EFFECT OF SOWING METHODS ON THE YIELD AND YIELD COMPONENTS OF WHEAT UNDER TWO SEED RATES AT SULAIMANI REGION

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ABSTRACT

This experiment was implemented in the College of Agricultural Engineering Sciences fields in Bakrajo-Sulaymaniyah in two consecutive cropping seasons, 2017-2018 and 2018-2019. Two seeding rates were applied with three seeding methods, seed drill, conventional scattering pattern by centrifugal seeds spreader, and an un familiar pattern in the region, which is the overlapping pattern of grain spreading lines by the distributor. the coefficient of variance (% CV) for seeds had the best value in comparison to overlap spreading, which in turn was better than conventional scattering was 1.1, 8.2 and 47.2 for seed rate of 200 kg ha^{-1} and 1.7, 7.6, and 44.8 for seed rate of 160 kg ha^{-1} respectively. The seeding rate 200 kg ha-1 was significantly recorded higher averages for most of the studied traits. The sowing patterns had significantly superior to the overlapped grain spreading lines when it recorded 106.23 cm plant high, 341.47 spikes m^{-2}, 43.1 grains spike^{-1}, 38.7 g thousand grains weight, 3623.74 kg ha^{-1}, 11379.03 kg ha^{-1} and 0.32 harvest index. The overlapped spreading mode also significantly superior to the conventional mode of prose.

Key word: sowing patterns, seed drill, overlap spreading, spikes m^{-2}.

تاثير طرائق الزراعة على حاصل الحنطة ومكوناته تحت معدلين للبذار في منطقة السليمانية

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مدرس

قسم التقنيات الحياتية و علوم المحاصيل, كلية علوم الهندسة الزراعية, جامعة السليمانية المكننة الزراعية،

المستخلص

تم تنفيذ التجربة في حقول كلية علوم الهندسة الزراعية في بكرجو- السليمانية في موسمين زراعيين متتالين 2017-2018 و 2018-2019، حيث تضمنت معدلين للبذار مع ثلاثة انماط للزراعة وهي نمط الزراعة بالباذرة، النمط التقليدي لموزع الحبوب بالطرد المركزى مع نمط ثالث غير متبع في الاقليم وهو النمط المتداخل لخطوط نثر الحبوب للموزعة. اعطى نمط الزراعة بالباذرة افضل نتيجة لصفة معامل التباين (% CV) لتجانس توزيع البذور مقارنة بالنمط المتداخل والذي بدوره كانت افضل من النمط التقليدي للنثر وكانت 1.1 ، 8.2 و 47.2 بالتتابع لمعدل بذار 200 كغم\ هكتار و1.7, 7.6و 44.8 بالتتابع ايضا ولكن عند معدل بذار 160كغم\ هكتار. سجل معدل البذار 200 كغم\ هكتار تفوق معنوي لمتوسطات اغلب الصفات المدروسة. كما نفوقت الزراعة بالباذرة على النمط المتداخل لخطوط النثر معنويا بنسجيل 106.23سم ارتفاع للنيات، 341.47 سنبلة لكل م2، 43.1 حبة لكل سنبلة، 38.7 غم وزن الالف حبة، 3623.74 كغم\ هكتار، 11379.03 كغم\ هكتار و0.32 دليل حصاد، كما تفوق نمط النثر المتداخل على النثر التقليدي في تسجيل متوسطات افضل لاغلب الصفات المدروسة.

الكلمات المفتاحية: انماط الزراعة, باذرة الحبوب, النثر المتداخل، عدد السنابل في المتر المربع.

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INTRODUCTION

Wheat (*Triticum aestivum L*) ranks first in cereal production in the world. It is considered the most important crop used as a staple food by about a third of the world's population (15). Where different food forms can be produced from this crop, wheat consumption is expected to double by 2050 as the population increases and the demand for its products increases (24), especially in developing countries. Where the trend is towards increasing the production per unit area while maintaining its quality with sufficient care (33). And do not forget its high quality in its inclusion as an important factor in the composition of feed in feeding livestock and poultry. The rate of seeds and sowing manners are two of the most influential factors in increasing production per unit area. In which increasing sowing rates increases the number of plants per unit area, which means higher yields. This relationship is real because many plants mean increased competition between them, which leads to the failure of many plants to reach the typical size of the harvest; in this case, the result, is the opposite, (20). The low yield is attributed to many factors viz. sowing patterns, seed rate, and varietal potentiality. Yield is the function of many components when that yield relating components have been modified and observed direct influence on the production enhancement viz. optimum seed rate, plant density, climatic condition, soil, sowing time and varieties (21). The competition between individuals and populations can be controlled indeterminately through optimum cultivation intensity, by establishing a suitable population pattern, (34). Seeding rates below optimum may reduce yield potential, while excessive seeding rates increase lodging, create a more enormous potential for disease, and increase seed costs. The optimum planting should be calibrated for seed drill is to put 30 to 35 live seeds per square foot (3,800,000 seeds. ha^{-1}) to obtain at least 25 plants per square foot. The rotary seed spreader, the rates should be increases by 30 to 35 percent over drilled seeding rates (45 to 47 seeds per square foot) In order to compensate for the shortage in the number of seeds necessary for proper emergence per unit area. The shortage in the number of plants unit area required is due to the irregular establishment of the seedbed in addition to the unequal distribution of seeds on the soil surface (13). The higher seed rate leads to an increase in water consumption prior to synthesis, lead to greater plant height grains and grains in the spike (10 and 25). When the seeding rate is increased to a certain extent, it leads to an increase in spikes per square meter, biological yield, and thus crop yield (1). In a study on the effect of seed rates of 60, 80, 100 and 120 kg ha^{-1} on the regulation of tillering in wheat and its relationship to grain yield and its components, the results indicated that the seeding rate of 80 kg ha^{-1} was significantly superior giving the highest average number of spikes m^{-2} by 363 spikes and a grain yield of 4.775 tons h^{-1} compared to other seed rates (18). Usually standard deviation of plant spacing (SD) and coefficient of variation (CV) are used to represent the seeding equilibrium. Resulting in good germination quality, the yield will directly depend on the quality of sowing and plant organization per unit of surface area, (30). The Coefficient of Variation (CV) is an indicator measurement of how uniformity the granular distributes; Better spreaders should have both a low CV less than 5% and a good basic spread pattern – and these should be verified by an independent test conditions in test halls. However, in the field, values up to 15% are acceptable, but once the CV goes above 20% a crop and financial loss will happen (11). The distribution pattern of the scattered seeds over the soil is not sufficient even after conducting all the modifications that can be obtained, based on the numerous recommendations of many books and researchers to solve the problem of non-homogeneity by making the application rate for half and covering the field twice in perpendicular direction (7). The sowing pattern has a massive impact on the variation of winter wheat seed rates. Also, a common drilled seed rate of 120 kg ha^{-1} is used for all the varieties, still farmers use too high seeding rate, and sometimes they even use twice amount than the recommended in order to control weeds, compensate the wasted amount by the birds and higher yield expectation, and, they observed that with increasing the seeding application rates, the total production was increased (3). It is important to notice that seed drill planter allowed a saving in wheat seeds of 26% as compared to the seed spreader method (12). In the field, seed broadcasters are used for granular (fertilizers and seeds) to increase the expected yield and crop quality and save time, energy, and cost requirements. (6 and 9). Broadcasting not only requires a highest seed rate but also results in a lower number of plants, as drilling sowing method, which is recommended due to the uniform distribution of seeds and sowing to the required depth, which usually results in higher germination and uniform seed horizontally and vertically distribution (25). It is necessary to follow the modern technique of broadcasting by scattering the granules by two passes across the field; in this case, half of the seeding rate must be applied for each pass as recommended by many researchers and specialists (22). This study was aimed to determine the best seeding pattern and seeding rate applied to introduce highest wheat yield in Sulaimani region.

MATERIALS AND METHODS

The field experiment was conducted at Bakrajo Experimental fields of the College of Agricultural Engineering Sciences, Sulaimani University, located at the southwest of Sulaimani city, Iraq- Kurdistan region, during November of 2017 and 2018. Two fallow land were selected for each cultivating season, which previously plowed in spring. The experiment was conducted when the soil moisture was approximately 18 % with Silty Clay texture and pH of 7.44. The prevailing climate for this location is rainy with cloudy winters, rainy springs, hot and dry summers, the information on agro-climatic conditions is given in Table 1. Adana wheat variety was sown in the experiment. After taking into consideration the germination rate of wheat 90 % seeds, the amount of fertilizer added per hectare and the recommendations of many researches due to articles in particular (13), regarding the optimal seed rate for unit of area, the seed rates of 160 and 200 kg ha^{-1} were selected for sown by each of seed drill and grain spreader. It should be noted that these rates are the same rate as followed by most farmers in Iraq - Kurdistan region.

Table 1. Agro-climatic conditions at the Bakrajo Experimental Station during cropping season 2017-2018 and 2018-2019

Season		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total mm
					Precipitation (mm)					
2017-2018		10.0	114.6	22.2	72.4	323.0	44.6	98.6	70.4	755.8
2018-2019		48.2	99.8	281.8	210.6	108.2	248.6	190.0	28.4	1215.6
					Air temperature (°C)					
2017-2018	Max.	33.1	23.9	17.8	15.6	20.9	24.4	31.6	38.1	37.8
	Min.	10.4	7.6	-2.5	1.4	-2.3	1.0	2.2	13.0	19.6
2018-2019	Max.	32.0	22.0	15.0	13.8	17.4	21.2	26.0	33.8	37.8
	Min.	9.6	6.2	-12.6	0.8	12.0	1.6	2.4	12.8	19.6

The study was applied using Randomized completely Block Design in split plot arrangement using three replications, each was consisting of two factors: the first factor represented two main plots, net treated size of (48x 40) m for each, which were for seeding rates: 200 kg ha^{-1} as (S1) and 160 kg ha^{-1} as (S2), the second factor placed as sub plots which were for seeding method: seed drill as (SD), spinning disc seed broadcaster with conventional spreading pattern as (CP) and spinning disc seed broadcaster with overlapped spreading pattern as (OP). Each plot size was 16 m width ×40 m long. For both seasons, the land was plowed by Moldboard and harrowed during the perform of the experiment. The plots which sown by the spreader, the seeds were covered with a tine-type harrow till to 10 cm deep.

Calibration

The calibration of the machine ensures the seeds can be set in a place which can give the required number of granules above the soil surface. The calibration was started by carrying out the following steps mentioned by (16). The coefficient of variation for the seeds placed in the soil by seed drill also was found by the same equation used for Broadcaster machine. The process was started by adopting the same method followed by other researchers

(2). A plastic strip of 20 m by 1.5 m was elongated on the land. A layer of fine sand of 50 mm thickness was placed out on the plastic strip. The seed drill run and seeds were drilled over the sand layer at selected forward speed for the study. Several meter squares were randomly selected using a wooden frame. A sieve was used for separate the planted seeds in the chosen randomly area from the sands. The test was replicated three times and the average was taken to compute the coefficient of uniformity of seed distribution.

Calibration of seed broadcaster

The calibration was carried out as followed by others (17 and 23). The machine was operated over a level floor area on the selected speed and feed rate settings for each seed rate. During the run, seeds were collected in a series of trays placed at perpendicular angles to the line of tractor travel. 20 collectors of 1.0 x 1.0 m (each had partitions barriers) spaced in 0.5 m (for tractor tire pass) were used. Following each test, the contents of each tray were weighed until the required seed rate was obtained. Table (2) and following histograms in Fig.1 and Fig.2 were drawn to show the seeds distribution pattern. After the calibration processes was completed at the required seed rates, the wheat grains were grown as the conventional manner which followed by the farmers. As Fig.1 and Fig. 2 shows the distribution of wheat granules is uneven over the soil surface and the seed distribution pattern tends to be like a bell-shaped as confirmed by other (32) that, Intensive seeds are divided into distributed path center, while utilization rates decrease as we move far away from the prose center. In order to distribute the seeds uniformly on the soil surface, it is necessary to follow the modern technique by broadcast granules in two passes across the field, and that occur completely by (13 and 22). Therefore, other calibrations were made for both seed rate 80 and 100 kg as the same manner as mentioned previously for 160 and 200 Kg ha^{-1}. During the calibration process, the wind velocity was very low and almost negligible and had no effect on the granular distribution pattern. After the calibration process was completed, the wheat seeds were grown in the field by following half-width method and half rate application (a right-on-right) and (a left -on-left) overlap pattern. Fig.3 explains the modern technique pattern for sowing wheat seeds.

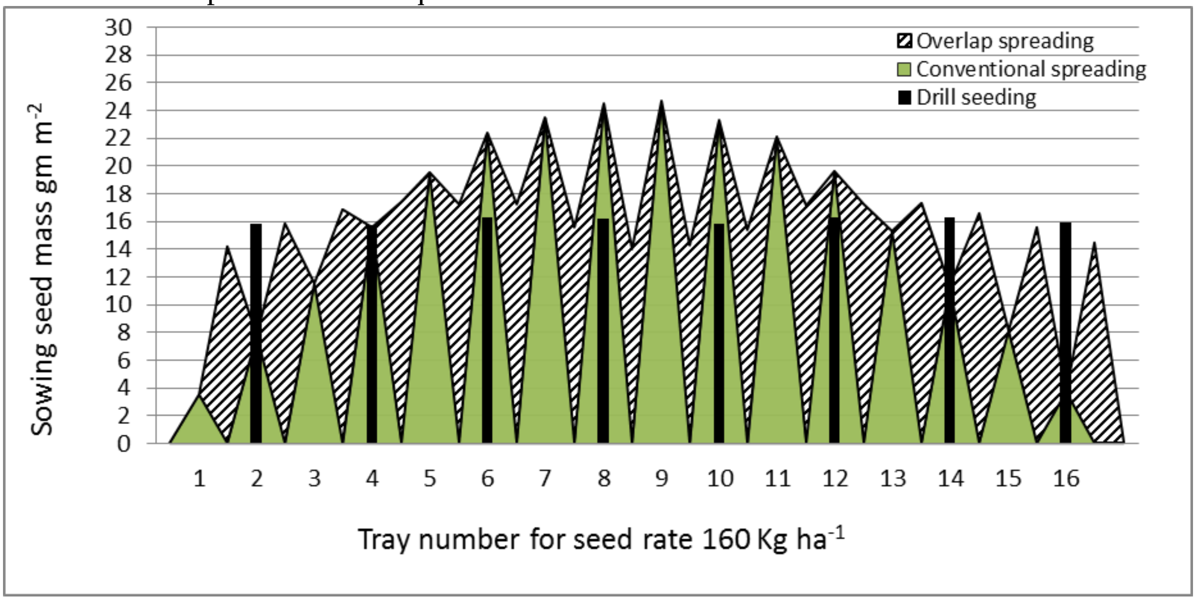

Figure1. Seed distribution pattern for both conventional and overlapped spreading after calibration of the seed broadcaster on seeding rate 160 kg ha^{-1}

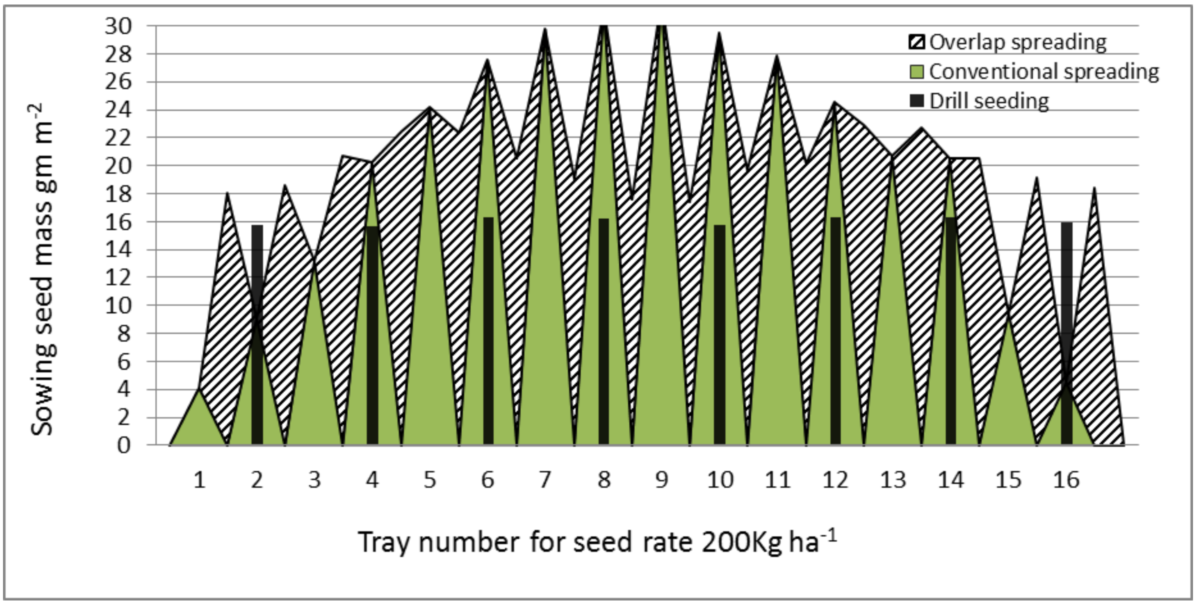

Figure2. Seed distribution pattern for both conventional and overlapped spreading after calibration of the seed broadcaster on seeding rate 200 kg ha^{-1}.

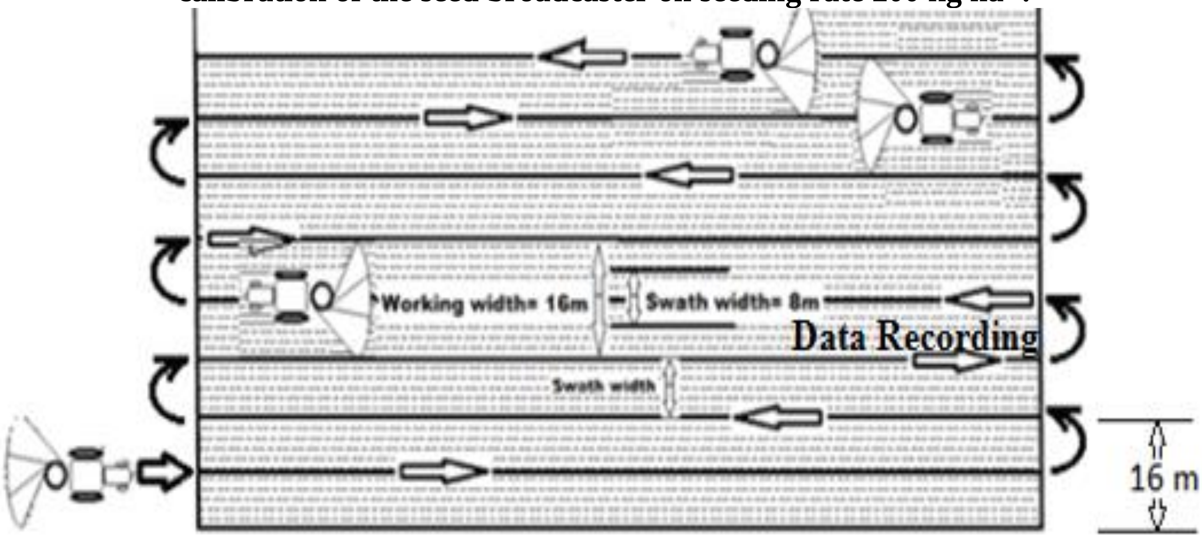

Figure3. Spreading sowing for wheat seeds by applying the overlapped mode (a right-on-right) and (a left -on-left).

Coefficient of variation (C.V.)

Coefficient of variation is a relative measure of dispersion that gives the standard deviation as a percentage of the mean value; the following formula was used to calculate the C.V as (4) mentioned:

CV % = (100 × Sd)/ $\bar{x}$ ------------------1

$$sd = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(xi - \bar{x})^2}$$

Where;

CV = Coefficient of variation

Sd = Standard division

n = Number of observations

xi = Value of an individual observation

x = Mean value of all observations

Four samples were taken randomly from each plot, the area of each sample was one meter square, and subjected for recording data using standard methods. Following treats were recorded:

x = Mean value of all observations

2- Plant height (cm)

3- Numbers of spikes m^{-2}

4- Numbers of grains spike^{-1}

5- 1000- grains weight (g)

6- Grain yield (Kg ha^{-1})

7- Biological yield (t ha^{-1})

8- Harvest Index (%).

The data were statistically analyzed and then the averages were compared by Duncan's multiple ranges for a test under the 5% probability level

RESULTS AND DISCSSION

Coefficient of variation (C.V.)

Results in Table 2 show the coefficient of variance (C.V) for both seeding rates 200 Kg ha^{-1} and 160 Kg ha^{-1} which indicate that seeding by conventional distribution results high value of 48.4 % and 46.8 % CV respectively, that mean, the homogeneity of distribution was very bad compared to the overlapped pattern of grain distribution when gave 9.2% and 7.8% for the two seed rates respectively. As known, the lower the coefficient of variation, the better the distribution. The reason of the variance could be due to in centrifuge type of spreader, the grain is scattered by the rotating disc after falling from the control gate of the exit amount of the granules. The spinning disc results a centrifugal force. By means of radial feathers on the spinning disc, the centrifugal force pushes those falling seeds to out in all directions and far away from the center of the rotation. In fact, the plate barrier which place in the back part of broadcaster (tractor side) prevents the seeds from being distributed, that a small percentage of the grain bounce towards the rotate disc to dispersed again, while, most of these grains, fall on the ground in places near to the center of the prose disc which causing an increase in the number of grains m^{-2} compared to places far from the center. This fact is consistent with what was confirmed by (23). Results in Table 3 show that the weather conditions did not significantly affect most studied characters except on grain yield. The second cropping season gave highest production by 3209.9 kg ha^{-1} than the first cropping season 3003.33 Kg ha^{-1}. The reason for these results might be due to the differences in the precipitation percent between the two-cultivation season as it shows in Table 1, since the abundance of water available to the plant in the soil by precipitation was higher in the second year 1215.6 mm, which did not cost the plant more effort for absorption for growth and make more grains compared to the second cultivation season 755.8 mm. This is in agreement with Twizerimana et al. (31) concluded that the planting season did not have a significant effect on the high intentions nor on the number of grains per spike but it led to a significant increase in the grain yield.

Table 2. Coefficient of variance (C.V) for seeding uniformity for the samples of seeds collected for each of seed drill, overlapping prose and conventional spreading

Scattering side	Collecting trays number	Sowing method at a seeding rate 200 kg ha^{-1} in (g m^{-2})			Sowing method at a seeding rate 160 kg ha^{-1} in (g m^{-2})		
		SD*	O	C	SD	O	C
Right	1	19.8	18.1	4.1	15.8	14.2	3.5
	2		18.6	9.1		15.8	7.7
	3	20.2	2 0.7	13.2	15.7	16.9	11.5
	4		22.5	20.3		17.4	15.6
	5	20.1	22.4	24.2	16.3	17.2	19.5
	6		20.5	27.6		17.2	22.4
	7	19.7	19.1	29.8	16.2	15.6	23.5
	8		17.6	31.3		14.0	24.5
Left	9	19.9	17.4	31.9	15.8	14.3	24.7
	10		19.7	29.5		15.4	23.3
	11	20.3	20.2	27.9	16.3	17.1	22.1
	12		22.9	24.6		17.2	19.6
	13	20.2	20.7	20.7	16.3	17.3	15.3
	14		20.5	12.9		16.6	11.3
	15	19.8	19.2	9.4	15.9	15.6	8.1
	16		18.8	4.5		14.5	4.5
Coefficient of variance CV%		1.1	8.2	47.2	1.7	7.6	44.8

Table 3. Effect of cropping season on wheat grain yield and its components

Season	Plant height (cm)	Spike number m^{-2}	Grain number $spike^{-1}$	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index
2017-2018	95.46 a	309.69 a	39.46 a	39.98 a	3003.33 b	10190.77 a	0.3 a
2018-2019	97.41 a	315.78 a	39.95 a	40.07 a	3209.9 a	10219.24 a	0.31 a

The results showed in Table 4 illustrate the effect of the seeding rate on the yield of wheat grains and its components, where the seed rate of 200 kg hectare had a significant effect on each of the spike number m^{-2}, the number of seeds per spike, the grain yield and the biological yield by giving the highest values by 320.62, 40.87, 3300.43 kg ha^{-1} and 10880 kg ha^{-1} respectively, compared to the results obtained from the application of seed rate 160 kg ha^{-1}. While the plant height, the weight of a thousand grains and the harvest index were not affected by the seed rate when the application amount decreased from 200 kg to 160 kg ha^{-1}. The reason for the significant differences could be due to the increases in competition between plants resulting from the high seed rates leads to a decrease in the number of tillers that carry spikes per plant and not the total number of spikes unit $area^{-1}$ within some ranges of plant density. It seems clear that the increase in the number of main plants per unit area resulting from the increases in the seeding rate overcame the decrease in the number of stems produced by one plant due to the increases in seed density (5 and 29). Also, using low seeding rates will not produce the required number of plants in the field, and thus it will not be able to use light, water and nutrients with high efficiency, which results in less yield (27).

Table 4. Effect of seed rate on wheat grain yield and its components

Seed rate Kg ha^{-1}	Plant height (cm)	Spike number m^{-2}	Grain number $spike^{-1}$	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index
200 (S1)	**97.27 a**	**320.62 a**	**40.87 a**	**40.28 a**	**3300.43 a**	**10880.96 a**	**0.3 a**
160 (S2)	**95.59 a**	**304.85 b**	**38.55 b**	**39.77 a**	**2912.81 b**	**9529.05 b**	**0.31 a**

Data in Table 5, shows that there are clear significant differences for the effect of seeding type on most of the studied traits, where sowing pattern with seed drill recorded the highest values when had 106.23 cm, 341.47, 43.1, 3623.74 kg ha^{-1}, 11379.03 kg ha^{-1} and 0.32 for plant height, spike numbers per m^2, grain numbers $spike^{-1}$, grain yield, biological yield and harvest index respectively. While the treatment of sowing by conventional seed spreading by grain distributor machine recorded lowest values which were 86.56 cm, 285.3, 36.17, 2663.16 kg ha^{-1}, 11379.03 kg ha^{-1} and 0.31 for the studied traits respectively except for thousand kernel weight and harvest index, where the lowest mean value was 40.06 g and 0.29 respectively, when the overlapped spreading pattern of seeds was applied. These differences between the treatments average are due to the variance distribution of seeds over the surface of the soil, where the seeding by seed drill left the seeds more homogeneous than the application of the overlapped method of prose lines of the seed distributor, which in turn, the homogeneity distribution of the grains is better than the seed dispersal by the conventional method, the practice of farmers, as explained in the Table 2. The irregular distribution of seeds makes plant competition for energy sources differ from place to another in the treated area, which ultimately negatively affects the growth of the plant (25).

Table 5. Effect of seeding pattern on wheat grain yield and its components

Seed rate Kg ha^{-1}	Plant height (cm)	Spike number m^{-2}	Grain number $spike^{-1}$	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index
SD	**106.23 a**	**341.47 a**	**43.1 a**	**38.7 a**	**3623.74 a**	**11379.03 a**	**0.32 a**
CP	**86.56 c**	**285.3 c**	**36.17 c**	**41.32 c**	**2663.16 c**	**8725.34 c**	**0.31 c**
OP	**96.50 b**	**311.45 b**	**39.85 b**	**40.06 b**	**3032.96 b**	**10510.65 b**	**0.29 b**

As seen in Table 6 there were significant effect for most of the interaction of the cultivation year and seed rate except for thousand kernel weight traits. the highest averages were recorded from using the seed rate of 200 kg ha^{-1} in the second season for plant height, spike number m^{-2}, grain number $spike^{-1}$ and grain Yield by 98.28 cm, 322.02, 40.92 and 3396.09 respectively. While the highest value gave for biological yield was obtained when the wheat was cultivated at the first season with seed rate of 200 kg ha^{-1} by 10917.94 kg ha^{-1} and harvest index by 0.32 at seed rate 160 kg ha^{-1} in the second planting season. On the other side, the cultivation at seed rate of 160 kg ha^{-1} in the season 2017-2018 gave the lowest averages compare to most other interaction treatment except the harvest index, which the lowest value was produced from applying seed rate of 200 kg ha^{-1} at the first cultivation season by 0.29. the reason of the differences among the averages value It might be due to the apparent variation in the percentage of rain and the period of fall during the months of the plant growing season, which has a great impact on the composition of the seed and its number within the spike and the number of spikes and thus the yield as shown in Table 1. Highest density of the plants per meter square from using 200 kg ha^{-1} which introduced more spike number m^{-2} and more grain in one spike then the total yield although the thousand kernel weight value of this interaction was lower than the other treatments as illustrated in Table 6. These results are in agreement with what (31) and (19) reached to.

Table 6. Effect of cropping season and seeding pattern on wheat grain yield and its components

Seed rate Kg ha^{-1}	Plant height (cm)	Spike number m^{-2}	Grain number spike^{-1}	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index	Seed rate Kg ha^{-1}
2017-2018	200 (S1)	96.27 ab	319.23 a	40.82 a	40.57 a	3204.77 b	10917.94 a	0.29 b
	160 (S2)	94.64 b	300.16 c	38.11 b	39.4 a	2801.9 d	9463.6 b	0.3 ab
2018-2019	200 (S1)	98.28 a	322.02 a	40.92 a	40.0 a	3396.09 a	10843.98 a	0.31 ab
	160 (S2)	96.53 ab	309.55 b	38.98 ab	40.15 a	3023.71 c	9594.5 b	0.32 a

The average observes in Table 7 shows that the interaction between the cropping season and seeding pattern had a significant effect on all studied traits. Using the seed drill for planting in the second season had the highest values for plant high, spike number m^{-2}, grains number spike^{-1}, grain yield and harvest index by 108.15 cm, 346.44 spike m^{-2}, 43.24 grain per spike, 3772.77 kg ha-1 and 0.34 respectively compare to the lowest values were obtained from using seed spreader with conventional scattering for plant high by 86.18 cm, spike number per m^{2} by 284.13, grain m^{-2} by 35.62, grain yield 2568.76 kg ha^{-1} and biological yield by 8463.25 kg ha^{-1}. While the highest value recorded for thousand Kernel Weight was 41.55 g and for biological yield was 11488.66 kg ha^{-1} when the wheat was planted by applying conventional seed spreading in the second cropping and seed drill in the first season respectively. The homogeneity of the distribution of seeds horizontally and vertically on the soil has a great role in equal opportunities for plants to access light and available water, as well as nutrients in the soil, which makes competition less than in the case of random scattering of seeds on the soil, as competition intensifies in dense places, which negatively affects the variation of the outcome of plant height and the total yield of wheat and its components, plant density, grain per spike, spike per m^{2}, thousand Kernel Weight and harvest index (26). what is known about the seed drill is its ability to place the seeds at equal distances, depths and then cover directly, while in the case of random scattering the opposite is occurred, bad feature of heterogeneity of seed distribution has been overcome by following the overlapped scattering of seed distribution lines.

Table 7. Effect of cropping season and seed rate on wheat grain yield and its components

Seed rate Kg ha^{-1}	Plant height (cm)	Spike number m^{-2}	Grain number spike^{-1}	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index	Seed rate Kg ha^{-1}
2017-2018	SD	104.32 b	336.51 b	42.96 a	39.02 a	3474.7 b	11488.66 a	0.3 b
	CP	86.18 d	284.13 d	35.62 c	41.09 d	2568.76 f	8463.25 d	0.31 b
	OP	95.87 c	308.44 c	39.81 b	39.83 b	2966.54 d	10620.41 b	0.28 c
2017-2018	SD	108.15 a	346.44 a	43.24 a	38.39 a	3772.77 a	11269.4 a	0.34 a
	CP	86.93 d	286.46 d	36.73 c	41.55 c	2757.56 e	8987.43 c	0.31 b
	OP	97.13 c	314.46 c	39.89 b	40.28 b	3099.38 c	10400.9 b	0.3 b

The result in Table 8 shows the variations in studied traits in response to the seed rate and sowing methods interaction. the variations were significant where using the treatment of seed drill with seed rate 200 kg ha^{-1} recorded maximum value for plant height, spike number m^{-2}, grains number $spike^{-1}$, grain yield and biological yield by 107.08 cm, 355.08 spikes, 44.67 grains, 3814.56 kg ha^{-1} and 11889.45 kg ha^{-1} respectively. While, the lowest average was obtained by 85.25 cm, 282.64 spike, 35.77 grain, 2495.68 kg ha^{-1} and 7612.38 kg ha^{-1} respectively. the highest mean was 42.43 g for thousand Kernel weight when conventional seed spreading was applied at seed rate 200 kg ha-1 and 0.33 for harvest index when seed drill was used with seed rate of 160 kg ha^{-1}. The lowest value recorded for thousand kernel weight was 37.81 g from using seed drill machine with 200 kg ha^{-1} seed rate and for harvest index was 0.28 when the overlapped seed spreading was applied. The appropriate seed rate, seeding method and their interactions positively affect the viability and productivity of the plants. They encourage nutrient availability, adequate penetration of sunlight for photosynthesis, and a suitable environment for plants to obtain soil nutrients and efficient use of stored water leading to to increased yield and its components, including spikes $plant^{-1}$ and the number of grains in the spike (25). Sowing wheat by drilling method at seed rates of 150 kg ha^{-1} led to a significant increase in plant strength and yield. Increase in yield was associated with the gradual increase in all growth components and biological yield compare to seed broadcasting method.

Table 8. Effect of seeding pattern and seeding pattern on wheat grain yield and its components

Seed rate Kg ha^{-1}	Seeding pattern	Plant height (cm)	Spike number m^{-2}	Grain number $spike^{-1}$	Thousand kernel weight (g)	Grain yield (kg ha^{-1})	Biological yield (Kg ha^{-1})	Harvest index
200 (S1)	SD	107.08 a	355.08 a	44.67 a	37.81 d	3814.56 a	11889.45 a	0.32 a
	CP	87.87 c	287.95 d	36.58 d	42.43 a	2830.64 d	9838.3 c	0.29 bc
	OP	96.87 b	318.84 b	41.37 b	40.61 b	3256.1 c	10915.13 b	0.3 b
160 (S2)	SD	105.38 a	327.86 b	41.54 b	39.6 c	3432.91 b	10868.61 b	0.32 a
	CP	85.25 d	282.64 d	35.77 d	40.22 b	2495.68 e	7612.38 d	0.33 a
	OP	96.13 b	304.06 c	38.34 c	39.51 c	2809.83 d	10106.18 c	0.28 c

Results in Table 9 illustrates the average of the interactions among the cropping season, seed rates and seeding patterns which significantly affected all the traits entered in the study. The interaction between seed rate 200 kg ha^{-1} and seed drill sowing in 2018-2019 season recorded highest values for plant high, spike number m^{-2}, grain number $spike^{-1}$ and grain yield were 109.27cm, 356.08 spike, 44.93 grain and 3921.72 kg ha^{-1} respectively. While the lowest averages were obtained from using seed rate of 160 kg ha^{-1} by conventional spreading in the first season by 84.77 cm, 282.6 spikes, 34.69 grain, and 2416.44 kg ha^{-1} respectively, and 7178.07 kg ha^{-1} for biological yield. The highest weight for thousand Kernel was 42.42 g recorded from a conventional pattern with 200 kg ha^{-1} seed rate in the first planting season. The lowest value was 38.91 g from applying seed drill with 200 kg ha^{-1} and the first cultivation season. Lowest biological yield was 7178.07 kg ha^{-1} produced from applying conventional method with seed rate 160 kg ha^{-1}. The uniformity distribution of the seeds in the soil surface by seed drill make the competition between the plants cause to reduce the light and nutrient with an increasing the seed rate of wheat to 175 kg ha^{-1} which lead the high of plants close to each other that produce plant higher than that in broadcasted treatment, this result was explained by (25). Also, with increasing wheat seeding rates with homogenous seed distribution, curbing weed growth has increased (35). The highest number of the spike per m^2 in the seed drill at the seed rate of 200 kg ha^{-1} resulted in the higher amount of the grain yield in the same treatment which might be attributed to the improvement in the number of tillers and directly related to the number spikes unit $area^{-1}$ (14). The tendency of the plant to increase the number of grains was accompanied by a weakness in the formation of a single seed, which affected the weight of the grain especially in the rainy season, which might cause waterlogging at stem elongation decreases the kernels number spike^{-1} or reduces kernel weight (8). The grain yield will increase due to increasing spikes m^{-2} and biological yield (1). The decrease in the harvest index value results from the high of the yield to the relatively small weight of the same treatment's biological yield.

Table 9. Effect of cropping season, seeding pattern and seeding pattern on wheat grain yield and its components

Season	Seed rate Kg ha^{-1}	Seeding pattern	Plant height (cm)	Spike number m^{-2}	Grain number spike^{-1}	Thousand kernel weight (g)	Grain Yield (kg ha^{-1})	Biological yield (Kg ha^{-1})	Harvest index
2017-2018	200 (S1)	SD	104.90 bc	354.07 a	44.4 a	38.91 e	3707.4 b	11983.37 a	0.31 bc
		CP	87.60 e	285.66 ef	36.55 cd	42.42 a	2721.08 g	9748.42 d	0.28 def
		OP	96.30 d	317.95 c	41.5 b	40.37 bc	3185.84 d	11022.01 b	0.29 cde
	160 (S2)	SD	103.73 c	318.94 c	41.52 b	39.13 e	3242.0 cd	10993.94 b	0.29 cde
		CP	84.77 f	282.6 f	34.69 d	39.76 cde	2416.44 i	7178.07 f	0.34 a
		OP	95.43 d	298.94 ed	38.13 c	39.3 de	2747.24 fg	10218.8 cd	0.27 f
2018- 2019	200 (S1)	SD	109.27 a	356.08 a	44.93 a	36.72 f	3921.72 a	11795.52 a	0.33 a
		CP	88.13 e	290.24 ef	36.6 cd	42.43 a	2940.2 e	9928.17 d	0.3 bcd
		OP	97.43 d	319.73 c	41.23 b	40.84 b	3326.36 c	10808.25 bc	0.31 bc
	160 (S2)	SD	107.03 ab	336.79 b	41.55 b	40.07 bcd	3623.82 b	10743.27 bc	0.34 a
		CP	85.73 ef	282.68 f	36.85 c	40.67 b	2574.92 h	8046.68 e	0.32 ab
		OP	96.83 d	309.18 cd	38.55 c	39.71 cde	2872.41 ef	9993.55 d	0.29 cde

CONCLUSION

The results obtained from present research it can be safely concluded that wheat sown under drilling at seed rate 200 kg ha^{-1} is optimal, had better growth and grain yield components compare to overlapped and conventional spreading pattern by seed distributer machine. the results proved that using overlap pattern is better than conventional scattering of grains, because it was produced better results for the uniformity distribution of grains entire the soil by recording very satisfying CV % value which was close to that produced from seed drill. uniform distribution of grain with desire seeds rate provides appropriate environment for seed- soil contact and encourage better establishment for seeds emergence. Furthermore, it provides proper distance for optimum sun light penetration for photosynthesis of plants and for roots uptake of water and soil nutrients resulted in good water use efficiency. The recommendation is applying more seed rate higher than 200 kg ha^{-1} with different overlap percentages for prose lines.

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