Field test for methods and cultivation distances on wheat productivity

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Abstract:

The impact of sowing method,organized lines traffic (SOLT) and random lines traffic(SRLT), on the wheat/Abu Ghraib3 cultivar was carried out based on some technical indicators, under two levels SDE of 9.6 and 10.8cm, and three SD of 14,16and 18cm. A field experiment carried out in the AL-Hashimia 15 km south of the centre of Hila city, for the fall agricultural season of 2021 in silty loam soil. The SDE of 9.6cm was meaningfully better than SDE of 10.8cm in all studied parameters. Such as, the germination percentage, germination speed, PVI, root length, root dry and fresh weight, plant dry and fresh weight and grain yield, were79 %,75.87%,54.76%, 16.88 cm, 1.42 g,0.43g, and 4.311tha^{-1}respectively. The MS- SOLT was meaningfully superior than MS- SRLT in all study properties .The SD (14cm) was significant at level better than of 16 and 18cm in all studied parameters. For sowing distances of 14cm, the germination percentage, germination speed, PVI, root length, root dry and fresh weight, plant dry and fresh weight and grain yield, were 79.66%, 75.99%, 57.24% ,17.31 cm, 1.42 g, 0.43g, and 4.656 tha^{-1} respectively.

Keywords: Famarol, wheat/Abu Ghraib3 cultivar, (SM), SDE, SD.

1. Introduction

Wheat Triticum aestivum L is the greatest significant cereal crop for the mainstream of world's inhabitants. It is the greatest significant chief food of about 40 million people in Iraq. Wheat output variability in yield from time to time and from place to place, and the production of the wheat crop was estimated at 4343 thousand tons, with a percentage of 99.4%.The cultivated area is 1586.25 thousand hectare with a percentage of 98.7% for 2020, which is higher than the last two years 2018 and 2019.Iraq witnessed a decrease in wheat productivity, recording a output of impartial above 2 million tons, depressed by about one million tons from the previous year, which reached 3 million tons. The reason for this result is due to the no scientific use of agricultural and crop service processes[1], [2]. [3]. In 2010, Iraq adopted the method of using wheat seeds that are resistant to salt water and drought, encouraging farmers to use saline lands for cultivation and providing them with support from planting equipment and fertilizers for the purpose of the success of the national project and creating a successful agricultural environment by adopting engineering foundations in soil preparation, irrigation and fertilization and involving all farmers in the courses Agriculture organized by the directorates of agriculture under the supervision of the Ministry of Agriculture[4], [5]. The traditional seeding process that relies on using a bucket in which seeds are placed with a capacity of 10 kg and the seeds are thrown back and forth in the field. This method of seed is very expensive as a result of the use of a large number of workers to carry out the seeding process, in addition to the irregular distribution of seeds and consequently the low productivity of the

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hectare compared to the method of automatic seeding. For broadcast sowing, [6], [7]. For germination to occur in seeds there is the need for row seedbed to be in perfect contact with the soil to facilitate water uptake[8], [9]. The output of the wheat crop is greatly influenced by the methods of cultivation, irrigation and the addition of fertilizers, and this depends mainly on the type of soil and equipment used in agriculture to perform the cultivation process using the appropriate depth and cultivation distance to obtain the highest productivity and growth rate of the wheat crop. [10], [11]. Integrating more than one agricultural process and one such as the process of agriculture and adding fertilizers at the same time using the agricultural machine that works to add fertilizers and seeds to the soil without causing any damage to the crop to be planted and the amount of seeds allocated per hectare , thus providing an energy source and lower production costs, [12], [13].

All farmers use the traditional hand sowing method in Iraq, Thus, the use of high seed rate and traditional sowing method affect the quality of the seed the productivity of the crop, [14], [15]. Amidst the plowing and some agricultural crops such as corn, soybeans ,wheat have achieved the best soil physical properties , because their roots provide organic matter to the soil.. Therefore, it is preferable to conduct the sowing process in a homogeneous manner and a regular distribution to reflect positively on the output and growth properties of the wheat crop[16], [17]. According to Arif et al [18]. Shtewy et al [19]. The seeds size , their safety, and their freedom from diseases and rots that lead to their failure to emerge in the germination stage. Good storage method, is one of the factors that are reflected in increasing growth characteristics and improving the productivity of the final crop[20], [21], impact of tillage on bulk density was important at 1% level. The maximum and lowermost soil bulk density values belonged to the conservative and direct seeding[22], [23].

What affects the agricultural characteristics of any crop, [24], including the wheat crop, is a set of basic factors such as the appropriate seeding method, according to the soil type and irrigation method, Also what determines the seeding distances, adopted and followed by the seeding machine, all of what is mentioned has an impact on growth characteristics and low yield[25], [26], [27]. Thus, the main goal of this research is to evaluate a wheat seeder Famarol type machine at different sowing methods, sowing distances and sowing depths on some properties of wheat yield.

2 . Materials and methods

This study was conducted in 2021 to evaluate the performance of the sowing machine (type Famarol). The experiments were done at two levels of sowing methods by sowing of organized lines traffic(SOLT), and sowing of random lines traffic (SRLT), two SDE at levels 6 and 8cm, and three SD at levels of 6.8, 8.9and 10.7 cm taken soil humidity with 11-13cm depth of the sowing machine was the humidity content of the soil at 12-14%. The speed of (Famarol type) was 2.432km hr^{-1}. This study was designed in the Alhashemia area, of the Directorate of Babylon Agriculture, were geographic character of the location state Latitude and longitude 44.6771425 , 32.3978923 and altitude elevation -B.M = 35 m above sea level, dominated by a desert climate characterized by low rainfall and high temperatures in summer, which reach 50 degrees celsius, and a warm weather prevails in winter. In this study the four cylinders a New Holland 66s -80tractor with a horsepower of 80 hp was use with mold board plow on depth of 0.20- 0.23 m to soil stir and provide smooth soil for growth seed. Agronomy operation during growing season are hoeing operations, after a month from the germination stage and, adding fertilizers in two batches during the germination stage, the second batch is in the flowering stage .Irrigation interval, was 8 irrigations during growing season ,weed

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control, by in flames on two batches during the germination and flowering stage.

Sowing method

2.1. Sowing of organized lines traffic (SOLT)

Sowing is done by lines and in organized traffic, as in figure **1**[28], [29]..

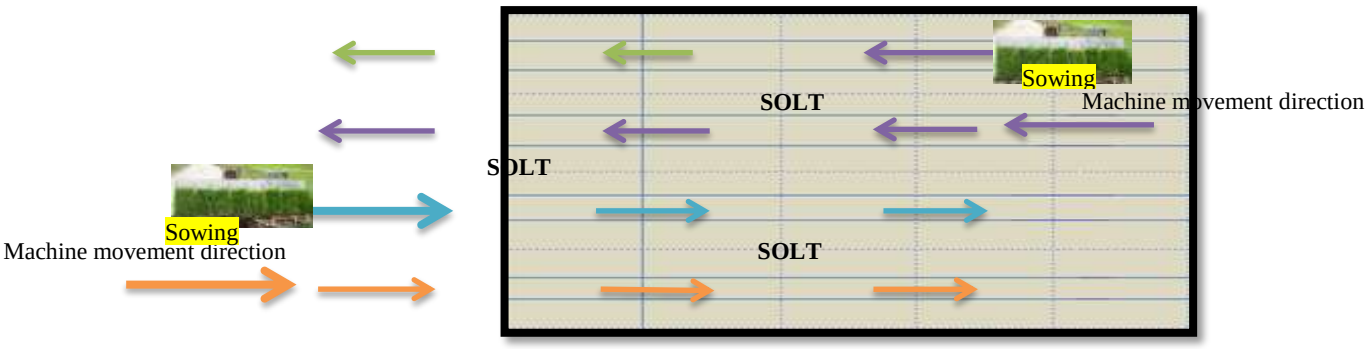

Fig 1.Sowing of organized lines traffic

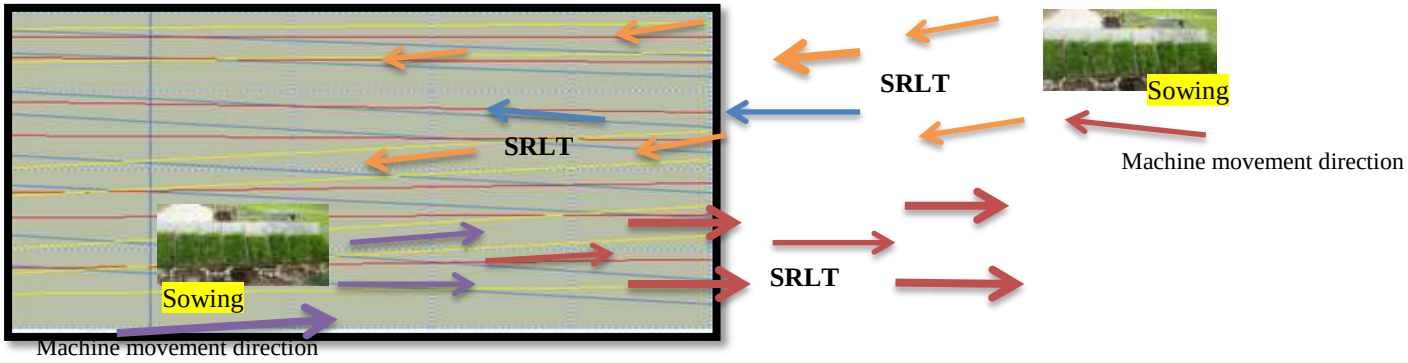

Fig .2 Sowing of random lines traffic

2.2.Sowing of random lines traffic **(SRLT)**

In this method, sowing of field according to random lines traffic, as in figure **2**. [30], [31]. .

Fig .2 Sowing of random lines traffic

Soil texture:

Using the pipette method soil separators were estimated[32], [33].

Table (1): Soil texture.

Soil texture	Sand ($g.kg^{-1}$)	Silt ($g.kg^{-1}$)	Clay ($g.kg^{-1}$)
Silty clay	132	426	442

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Table (2): Soil characteristics of the experiment field. [23], [29].

Soil moisture %	Sowing depth cm	Penetration resistance $kN.m^{-2}$) (	bulk density $Mg.m^{-3}$) (
12-14%	9.6	1627.24	1. 32
	10.8	1873.41	1.34

2.1. The crop and its components:

Germination percentage 2.1.1.

Percentage of germination was found 25 number of plants growing in one square meter in three replications[34], [35].

. **2.1.2.Germination speed**

The germination speed was calculated. [36], [37].

$$G_S = \frac{A_{B1} + A_{B2} + A_{B3}}{W_S} \times 100 \quad \textbf{(1)}$$

Where: G_S is germination speed %, A is the number of germinated seeds. B ,is the number of days from the sowing date , W_s is the total number of seed .

2.1.3.Plant vigor index (PVI)

Plant vigor index (PVI) is calculated by the following, equation[4], [8].

$$P_{VI} = \frac{P_L \times G_P}{100} \quad \textbf{(2)}$$

2.1.4. Root length:

Root length was estimated at full maturity by uprooting ten plants, The plant was cut 5-10 cm above the ground level dig out the root by using shovel without causing damage to root near the base of the stem. Roots were washed gently without damaging and the soil particles were removed then weight it. randomly selected with three replications[24] .

2.1.5. Root dry and fresh Weight

2.1.6. Plant dry and fresh weight

It was estimated at full maturity by uprooting ten plants, for both plant fresh and root fresh weight, then weights dry's, were obtained by drying the plant materials in an oven for 24 hours at 70°C.and were randomly selected with three replications[38] **.**

2.1.7. Grain yield

The randomly selected samples were taken for 2-3 meter and production of the crop was calculated in three replications. according to the method used by[21], [23].

The experiments were done at two ranges of sowing method (MS-COLT), and SM-CRLT),represented the main factor, and sowing depth were at two levels of 9.6and 10.8cm represented by the secondary factor and sowing distances at three levels (14,16, and 18 cm, represented under secondary factor .The tubes of the seeding machine have been organized, at the mentioned distances)were prepared for experiments including technical characteristics of the sowing machine, qualitative characteristics of the wheat (The crop and its components). The experiments were carried out according the Nested design according to program Gestate V.12 was used under the (RCBD), And tested the different amidst of the data for per factor according to the test L.S.D less significant differenced 0.05with three replications[39] .

3.Results and discussion

3.1.Germination ratio

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Table 3 shown impact of SM, SDE and SD, on the germination ratio, and results were 78.99 and 77.75 % respectively for the MS-SOLT, and MS-SRLT, The engineering foundations adopted in the implementation of farming methods in order to increase the crop output with the least time and effort[4], [19], while sowing depth SDE significantly at level affected the germination ratio , reaching 79 and 77.73% for 9.6 and 10.8cm (SDE) respectively. The increase in depth leads to the reduction of the germination ratio and negatively affected all studied conditions through the sowing process by using a Famarol type machine .This is also consistent with the study of[26], [7], which decided that there is a direct connotation among increased (SDE) and upsurge in the germination ratio. The (SD) had a important at level impact on the germination ratio .The SD of 18 cm recorded the lower germination ratio of 76.83% while, SD of 14 cm recorded 79.66%[17], [13].. The interaction amidst of MS-SOLT, SDE of 9.6cm and the SD of 14cm caused the best results (80.63%) .

4.2.Germination speed

The influence of SM, SDE, and SD, on germination speed. results arithmetical examination shows a noteworthy at level result for (SM),on germination speed and results were75.53% and74.13% respectively for the MS-SOLT, and MS- SRLT, under the same working conditions for SM-SRLT,. The engineering foundations adopted in the implementation of farming methods for a purpose to increase the output of the crop with the least time and effort sowing methods for MS-SOLT [24], [6]**,** study. **From table 4**,it is indicated that the depth was significant at level effect on germination speed. As the SDE increased, the germination speed decreased by75.87and73.83%for 9.6and10. 8cm SDE respectively at different planting depths. Because of the excessive load on the planting machine at the great depth, this hindered the seeding process .This is also consistent with the study of[13], [23] , SD of 14 cm was significantly at level better than the SD of 16 and 18cm , for germination speed the increasing SD leads to the decrease in germination speed and which was 75.99, 74.86 and 73.68 %respectively. [8], [20]. The interaction amidst SM-SOLT, SDE of 9.6cm and the SD of 14 cm was the best (77.62%).

4.3.Plant vigor index (PVI)

The impact of SM, SDE, and SD on (PVI). results of the statistical analysis shows a important at level effect for (SM),on the plant vigor index(PVI).Table 5,it is indicated that the plant vigor index(PVI),of the MS-SOLT, is significantly at level better than MS-SRLT, the results were 55.42and 52.55cm respectively for the MS-SOLT, and MS-SOLT, under the same operating conditions for SM-SRLT. The reason for this is the operator efficiency, and how to deal with a Famarol type machine in its path when the seeding process. [21], [14], was a significant at level effect for sowing depth. At SDE of 9.6 cm has the highest plant vigor index(PVI)of 54.76cm, and SDE of 10.8cm has the lowest plant vigor index(PVI)of 53.22cm . This due to consistency among machine wheels and soil when seeds depth increased hence field Soil resistance to penetration increased and soil porosity total decreased, and this reflect negatively on plant vigor index(PVI) [12], was a significant at level effect for sowing distances. The SD of 14 cm give greatest of results, which achieved of , 57.24 as compared with SD of 18cm,which required of,51.28cm. Because of fragility of the wheat petite and decreasing the heaviness, which with sowing distances decrease [19]. The interaction amidst of MS-COLT, SDE of 9.6cm and SD of 14 cm caused the best results (60.75 cm).

4.4.Root length

Table 6 shown the impact of SM, SDE and SD on root length (cm). The statistical analysis of the results showed the moral superiority, for sowing depth, the SDE led to the increase of root length, and the results

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were,16.88 and 15.91 cm respectively at different sowing depths, Increasing the growth and spreading of the roots of the plant with a decrease in the depth of cultivation and providing good nutrients for germination and growth[28], [31], while sowing distances SD significantly at level affected the root length the SD of 14 cm indicated the maximum root length of 17.13 cm, and the SD of 18 cm indicated the lowermost root length of 15.42cm. Because of creating a suitable environment for root growth[13]. However, the SM-SOLT was meaningfully at level better than the SM-SRLT and the results were 16.54 and 16.25 cm. [33], [21]. The interaction amidst of SM- SOLT , SDE of 9.6 cm and the SD of 14 cm caused the greatest result of (18.09 cm).

Table 3 Effect of MS, SDE and SD on germination percentage

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
SOLT		14	16	18	
	9.6	80.63	79.55	78.15	79.44
	10.8	79.94	78.66	77.01	78.53
SRLT	9.6	79.96	78.58	77.18	78.57
	10.8	78.13	77.65	75.01	76.93
L.S.D=0.05	1.813				1.891
Mean of SD		79.66	78.61	76.83	
L.S.D=0.05		1.541			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	80.28	79.10	77.58		78.99
SRLT	79.04	78.11	76.09		77.75
L.S.D=0.05	1.715				1.801
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	80.29	79.06	77.66		79
10.8	79.03	78.15	79.01		77.73
L.S.D=0.05	1.792				1.463

Note: L.S.D means Least Significant Difference

Table 4 Effect of MS, SDE and SD on germination speed

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
SOLT		14	16	18	
	9.6	77.62	76.14	75.92	76.58
	10.8	75.51	74.94	72.08	74.17
SRLT	9.6	76.18	75.26	74.10	75.18
	10.8	74.68	73.12	72.64	73.48
L.S.D=0.05	1.821				1.241
Mean of SD		79.66	78.61	76.83	
L.S.D=0.05		1.645			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	76.56	75.54	74		75.53
SRLT	75.43	74.19	73.37		74.13
L.S.D=0.05	1.392				1.132
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	76.90	75.70	75.01		75.87
10.8	75.09	74.03	72.36		73.83
L.S.D=0.05	1.663				1.196

Note: L.S.D means Least Significant Difference

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Table 5 Effect of MS, SDE and SD on PVI

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
COLT		14	16	18	
	9.6	60.75	55.26	52.34	56.11
	10.8	59.15	53.92	51.11	54.72
CRLT	9.6	55.91	53.08	51.22	53.40
	10.8	53.16	51.55	50.43	51.71
L.S..88D=0.05	2.934				2.101
Mean of SD		57.24	53.45	51.28	
L.S.D=0.05		2.611			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	59.95	54.59	51.72		55.42
SRLT	54.54	52.31	50.82		52.55
L.S.D=0.05	2.246				2.,143
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	58.33	54.17	51.78		54.76
10.8	56.15	52.74	50.77		53.22
L.S.D=0.05	2.709				2.306

Note: L.S.D means Least Significant Difference

Table 6 Effect of MS, SDE and SD, on root length **.**

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
COLT		14	16	18	
	9.6	18.09	17.17	16.19	17.13
	10.8	16.42	15.96	15.45	15.94
	9.6	17.91	16.81	15.17	16.63
CRLT	10.8	16.83	15.91	14.88	15.87
L.S.D=0.05	1.412				1.341
Mean of SD		17.31	16.45	15.42	
L.S.D=0.05		1.321			
Methods	The overlap amidst MS and SD				Mean of MS
COLT	17.26	16.55	15.82		16.54
CRLT	17.37	16.36	15.03		16.25
L.S.D=0.05	1.341				1.235
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	18	16.97	15.68		16.88
10.8	16.63	15.94	15.16		15.91
L.S.D=0.05	1.362				1.290

Note: L.S.D means Least Significant Difference

4.5.Root dry and fresh weight

The impact of SM, SDE, and SD on root dry and fresh weight . The statistical analysis of the results showed the moral superiority, for sowing methods (SM),on the root dry and fresh weight, in **Table 7**,dry and fresh weight of root obtained from SM resulted in the highest root dry and fresh weight (16.54 and

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16.25 g respectively),for the MS-SOLT and MS- SRLT ,under the same operating conditions for SM- SRLT. also was a significant at level effect for sowing depth ,at the SDE indicated the lowest root dry and fresh weight (16.88 and15.91 g respectively),at different planting depths[16], [27]. The SD had important at level effect on root dry and fresh weight, performed well when sown at shallow distances in terms of root were results 17.31,16.45and15.42 g respectively for both root dry and fresh weight. This is due that the sowing depth and sowing distances increased hence root dry and fresh weight decreased[16]. The interaction amidst SM-SOLT, SDE of 9.6 cm and SD of 14cm,caused the greatest results (18.09 g)

4. 6.Plant dry and fresh weight

Table.**8,**shown impact of SM, SDE and SD, on the plant dry and fresh weight, The statistical analysis of the results showed the moral superiority, for sowing methods (SM),on plant dry and fresh weight, and results were 0.42 and 0.33 g respectively for the MS- SOLT and MS- SRLT. Dealing with the soil and the method of seeding was better according to the method, SM-SGR, reflect positively on root dry and fresh weigh[5], sowing depth SDE meaningfully at level affected plant dry and fresh weight, reaching 0.43 and 0.33 for 9.6 and 10.8cm (SDE) respectively. The increase in depth leads to the decrease of the germination ratio and negatively affected all studied conditions during the sowing process by using a Famarol type machine [7], [28]. which determined that there is a direct affiliation amidst increasing sowing depth(SDE) and increase in the germination ratio. The (SD) had a important at level effect on the plant dry and fresh weight. The SD of 18 cm recorded the lower plant dry and fresh weight of 0.34 g while, SD of 14 cm recorded 0.42g[9]. The interaction amidst of MS- SOLT, SDE of 9.6cm and the SD of 14cm caused the best results (0.58 g) .

Table 7. Effect of MS, SDE and SD, on root dry and fresh weight **.**

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
SOLT		14	16	18	
	9.6	1.46	1.44	1.40	1.43
	10.8	1.41	1.38	1.34	1.37
SRLT	9.6	1.42	1.39	1.38	1.39
	10.8	1.38	1.36	1.33	1.35
L.S.D=0.05	0.16				N.S
Mean of SD		1.42	1.39	1.36	
L.S.D=0.05		0.11			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	1.44	1.41	1.37		1.41
SRLT	1.40	1.38	1.36		1.37
L.S.D=0.05	N.S				0.13
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	1.44	1.42	1.39		1.42
10.8	1.39	1.37	1.34		1.36
L.S.D=0.05	N.S				0.12

Note: L.S.D means Least Significant Difference

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Table 8. Effect MS, SDE and SD**, on** plant dry and fresh weight

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
SOLT		14	16	18	
	9.6	0.58	0.51	0.46	0.51
	10.8	0.35	0.33	0.31	0.33
SRLT	9.6	0.40	0.36	0.32	0.36
	10.8	0.34	0.31	0.28	0.31
L.S.D=0.05	0.09				0.05
Mean of SD		0.42	0.38	0.34	
L.S.D=0.05		0.04			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	0.46	0.42	0.39		0.42
SRLT	0.37	0.34	0.30		0.33
L.S.D=0.05	0.06				0.01
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	0.49	0.44	0.39		0.43
10.8	0.37	0.35	0.30		0.33
L.S.D=0.05	0.07				0.02

Note: L.S.D means Least Significant Difference

4.7.Grain yield

The impact of SM,SDE and SD on grain yield (t h^{-1}). The statistical analysis of the results showed the moral superiority, for sowing depth. Increasing the SDE leads to the increase of grain yield , and the results were, 4.317 and 3.942 t h^{-1} respectively. Increasing the growth and spread of roots, in fertile soils with high organic content, in a manner appropriate to plant growth and increasing its productivity. [25], [11]. From **Table 9**,was a significant at level effect for sowing distances, the SD of 14cm indicated the highest grain yield of 4.665 t h^{-1},and the SD of 18 cm indicated the lowest grain yield of 3.657 t h^{-1}. This is due to the method of sowing used, and to create the best properties of soil particles,(bulk density and soil porosity), gave better grain yield[19]. However, was a significant at level effect for sowing method the SM- SOLT was significantly better than the SM- SRLT and the results were 4.345 and 3.908 t h^{-1}. [10]. The interaction amidst of SM-SOLT , SDE of 9.6 cm and the SD of 14cm caused the greatest result of (5.109 t h^{-1}).

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Table 9. Effect of MS, SDE and SD**, on** grain yield

MS	SDE **cm**	SD **cm**			**The overlap amidst** MS and SDE
SOLT		14	16	18	
	9.6	5.109	4.242	4.086	4.479
	10.8	4.552	4.089	3.996	4.213
SRLT	9.6	4.984	4.028	3.455	4.155
	10.8	4.018	3.911	3.088	3.672
L.S.D=0.05	0.163				0.124
Mean of SD		4.665	4.068	3.657	
L.S.D=0.05		0.151			
Methods	The overlap amidst MS and SD				Mean of MS
SOLT	4.831	4.166	4.041		4.345
SRLT	4.501	3.970	3.272		3.914
L.S.D=0.05	0.135				0.103
SDE	The overlap amidst SDE and SD				Mean of SDE
9.6	5.046	4.135	3.771		4.317
10.8	4.285	4	3.542		3.942
L.S.D=0.05	0.151				0.129

Note: L.S.D means Least Significant Difference

5.Conclusions

The cultivation method achieved(MS-SOLT) the highest results in this study, while the seed depth of 9.6 cm gave the highest results compared to the levels of depths of 16 and 18 cm.The planting distance (SD-14cm) achieved the highest results for this study. The highest results were obtained from the overlap of sowing method(MS-SOLT), depth (9.6cm) and planting distance(14cm).

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