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INFLUENCE OF PRESS WHEELS, ROW SPACINGS AND SOWING RATES IN YIELD AND ITS COMPONENTS OF WHEAT CROP (*Triticum aestivum L.*) CULTIVATED BY ZERO TILLAGE METHOD IN GLYUKHAN DISTRICT

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ABSTRACT

A field experiment was carried out in a Moderate rainfall area (Jleokhan) in the Nineveh Governorate during the agricultural season 2018-2019 to study the effect of press wheels (use (+) and non-use (-), row spacing's (17 cm and 34 cm), and sowing rates (80, 100 and 120 kg. ha^{-1}) in the yield and its components of the wheat crop (*Triticum aestivum L*) Adana-99 cultivated with Zero Tillage (ZT) planting methods and Conventional Tillage (CT) as a control treatment.The results showed that the planting methods (ZT 17+P) and (ZT 34+P) achieved the highest significant values in the traits of plant height, the weight of 1000 grains, and grain yield. (ZT 17+P) planting method was achieved the highest significant values in the traits of tillers No. m^{-2}, spikes No. m^{-2}, biological yield and straw yield. The (ZT 34+P) planting method recorded the highest significant value in protein ratio trait. The sowing rate (120 kg. ha^{-1}) achieved the highest significant values in the traits of tillers No. m^{-2}, spikes No. m^{-2}, and grain yield. In grain yield trait, the interaction between the planting method (ZT 17+P) with all sowing rates and the planting method (ZT 34+P) with (120 and 100 kg. ha^{-1}) sowing rates achieved the highest significant value in grain yield, while the interaction between CT with (80 kg. ha^{-1}) sowing rate has the lowest significant value in grain yield.

Keywords: Conservation Agriculture, Grain yield, rain-fed planting.

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INTRODUCTION

Conservative agriculture has become a major requirement in the twenty-first century with strategic crops, such as wheat (Giraldo *et al.,* 2019). Zero-tillage systems, and sometimes minimal tillage (MT), are one of the sustainable crops Production methods that scientists around the world have sought (Farooq and Siddique.2015). In 2016, the total global land area increased to 180 million hectares, or approximately 12.5%. The global increase in adoption and expansion of land under the Zero Tillage system is a result of the many benefits associated with this agricultural practice. (Kassam *et al.,* 2019). Conservative agriculture practices have positive impact on the main soil characteristics, with reduced carbon pollution and climate protection, nutrient cycling and provision, water regulation to conservation it to the favor of crop, and reduced evaporation, and preserving soil

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biological diversity (Ghaley *et al.*, 2018). In general, the rules for applying zero-till cultivation is due to three main principles: reducing soil irritation, improving soil cover with previous crop residues, and increasing species diversity through the agricultural cycle (Tarolli *et al.*, 2019). In contrast, continuous tillage and removal of plant waste (Conventional Tillage) is characterized by high production costs, and it has a negative impact on soil and environmental characteristics, which leads to soil degradation, water erosion, and wind erosion, which can limit crop productivity (Santín *et al.*, 2017). Omara *et al.*, (2019) indicated that Zero-Tillage (ZT) can improve soil properties and crop yield. However, there are contrasting reports on its benefits compared to conventional tillage (CT). Dataset (2003–2018) from long-term continuous winter wheat (*Triticum aestivum L*.). Grain yield and soil nitrogen accumulation in conservative agriculture (Zero Tillage) were significantly higher than in Conventional Tillage. Bibek *et al.*, (2019) noticed that most of the results from factors, interaction showed that the interaction between past crop residues with zero tillage following the soybean – wheat cropping system had a significantly higher effect on the wheat yield. The interaction between zero tillage with maintaining crop residues can greatly improve the physical and chemical characteristics of the soil and reduce the risk of erosion. Early emergence and rapid vegetative growth were indicated under the zero-tillage system, as the grain yield was more under zero tillage compared to the conventional tillage. (Honsdorf *et al.*, 2019). The results of Woźniak (2020) showed that zero tillage is more effective under dry climatic conditions, while its effectiveness in rainy seasons decreases.

In Row Spacing trails, Avtar *et al.*, (2019) were implemented in a field experiment in India, where two cultivars of wheat were planted in the 2017-2018 season to study the effect of different row spacing (at a distance of 15 cm, and 22.5 cm). The experiment concluded that the distance of 15 cm was better in the traits of plant height, accumulation of dry matter,the weight of 1000 grains, grain yield and harvest index%.Sharma et al (2018) explained that the accumulation of the maximum dry material was recorded at a row spacing of 19.5 cm and the minimum accumulation of the dry material was recorded at a row spacing of 15.5 cm. Chhokar *et al.*, (2017) noticed that the maximum grain yield per ha was in a row spacing of 17.5 cm and the minimum grain yield per ha was in a row spacing of 22.5 cm. The data of Mamta and Roopkishore (2019) revealed that wheat crop sown at higher density (150 kg. ha^{-1} sowing rate, with a row spacing of 15cm) produced significantly more dry matter, effective tillers and finally higher grain yield as compared with (100 kg. ha^{-1} sowing rate and 22.5cm row spacing).

In a field experiments were conducted at the Barani Agricultural Research Station- Pakistan with three varieties of bread wheat during the 2016-17 season and 2017-18 seasons using different sowing rates: 75, 100, 125, and 150 kg. ha^{-1}. The results showed that the sowing rate of 125 kg. ha^{-1} showed significantly higher values in emergence rate, plant height, and grain yield in in Fatehjang-2016 variety. (Amina *et al.*, 2019). The results of Dongqing *et al.*, (2019) indicated that the increase in the sowing rate significantly increased the number of tillers and the number of spikes.M^{-2}, which led to an increase in grain yield, where the lowest grain yield was represented by the sowing rate of 75 plants.M^{-2}, while there was no

significant difference between the 300 plants.m^{-2} and 525 plants.m^{-2} in the trait of grain yield.

This study aims to compare between the Conventional Tillage system (CT) and the Zero Tillage system (ZT), as well as the comparison of ZT with using press wheel (ZT+p) and without using it (ZT-p), and different row spacings and sowing rates will be compared under ZT system too , to evaluate its effect on yield and its components of bread wheat, to find out the best multi-system for interaction between planting method, using press wheel, row spacings and sowing rates, which achieve the highest productivity of the crop, for recommending it to farmers.

MATERIALS AND METHODS

The experiment was implemented during the agricultural season 2018-2019 in farmers' fields in Glyukhan at Al-Hamdania district, which is a Moderate Rainfall Area 15 km southeast of the city of Mosul. Bread wheat (*Triticum aestivum L.*).The Adana-99 cultivar was chosen for cultivation. The experiment was implemented using a local manufactured Zero Tillage seeder (Raas Al rumh) containing press wheels parallel to the seed line opener, so that each opener followed by a press wheel which works as a compactor to the soil in the open seed line.

The study included two factors: The first factor : planting methods which included five levels: 1- Zero Tillage planting method with 17cm row spacing and use of a Press wheel (ZT 17cm+P), 2 -Zero Tillage planting method with 17cm row spacing without using a Press wheel (ZT 17cm-P), 3-Zero Tillage planting method with 34cm row spacing and use of a Press wheel (ZT 34cm+P), 4-Zero Tillage planting method with 34cm row spacing without using a Press wheel (ZT 17cm-P), 5-Conventional Tillage: the field cultivated by using a disc plow before sowing (CT).

The second factor: sowing rates, which included three levels (80, 100 and 120 kg. ha^{-1}) for each ZT planting methods, and Conventional Tillage.

Five sowing lines were approved for each experimental unit, and reading data were collected from the middle three lines. The length of the experimental unit was (8 m) and the width was tow meters according to the seeders width.

Soil analysis and precipitation rates: The experiment field soil was analyzed after taking samples at a depth of (0-30 cm). Results of soil analysis were: Soil Texture: was Silty clay loam, OM :1.9%, Ec (m/ds) :0.280, PH:7.2.
Monthly rainfall rates were recorded during the agricultural season, Table (1).

Table (1) Monthly precipitation, rainfall amounts (mm).

Agricultural season 2018 - 2019									
Month	Oct	Nov	Dec	Jan	Fib	March	April	Total (mm)	Total after sowing
mm.	44	117.5	208	97.5	36	231	296	830	660.5

The Sowing date was on 11/1/2019, and the harvesting date on 6/6/2019. Fertilization and weed control: A fertilizer dose was added at the Tillering stage with a DAP fertilizer (NPK) (0-46-18), and the given amount of fertilizer was

according to the quantity recommended by the Nineveh Agricultural Directorate at 200 kg ha-1,date of the addition was on 4/3/2019.

The field was sprayed with two types of herbicides, the first herbicide for thin-leaf weeds was (CLODIA-300) with (2400 ml. ha^{-1}), and the second herbicide for broad-leaf weeds, which was (ACIAD-6E) with (880 ml. ha-1) according to the manufacturer's recommended concentration of both herbicides , The spray date was on 28/2/2019.

Studied traits: Plant height (cm), Tillers No.m^{-2} , Spikes No.m^{-2}, No. of Spike grains, 1000 grains weight (gm), Biological yield (gm. m^{-2}), Grain yield(gm. m^{-2}), Straw yield (gm. m^{-2}), Test weight kg.Hectoliter-1, and Protein%.

Statistical analysis: A factorial experiment was carried out with two factors according to the Randomized Complete Block Design (RCBD) with three replicates using split-plot design. The main plots were two planting methods and secondary plots to sowing rates. The data were analyzed by computer using the SAS program. The significant differences were used by Duncan multiple-range test (Duncan, 1955). Independent comparisons were made between treatments (row spacing 17cm and 34cm, use and no use of press wheels, zero tillage and conventional tillage.The Duncan test was used to determine the significance, the identical letters in the tables did not differ from each other significantly according to the Duncan test with a significance level (0.05).

RESULTS AND DISCUSSION

1-Effect of sowing rate and planting methods on plant height (cm).

It is well defined from the table from the table (2) in the sowing rate factor that there were no significant differences in plant height among all sowing rates, and in the planting methods factor, the rates of planting methods ZT 17+P and ZT 34 + P achieved the highest significant value in plant height trait. In the interaction between the two factors, the interaction ZT 34+P with the sowing rate of 100 kg. ha^{-1} achieved the highest value in plant height. In the independent comparisons (Appendix) of this trait, it was obvious the significant superiority of the row spacing 17cm, zero tillage, and the use of a press wheel on 34 cm, conventional tillage and with no use respectively these results are agreed with Alrijabo *et al.,* (2014) and Amina *et al.,* (2019).

2-Effect of sowing rate and planting methods on the No.Tillers m^{-2}.

It is clear from Table (3) that 120 kg. ha-1 sowing rate exceeded significantly over the sowing rates, and in the planting methods factor, the rate of the planting method ZT 17 + P has the highest significant value in the number of this trait , and in the interaction between factors, the interaction ZT 17+P with 120 kg.ha-1 the sowing rate achieved the highest value in this trait. In the independent comparisons (Appendix) of this trait, it is clear the superiority of 17cm on 34cm and the use of a press wheel with no use while there was no significant difference between zero tillage and conventional tillage in this trait. These results are consistent with what the researcher Dongqing *et al.,* (2019) found that the increase in the sowing rate significantly increased the number of tillers of the plant, while for the planting

Table (2) Effect of sowing rate and planting methods on plant height (cm).

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg. ha-1	87.67 ab	78.78 def	87.22 ab	71.45 g	75.33 fg	80.09 a
100 kg. ha-1	83.67 b-e	79.33 def	90.44 a	76.34 fg	76.33 fg	81.22 a
120 kg. ha-1	86.00 abc	84.33 a-d	88.78 ab	79.83 c-f	77.67 efg	83.32 a
Mean	85.78 a	80.81 b	88.81 a	75.87 c	76.44 c	

Methods , the results were consistent with what the researcher Shafaqat *et al.*, (2016) and Latif *et al.*, (2018) showed there is a significant increase in the number of tillers when using the zero tillage method over the conventional method. As for the row spacing, the results agreed with Al rijabo *et al.*, (2014), and Singh *et al.*, (2017) where narrower row spacing 17 cm achieved a significant increase in the number of tillers over the wide row spacing

Table (3) Effect of sowing rate and planting methods on No. of Tillers m^{-2}.

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg. ha^{-1}	506.92 bc	400.20 e-h	360.72 gh	286..90 i	355.00 h	381.95 c
100 kg. ha^{-1}	524.71 bc	446.89 de	436.43 def	379.65 fgh	445.00 de	446.53 b
120 kg. ha^{-1}	589.18 a	466.90 cd	534.40 ab	419.73 d-g	550.00 ab	512.04 a
Mean	540.27 a	438.00 b	443.85 b	362.09 c	450.00 b	

3-Effect of sowing rate and planting methods on No. of spikes. m^{-2}.

It is clear from the table (4) in the sowing rate factor, the 120 kg. ha^{-1} exceeded significantly over the other sowing rates, and in the planting methods factor, the ZT 17 + P was achieved the highest significant value in the number of spikes. In the interaction between the two factors, the interaction between ZT 17 + P and 120 kg. ha^{-1} sowing rate achieved the highest value in this trait.

In the independent comparisons (Appendix), the significant superiority in this trait was in the row spacing 17 cm to 34 cm, the use of a press wheel on no use it, and zero tillage on conventional tillage. These results are consistent with what

Dongqing *et al.*, (2019) found that the use of high sowing rates resulted in a significant increase in the number of spikes. m^{-2}. In the method of planting , the results were consistent with what Alrijabo and Mohammed Amin (2019) found, where the use of zero tillage achieved high significant differences in the number of spikes. m^{-2} compared with conventional tillage , and in row spacings the results agreed with Gafari and others (2017), in that the narrow distance gave a significant difference in the number of spikes m 2 compared to Wide distances.

Table (4) Effect of sowing rate and planting methods on No.of spikes. m^{-2}.

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	480.25 abc	372.76 de	344.76 def	263.86 fg	224.00 g	337.13 c
100 kg.ha^{-1}	480.26 abc	383.21 de	407.90 cd	305.79 efg	244.67 g	364.37 b
120 kg.ha^{-1}	528.40 a	418.81 bcd	504.33 ab	346.25 def	274.00 fg	414.36 a
Mean	496.30 a	391.59 b	419,00 b	305.30 c	247.56 d	

4-Effect of sowing rate and planting methods on No.of spike grains .

Table (5) showed that 80 kg. ha^{-1} sowing rate exceeded the highest significant value in this trait compared with 120 kg. ha^{-1} sowing rate, and in the planting methods factor, ZT 34 + P achieved the highest significant value in this trait, and in the interaction between the two factors, the interaction of ZT 34 + P with 80 kg. ha^{-1} and 100 kg.ha-1sowing rates gave the highest value in No.of spike grains.

In the independent comparisons (Appendix) of this trait, it is clear the significant superiority of using press wheel over its non-use and the planting method zero tillage over conventional tillage , while there was no significant difference between row spacings in this trait These results are consistent with what Amare and Mulatu (2017) found, where the lowest sowing rate gave the highest increase in the number of No. of spike grains, and the results also agreed in the method of planting with the results of Abdul Latif et al (2018) that the zero tillage gave a significant increase In the number of No. of spike grains.The only significant difference in the number of spike grains was 120 kg. ha^{-1} sowing rate,which was significantly less than the sowing rate of 80 kg.ha-1, and this result may be due to the superiority of No. spikes. m^{-2} in the120 kg. ha^{-1} sowing rate on the other sowing rates, this increase in the No.spikes. m^{-2} in a fixed area unit may be affected the extent of adequate minerals and water supply as a result of competition.

Table (5) Effect of sowing rate and planting methods on No.of spike grains.

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	36.70 bc	31.56 cd	43.83 a	28.9 de	26.00 de	33.4 a
100 kg.ha^{-1}	37.43 bc	29.6 de	40.86 ab	29.8 de	24.67 e	32.5 ab
120 kg.ha^{-1}	36.54 bc	28.27 de	37.33 bc	26.27 de	25.00 e	30.68 b
Mean	36.89 b	29.81 c	40.67 a	28.32 cd	25.22 d	

5-Effect of sowing rate and planting methods on the weight of 1000 grains gm .
It is clear from the Table (6) that there were no significant differences in the weight of 1000 grains among all sowing rates,

Table (6) Effect of sowing rate and planting methods on the weight of 1000 grains gm .

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	29.10 ab	27.10 abc	29.03 abc	28.17 abc	27.70 abc	28.22 a
100 kg.ha^{-1}	29.60 a	27.50 abc	28.77 abc	29.23 ab	26.43 bc	28.31 a
120 kg.ha^{-1}	29.67 a	27.87 abc	29.27 ab	28.33 abc	26.17 c	28.26 a
Mean	29.46 a	27.49 bc	29.02 a	28.58 ab	26.77 c	

And in the factor of planting methods, the ZT 17+P , ZT 34+P and ZT 34-P planting methods achieved highest significant value. In the interaction between the factors, there was no significant difference between all the interactions of the zero tillage planting method with all sowing rates in this trait, whereas the interaction between conventional tillage and the sowing rate of 100 and 120 kg. Ha^{-1} was the lowest value in the weight of 1000 grains.

In the independent comparisons (Appendix) of this trait, the significant superiority was in the use of press wheels on non-use, and zero tillage on conventional tillage, while there was no significant difference between the row spacings17cm and 34cm.

6-Effect of sowing rate and planting methods for biological yield gm. m^{-2}.

It is clear from Table (7) that there are no significant differences in the biological yield trait among all sowing rates, and in the factor of planting methods, ZT 17 + P achieved significant superiority over the rest of planting methods, and in the interaction between the two factors, the highest value in the biological yield trait

was in the interaction between ZT 17 +p with all sowing rates. In independent comparisons (Appendix) for this trait, the significant superiority was for 17cm on 34cm row spacing, the use of a press wheel on Un use it, and zero tillage on conventional tillage.

Table (7) Effect of sowing rate and planting methods for biological yield gm.m^{-2}**.**

Planting methods / Sowing rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha-1	1142.64 ab	915.86 c	834.50 c	563.43 d	505.33 d	792.35 a
100 kg.ha-1	1166.80 ab	938.25 c	922.43 c	619.11 d	506.5 3 d	830.62 a
120 kg.ha-1	1224.83 a	1000.94 bc	1010.91 bc	629.31 d	643.07 d	901,81 a
Mean	1178.09 a	951.68 b	922.61 b	603.95 c	551.64 c	

In planting methods, the results of the research agreed with what Magdalena (2019) found that zero tillage planting method has achieved significant differences in the biological yield compared with conventional tillage , as well as the results of row spacing was agreed with what Abd El- Samie (2018) found that the use of a narrow row spacing of 17cm resulted in a significant increase in biological weight.

7-Effect of sowing rate and planting methods for grain yield gm.m^{-2} .

It is clear from the table (8) in the sowing rate factor that 120 kg. ha^{-1} sowing rate exceeded significantly over the other sowing rates. In the planting method factor, the mean of ZT 17+P and ZT 34+P achieved the highest significant value in grain yield trait, because the lowest significant value was at the conventional tillage method. In the interaction between factors, the interaction ZT 17+P with all sowing rates achieves the highest value in grain yield, while the conventional tillage interaction with the 80 kg. ha^{-1} sowing rate achieved the lowest value in the grain yield.

Table (8) Effect of sowing rate and planting methods on Grain yield gm.m^{-2}**.**

Planting Methods / Sowing Rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	527.37 ab	315.38 de	440.85 bc	221.64 efg	150.08 g	331.06 b
100 kg.ha^{-1}	540.94 ab	318,91 de	479.38 ab	271,40 def	190.65 fg	360.25 b
120 kg.ha^{-1}	579.31 a	352.26 cd	558.87 a	292.26 def	281.30 def	412.80 a
Mean	549.21 a	328.85 b	493.03 a	261.77 c	207.34 c	

In the independent comparisons (Appendix), the significant superiority was in the row spacing 17cm on 34 cm, and the use of a press wheel on Un used it, and zero tillage on conventional tillage .These results shaw that the most influential trait in achieving the highest grain yield is the trait of no. spikes. m^{-2} associated with the trait of No.tillers. m^{-2}. These results are consistent with what Amina *et al.,* (2019) found that the use of a high sowing rate gave the highest grain yield. As for planting methods, the results agreed with Honsdorf *et al.,* (2019) that the zero tillage method achieved the highest grain yield compared to the con ventional tillage method, The results also agreed with Shafagat *et al.,* (2016) that the narrow distance between the row spacing achieved the highest grain yield per area unit, and the results of the positive role of press wheels in increasing the grain yield agrees with the results of Asoodar and Mohajer (2014).

8-Effect of sowing rate and planting methods on Straw yield gm. m^{-2}

From table (9), it is clear that there were no significant differences in straw yield between sowing rates. In planting methods, the mean of planting methods ZT 17+P and ZT 17-P achieved the highest significant value in straw yield, while the lowest significant value was at the rate of conventional tillage method. Equally for the interaction between the two factors, the two interactions ZT 17+P and ZT 17-P with all sowing rates achieved the highest significant values of straw weight, while the interaction of conventional tillage with all sowing rates achieved the lowest value for straw yield. In independent comparisons (Appendix) for this trait, significant superiority achieved at 17cm on 34 cm, and zero tillage on conventional tillage, and the use of press wheels also achieved a significant advantage over not using it.

Table (9) Effect of sowing rate and planting methods on straw yield gm.m^{-2}.

Planting methods / Sowing Rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	615.27 a	600.48 a	395.60 bcd	341.79 cd	355.32 bcd	461.69 a
100 kg.ha^{-1}	625.86 a	619.34 a	443.05 bc	347.71 cd	315.89 d	470.37 a
120 kg.ha^{-1}	645.52 a	648.68 a	452.03 b	337.05 d	361.71 bcd	486.02 a
Mean	628.88 a	622.83 a	430.23 b	342.18 c	339.16 c	

These results are consistent with what Alrijabo *et al.,* (2014), and Alrijabo and Mohammed Amin (2019) found, that the use of the zero tillage planting method resulted from the significant increase in straw yield compared to conventional tillage and the row spacings were consistent with the results of Mamta and Roopkishore (2019) where the row spacing 17cm achieved the highest significant value in straw yield trait.

9-Effect of sowing rate and planting methods on the protein % .

Table (10) showed that there are no significant differences between all sowing rate levels, in planting methods, the planting method ZT 34+P achieved the highest

significant value in the percentage of protein%. and in the interaction between the factors, the interaction of ZT 34+P with 80 kg. ha^{-1} and 100 kg. ha^{-1} sowing rates achieves the highest value in the protein ratio. In independent comparisons (Appendix) for this trait, it is clear the significant superiority of zero tillage on conventional tillage and the superiority of using press wheels on not using it, while there was no significant difference between row spacing's.

Table (10) Effect of sowing rate and planting methods on Protein %.

Planting methods / Sowing Rates	ZT 17+P	ZT 17-P	ZT 34+P	ZT 34-P	CT	Mean
80 kg.ha^{-1}	11.9 ab	11.7 bc	12.4 a	10.8 de	10.6 e	11.5 a
100 kg.ha^{-1}	11.4 bcd	11.4 bcd	12.0 ab	11.2 cde	11.7 bc	11.5 a
120 kg.ha^{-1}	11.2 cde	11.2 cde	11.7 bc	11.00 de	10.7 e	11.2 a
Mean	11.5 b	11.4 b	12.0 a	11.0 c	11.0 c	

It is evident in the trait of plant height that adding press wheels resulted in a significant increase in plant height in both rows spacing 17cm and 34cm, and this result in this trait and other traits like,No. tillers.m^{-2}, No.spikes.m^{-2} traits are due to the role of press wheels in compacting the soil above the grain line and thus achieving the highest contact between soil and grains by decreasing the air voids of the soil, the soil compacting as a result of press wheels achieved increases in water absorption by grain surface area which attached to the wet soil minutes. Thus, accelerate the germination and emergence stages, then accelerating all growth stages of the.

In the traits weight of 1000 grains, test weight, biological yield, grain yield and straw yield we notice the superiority of zero tillage in these traits comparing with conventional tillage, and this due to the efficiency of this method in rain harvesting and in the optimal distribution of grains during sowing in terms of seed depth and the distance between seed lines, which achieves the highest germination and emergence compared with conventional tillage.

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تأثير عجلات الضغط ومسافات ومعدلات البذار في الحاصل ومكوناته لمحصول الحنطة (*Triticum aestivum L.*) المزروع بطريقة الزراعة بدون حراثة في موقع جليوخان

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الخلاصة

نفذت تجربة حقلية في منطقة شبه مضمونة الأمطار (جليوخان) في محافظة نينوى في الموسم الزراعي 2018–2019 لدراسة تأثير عجلات الضغط Press wheel وبمستويين (استخدام P+ وعدم استخدام P–) , ومسافتي الزراعة (17 و 34 سم) , ومعدلات البذار (80 و 100 و 120 كغم.هكتار–1) في الحاصل ومكوناته لمحصول حنطة الخبز (Triticum aestivum L) صنف أدنة–99 (Adana-99) المزروع بطريقة الزراعة بدون حراثة Zero Tillage ZT. مع الزراعة التقليدية Conventional Tillage CT. كمعاملة مقارنة ضمن توليفة خماسية تضمنت: (ZT 17cm+P) و (ZT 17cm-P) و (ZT 34cm+P) و (ZT 34cm–P) و الزراعة التقليدية (CT) تحت معدلات البذار الثلاثة.

أوضحت نتائج الدراسة أن طريقتي الزراعة (ZT 17+P) و (ZT 34+P) حققتا أعلى قيم معنوية في صفة (ارتفاع النبات، ، ووزن 1000 حبة، وحاصل الحبوب)، كما سجلت طريقة الزراعة (ZT 17+P) أعلى قيم معنوية في صفات عدد الاشطاء وعدد السنابل والحاصل البيولوجي وحاصل القش. وسجلت طريقة الزراعة (ZT 34+P) أعلى قيمة معنوية في صفة نسبة البروتين. وفي معدل البذار حقق المعدل (120كغم. هكتار–1) أعلى فرق معنوي في صفات (عدد الاشطاء، وعدد السنابل، وحاصل الحبوب). في صفة حاصل الحبوب حقق التداخل بين طريقة الزراعة (ZT 17+P) مع جميع معدلات البذار وتداخل طريقة الزراعة (ZT 34+P) مع معدلي البذار (120و100كغم.هكتار–1) أعلى قيمة معنوية في حاصل الحبوب، في حين حقق التداخل بين الزراعة التقليدية مع معدل البذار 80كغم. هكتار–1 أقل قيمة معنوية في حاصل الحبوب.

الكلمات الدالة: الزراعة الحافظة، حاصل الحبوب، الزراعة الديمية.

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Appendix (1) Analysis of Indepented comprisions of wheat traits in Glyukhan site

Sources of variation	df.	Plant height cm.	Tillers No. m^{-2}	Spikes No. m^{-2}	No. Grains per Spike
17cm vs 34cm	1	8.18	**66815.36	**60221.16	11.87
(+P) vs (-P)	1	**721.46	**76199.92	**107326.13	**850.01
ZT vs CT	1	**292.66	112.21	**174081.63	**545.42

Sources of variation	df.	1000grain weight gm.	Biological yield $gm.m^{-2}$	Grain yield $gm.m^{-2}$	Straw yield $gm.m^{-2}$	Protein %
17cm vs 34cm	1	0.97	**816945.43	**34184.93	**516901.09	0.03
(+P) vs (-P)	1	*13.08	**670073.76	**458918.18	**19921.91	**2.67
ZT vs CT	1	**25.16	**946540.04	**290516.67	**200052.67	**1.76