed. The weeding process was manually conducted, as well as the control of the thickets using the Pesticides of herbicide with thin leaves (COLDISTAN) to get rid of the thickets of the competition for the crop from time to time when the appearing of the thicket,The experiment ended when the signs of maturity appeared. Samples of all experimental units were obtained using 1 m^2 to measure the traits: number of seed / packet, weight of 1000 seed, total yield and percentage of protein.Statistical data were statistically analyzed for the studied traits and the averages were compared according to the least significant difference (L.S.D), with 5% probability level (Al-Rawi and Abdul, 1980). Excel 2010 was used.

Table 1 : Physical and chemical traits of the field soil for the two locations.

Traits	Units	First location	Second location
pH	-	7.2	7
Ec	ds.m^{-1}	2.7	3.3
N	mg.kg^{-1}	32	29.4
P		17.4	16.2
K		115	122
Organic matter		7.8	8.1
Soil components			
Sand	g.kg^{-1}	435	133
Silt		412	460
Clay		153	407
Texture	-	**Sandy silt loam**	**Silty clay loam**

Results and Discussion

Table 2 indicates that there are significant differences between the levels of the studied factors in the trait of seeds number in packet. Rafedeen cultivar significantly excelled in the seeds number in packet by giving it the highest average of (60.83 seeds) compared to the local cultivar which gave the lowest average for this trait (66.10 seeds) for first location, while Wadae cultivar significantly excelled by giving it the highest average of (64.86 seed) for the second location.While Rafedeen cultivar gave the lowest average of (64.86 seeds). The reason is the nature of the genetic variety and its response to the available environmental conditions. this result agrees with Mohammedi (2001), Foroghi *et al*. (2013) when studying the effect of the different cultivating distances on the yield and components of sesame that indicated that the sesame cultivars differed substantially in the trait of seeds number in packet. In terms of seeding rate, the treatment of (6 kg.ha^{-1}) was significantly excelled by giving it the highest average of (60.39, 66.79 seed) compared to the treatment of (10 kg.ha^{-1}), which gave the lowest average of (58.26, 63.81 seed), respectively for the two locations, This may be due to an increase in the length of the fruit packet, which has led to increase the number of seeds in the packet.The reduction in plant density led to an increase in the number of seeds in the packet of the plant. El-Naim *et al*. (2012) when they studied the average seed yield for three sesame cultivars, they pointed out that reducing the plant density led to an increase in the plant length. The same table showed that there was a significant interaction between the two factors. The interaction treatment (Rafedeen, 8 kg.ha^{-1}) was excelled by giving it the highest average of (62.8 seeds) compared to the interaction treatment (local and 10 kg.ha^{-1}), which gave the lowest average (55.4 seed) for the first location,While the interaction treatment (Wadae and 6 kg.ha^{-1}), which gave the highest average of (67.9 seed) compared to the interaction treatment (local and 8 kg.ha^{-}

Table 2 : Effect of cultivars, seeding rates and interaction between them in the number of seeds / packet, for the two locations.

Averages / Cultivars	First location				Second location			
	R1	R2	R3	Average	R1	R2	R3	Average
Wadae	60.4	56.7	59.7	60.05	67.9	66.4	64.3	66.10
Rafedeen	62.0	62.3	59.7	60.83	66.7	67.2	63.0	64.86
Local	58.7	59.1	55.4	57.08	65.8	61.5	64.1	64.94
Average	60.39	59.37	58.26		66.79	65.02	63.81	
L.S.D	Cultivars		1.40		L.S.D	Cultivars		0.81
	Average		1.40			Average		0.81
	Interaction		2.42			Interaction		1.39

Table 3: Effect of cultivars, seeding rates and interaction between them in the weight of 1000 seed, for the two locations.

Averages / Cultivars	First location				Second location			
	R1	R2	R3	Average	R1	R2	R3	Average
Wadae	4.0	4.2	4.6	4.30	4.0	3.8	4.2	4.10
Rafedeen	4.5	4.7	4.5	4.50	4.3	4.4	4.4	4.37
Local	3.9	4.0	4.6	4.24	3.7	4.0	4.7	4.20
Average	4.15	4.29	4.54		4.01	4.05	4.43	
L.S.D	Cultivars		0.16		L.S.D	Cultivars		0.24
	Average		0.16			Average		0.24
	Interaction		0.27			Interaction		0.41

^{1}) which gave the lowest average (61.5 seed) for the second location of the experiment.

Tables 3 shows significant differences between the levels of the studied factors in the weight of 1000 seeds. The Rafedeen cultivars are significantly excelled in the increase the weight of 1000 seeds by giving it the highest average of (4.50, 4.37 g) compared to the local and Wadae cultivars, which gave the lowest average of this trait (4.24, 4.10 g), respectively for the two locations. The reason for the difference in the genotype of the cultivar and the extent of its response to the environmental conditions surrounding the crop, which led to increase its efficiency in the average of seeds filling, which reflected on the weight of seeds and these agree with Lee *et al*. (1991), Patial *et al*. (1992), who pointed to significant differences between the cultivars in the weight of 1000 seed, as from seeding rates side, the treatment of (10 kg.ha^{-1}) was significantly excelled by giving it the highest average of (4.54, 4.43 g), compared with the treatment of (6 kg.ha^{-1}), which gave the lowest average (4.15, 4.01 g), respectively for the two locations,The increase in the average (10 kg.ha^{-1}) is due to the small number of branches and the small number of packets in the plants. Thus, the nutrients in the seeds, so its size increased.These results agree with Al-Saqqaf (2004), which indicated that the weight of 1000 seeds increased plant density because of the inverse relationship between the number of packets / plant and the weight of 1000 seeds, which led to the distribution of metabolic products on fewer seeds number due to the few number of cans/plant. The same table showed that there were significant differences in the interaction between the factors. The interaction treatment of (Rafedeen and 8 kg.ha^{-1}) was excelled by giving it the highest average in the weight of 1000 seeds (4.7 g) compared to the interaction treatment (local and 6 kg.ha^{-1}) which recorded (3.9 g) for the first location, while the interaction treatment (local and 10 kg.ha^{-1}) was excelled for this traits by recording it the highest average (4.7 g) compared to the interaction (local and 6 kg.ha^{-1}) which gave the lowest average (3.7 g) for second location.

Table 4 indicates significant differences between the levels of the studied factors in the trait of total yield, Rafedeen cultivar was significantly excelled in the increase the total yield by giving it the highest average of (1092.83, 1094.50 kg.ha^{-1}) compared to the local cultivar, which gave the lowest average of this trait (949.00, 1039.00 kg.ha^{-1}), respectively for two locations. The reason for the excelling of the Rafedeen cultivar to the

Table 4 : Effect of cultivars, seeding rates and interaction between them in the total yield trait (kg.ha^{-1}), for the two locations.

Averages / Cultivars	First location				Second location			
	R1	R2	R3	Average	R1	R2	R3	Average
Wadae	994.7	1102.0	1147.0	1070.83	1085.7	1089.0	1091.3	1088.50
Rafedeen	1090.3	1094.3	1095.3	1092.83	1084.0	1090.0	1105.0	1094.50
Local	946.7	941.7	951.3	949.00	1008.0	1017.0	1070.0	1039.00
Average	1010.56	1046.00	1064.56		1059.22	1065.33	1088.78	
L.S.D	Cultivars		41.63		L.S.D	Cultivars		15.95
	Average		41.63			Average		15.95
	Interaction		72.11			Interaction		27.63

Table 5 : Effect of cultivars, seeding rates and interaction between them in the percentage of protein (%), for the two locations.

Averages / Cultivars	First location				Second location			
	R1	R2	R3	Average	R1	R2	R3	Average
Wadae	27.3	26.9	23.5	25.40	28.1	26.1	25.6	26.85
Rafedeen	27.7	25.8	25.1	26.41	27.4	26.2	23.4	25.42
Local	27.0	23.8	22.3	24.65	24.6	23.6	25.2	24.92
Average	27.34	25.49	23.64		26.71	25.29	24.75	
L.S.D	Cultivars		0.90		L.S.D	Cultivars		1.16
	Average		0.90			Average		1.16
	Interaction		1.57			Interaction		2.01

nature of the plant's genetic makeup and its responsiveness to environmental conditions This agrees with Al-Awaidi (2015), Al-Issawi (2004), Al-Mohammadi (2005), which pointed to genetic differences between the studied cultivars and their difference in the efficiency of converting photosynthesis products into an economic product, In terms of seeding rates, the treatment (10 kg.ha^{-1}) was excelled by giving it the highest average of (1064.56, 1088.78 kg.ha^{-1}), compared to the treatment (6 kg.ha^{-1}), which gave the lowest average of (1010.56, 1059.22 kg.ha^{-1}), respectively for two locations. The reason is that when increasing the plant density the number of plants in the unit area will be more and thus the number of packets becomes more numerous, which effects on the yield of the unit area and this agrees with Al-Naim *et al*. (2010, 2012), Oztürk and Şaman (2012) that the increase in plant density led to an increase in the total yield of seeds, and the same table showed significant differences between the factors. The interaction treatment (Wadae, 10 kg.ha^{-1} and Rafedeen, 10 kg.ha^{-1}) was excelled by giving it the highest average inthe total yield trait of (1147.0, 1105.50 kg.ha^{-1}), respectively for the two locations, compared to the interaction (local, 6 kg.ha^{-1} and local, 6 kg.ha^{-1}), which gave the lowest average of (941.7, 1008.0 kg.ha^{-1}), respectively.

Table 5 indicates that there are significant differences between the levels of the studied factors in the trait of the percentage of protein. The two cultivars (Wadae and Rafedeen) were significantly excelled in the increase the percentage of protein by giving it the highest average of (26.41, 26.85%), respectively for two locations compared to local cultivar which gave the lowest average of this trait (24.65, 24.92%), respectively for two locations. This is due to differences in genotype for cultivar and its responsiveness to environmental conditions. These results agree with Al-Jabouri (1997) when studying the effect of cultivation dates and harvesting in the qualitative traits of two cultivars of sesame crop, which pointed out that the cultivars differed among themselves in the percentage of protein.In terms of seeding rate, the treatment of (6 kg.ha^{-1}) was significantly excelled by giving it the highest average (27.34, 26.71%) compared to the treatment (10 kg.ha^{-1}), which gave the lowest average of (23.64, 24.75%) respectively for both locations,This may be due to low plant density and light seed weight which led to increasing the percentage of protein, these results agree with Alpaslana *et al*. (2001), Caliskan *et al*. (2004) when studying the effect of the agriculture distances and

agriculture methods in the qualitative traits of sesame plant, who pointed out that reducing plant density led to increase the percentage of protein. The same table indicated that there were significant differences in the interaction between the factors. The interaction treatment (Rafedeen, 6 kg.ha^{-1} and Wadae, 6 kg.ha^{-1}) gave the highest average of protein percentage (27.7, 28.1%), respectively for two locations compared to the interaction treatment (Local, 10 kg.ha^{-1} and Rafedeen, 2 kg.ha^{-1}), which gave the lowest average of (22.3%, 23.4%), respectively for two locations.

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