Effect of zero tillage system, seeding rate and row spacing on growth, yield and its components of bread wheat in moderate rainfall area in ninevah province.

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Abstract

A RCBD factorial experiment with 3 factors in Split Split Plot design was conducted in 2011-2012 agricultural season at Telkief location in rainfed field (183.5 mm–very drought season) to evaluate the effect of tillage systems (Conventional Tillage and Zero-Tillage) with three row spacing level (14.7, 29.4 and 14.7 + 29.4 cm) and two seeding rate (80 and 100 kg/ hectare) on growth, yield and its components of Bread wheat (cv. Cham-6). ZT significantly decrease fuel consumption and weeds/m^2 and significantly increase plant height, flag leaf area, No. of tillers and spikes /m^2, grains and straw yield / m^2 comparing with CT planting method. 100kg/ha seeding rate and 14.7cm row spacing factors increased significantly No. of plants, tillers and spikes/m^2, grains and straw yield/m^2 comparing with 80kg/ha and 29.4cm row spacing respectively. The highly significant value in grain and straw yields were in the triple interaction between ZT planting method, 100kg/ha seeding rate and 14.7 cm row spacing, this results due to the highly seeding rate in 14.7 row spacing in combined with the highly seeding rate.

Introduction

Conservation agriculture (CA) is as minimal soil disturbance (No-till) and permanent soil cover (mulch) combined with rotations, is a more sustainable cultivation system for the future than those presently practiced. (Hobbs, 2007). No-till is sowing a crop without prior cultivation and with very little soil disturbance at seeding. By controlling weeds, which are hosts to diseases, problems with both weeds and diseases are reduced. However, the year before seeding good stubble management is also essential. (Ross et. al, 1999).

In the conventionally tilled treatment (CT) soil losses were greater than in any of the no tillage treatments. (Engela et al, 2008). Alrijabo, (2012a) in his research on effect of ZT planting method on Wheat and barley mentioned that grain yield in ZT planting method was not less than CT. in any way. In a field study by Alrijabo, (2012b) in three different environmental sites within the region of low rainfall area , new agricultural technology of Zero Tillage were implemented in 2006 - 2007 season compared with conventional agriculture, results showed that the highest significant values in grain yield،

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number of spikes per square meter , plant height and specific weight traits was in Z.T planting method. The study of Alrijabo and Hassan, (2011) included the comparison between the (Z.T.) with Conventional Tillage(farmer method) in growth and yield traits for wheat. the results showed that ZT. was higher than the CT. in No. of seeds per spike, grain yield, and straw biomass (gm/ m^2). In a field study by Alrijabo, (2012c) in 2006-2007 season three planting methods (ZT, Chisel and CT.) were used with numerous varieties of Bread Wheat and Durum Wheat in three different environmental sites within the region of rainfall area but under supplementary irrigation. As a scientific evaluation for the two used planting methods (Z.T and Chisel) in comparing with CT. and its effect on the studied traits in each crop, ZT planting method was significantly superior in (11 traits) while Chisel in (4 traits) then CT. in 2 traits only. Iqbal et.al., (2010) evaluate the effect of different seed rates and row spacing's on the growth and yield of bread wheat . Four levels of seed rates (125, 150, 175 and 200 kg/ha) and three row spacing's (11.25, 15.0 and 22.5 cm) were tried . The results showed that seed rate of 150 kg gave higher grain yield (4.10 t/ha). Among row spacing's 22.5 cm performed better (3.96 t/ha) as compared to other spacing's (3.82-3.87 t/ha). Interaction effect of seed rates and row spacing's was non-significant. Nazir et al., (2000) concluded that seed rate of 150 kg gave significantly higher grain yield (3101 kg/ha) than 100 kg seed rate. According to Singh and Uttam, (1994) the highest yield was obtained by using a seed rate of 125 kg whereas, seed rate of 160 kg for getting maximum yield was suggested by Ram et al., (1988). Geleta et al., (2002) reported that increasing seed rates resulted in increased plants emerged.

Material and Methods

A factorial experiment was conducted in 2011-2012 season at Telkief location in rainfed field (183.5 mm–very drought season) to evaluate the effect of tillage systems (Conventional Tillage and Zero-Tillage) with three row spacing level (14.7, 29.4 and 14.7 + 29.4 cm) and two seeding rate (80 and 100 kg/ha) on growth, yield and its components of Bread wheat (cv. Cham-6). Soil texture of the field was clay loam (35% clay, 31% silt and 33% sand). The experimental design for this factorial experiment was split split plot using RCBD with three replicates (blocks), the factors were two tillage systems (conventional tillage and zero-tillage), three row spacing (14.7, 29.4 and 14.7 + 29.4 cm) and two seeder seeding rate (80 and 100 kg/ hectare) fixed for all row spacing levels as shown in table (1).

Table (1): Row spacing (cm), fixed seeding rate treatments kg/ha, no. of furrow opener and actual seeding rate kg/ha.

Row spacing (cm)	Fixed seeding rate treatments kg/ha	No. of furrow opener	Actual seeding rate kg/ha
14.7	80	17	80
14.7+29.4	80	11	51.76
29.4	80	9	42.35
14.7	100	17	100
14.7+29.4	100	11	64.70
29.4	100	9	52.92

Gaspardo SC250 seeder (2.5 m working width) was used in CT planting method after plowing the field by disc harrow (Fig 1), the same seeder was modified by replacing the bird tongue tine with ZT tine which is sharp tine (Fig 2) and adding press wheel after each furrow opener (Fig 3) and used it directly in seeding without plowing. The experimental unit equal 250 m^2 (2.5 x 100 m). The data was analyzed by Statistical Analysis System (SAS), Duncan Multiply rang test was used for testing significantly between traits results. The following traits were studied: fuel consumption by filling the tractor fuel tank before the operation then after finished it refilling the fuel tank by using grading cylinder to determine the using fuel in each operation, No. of weed plants/m^2, Plant height (cm), flag leaf area (cm^2), No. of plants/ m^2, No. of tillers/m^2, No. of Spikes/m^2, Straw biomass (gm/m^2). No. of Grains /spike. Weight of 1000 grains (gm) and Weight of grain yield (gm/m^2).

Fig (1): Gaspardo seeder before modification

Fig (2): ZT tine (green) bird tongue tine (Red)

Fig (3): Gaspardo seeder after modification to ZT seeder and adding press wheels.

Results

1- Effect of tillage systems, row spacing and seeding rate in fuel consumption:

As shown in table (2) the best significant results in minimized fuel consumption in factors and interaction are summarized: (P)= Z.T, (R)= 29.4 cm row spacing, (S)=(N.S), (P×R)= Z.T under 29.4cm row spacing, (P×S)= Z.T under the tow seeding rates , (R×S)= 29.4 cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 29.4cm row spacing at the tow seeding rates.

Table (2): Effect of tillage systems, row spacing and seeding rate in fuel consumption(L).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	d 6.53	de 6.47	d 6.50		
	14.7+29.4	de 6.17	de 6.17	e 6.17		
	29.4	ef 5.67	f 5.53	f 5.60		
C.T	14.7	a 19.60	a 19.80	a 19.70		
	14.7+29.4	b 18.80	b 18.40	b 18.60		
	29.4	c 16.53	c 16.46	c 16.50		
(P) x (S) interaction	Z.T	b 6.12	b 6.05		b 6.08	
	C.T	a 18.34	a 18.25		a 18.30	
(R) x (S) interaction	14.7	a 13.07	a 13.13			a 13.10
	14.7+29.4	b 12.53	b 12.33			b 12.43
	29.4	c 11.10	c 10.99			c 11.05
(S) mean		a 12.23	a 12.15			

2- Effect of tillage systems, row spacing and seeding rate in No.plants/m^2:

As shows in Table (3) the higher significant results of this trait in factors and interactions are summarized: (P)= (N.S), (R)= 14.7 cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 14.7 cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7 cm row spacing under 100 kg/ha seeding rate, (P×R×S)= Z.T under 14.7cm row spacing at 100 kg/ha seeding rate.

Table (3): Effect of tillage systems, row spacing and seeding rate in No. plants/m^2.

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate (kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	c 221.70	a 269.57	a 245.63		
	14.7+29.4	e 140.10	d 157.36	c 148.73		
	29.4	g 87.70	f 117.30	e 102.50		
C.T	14.7	c 208.33	b 249.17	b 228.75		
	14.7+29.4	f 122.53	De 151.33	d 136.93		
	29.4	g 87.60	f 104.47	e 96.03		
(P) x (S) interaction	Z.T	c 149.83	a 181.41		a 165.62	
					a 153.90	
(R) x (S) interaction	14.7	b 215.02	a 259.37			a 237.19
	14.7+29.4	d 131.31	c 154.35			b 142.83
	29.4	f 87.65	e 110.88			c 99.27
(S) mean		b 144.66	a 174.86			

3- Effect of tillage systems, row spacing and seeding rate in No. weeds/m^2:

As shown in table (4) the best significant results in minimized No. weeds /m^2 in factors and interaction are summarized: (P)= Z.T, (R)= 14.7 cm row spacing, (S)= (N.S), (P×R)= Z.T under 14.7cm row spacing, (P×S)= Z.T under the tow seeding rates, (R×S)= 14.7cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 14.7cm row spacing at the tow seeding rates.

Table (4): Effect of tillage systems, row spacing and seeding rate in No. weeds / m^2.

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	e 42.00	de 43.67	e 42.83		
	14.7+29.4	ed 56.67	bc 62.67	d 59.67		
	29.4	b 71.67	b 73.67	c 72.67		
C.T	14.7	a 94.00	a 98.67	b 96.33		
	14.7+29.4	a 91.67	a 94.67	b 93.17		
	29.4	a 104.67	a 102.67	a 103.67		
(P) x (S) interaction	Z.T	b 56.78	b 60.00		b 58.39	
	C.T	a 96.73	a 98.67		a 97.72	
(R) x (S) interaction	14.7	c 68.00	bc 71.17			c 69.58
	14.7+29.4	bc 74.17	ab 78.67			b 76.42
	29.4	a 88.17	a 88.17			a 88.17
(S) mean		a 76.78	a 79.33			

4- Effect of tillage systems, row spacing and seeding rate in plant height (cm):

As shows in Table (5) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 29.4cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 29.4cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate , (R×S)= 29.4cm row spacing under 100 kg/ha seeding rate, (P×R×S)= Z.T under 29.4cm row spacing at the tow seeding rates and 14.7cm row spacing under 100 kg/ha seeding rate.

Table (5): Effect of tillage systems, row spacing and seeding rate in plant height (cm).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	b 31.92	a 37.09	b 34.50		
	14.7+29.4	b 31.58	ab 33.85	b 32.72		
	29.4	a 36.37	a 37.10	a 36.73		
C.T	14.7	cd 24.68	d 22.08	d 23.28		
	14.7+29.4	d 23.83	d 23.53	d 23.68		
	29.4	cd 24.92	c 27.55	c 26.23		
(P) x (S) interaction	Z.T	b 33.28	a 36.01		a 34.65	
	C.T	c 24.47	c 24.38		b 24.43	
(R) x (S) interaction	14.7	bc 28.30	bc 29.58			b 28.94
	14.7+29.4	c 27.71	bc 28.69			b 28.20
	29.4	ab 30.64	a 32.33			a 31.48
(S) mean		b 28.88	a 30.20			

5- Effect of tillage systems, row spacing and seeding rate in flag leaf area (cm^2):

As shows in Table (6) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 14.7 and 29.4 cm row spacing, (S)= (N.S), (P×R)= Z.T under 14.7cm row spacing, (P×S)= Z.T under the tow seeding rates, (R×S)= 14.7cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 14.7cm row spacing at 100 kg/ha seeding rate.

Table (6): Effect of tillage systems, row spacing and seeding rate in flag leaf area (cm^2).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	ab 10.48	a 12.04	a 11.26		
	14.7+29.4	cd 8.74	cd 8.48	c 8.61		
	29.4	ab 10.75	bc 9.72	b 10.24		
C.T	14.7	e 6.44	f 4.60	f 5.52		
	14.7+29.4	ef 5.96	e 6.61	e 6.28		
	29.4	e 9.56	de 7.45	d 7.01		
(P) x (S) interaction	Z.T	a 9.99	a 10.08		a 10.03	
	C.T	b 6.32	a 6.22		b 6.27	
(R) x (S) interaction	14.7	ab 8.46	ab 8.32			a 8.39
	14.7+29.4	b 7.35	ab 7.55			b 7.95
	29.4	a 8.66	ab 8.59			a 8.62
(S) mean		a 8.16	a 8.15			

6- Effect of tillage systems, row spacing and seeding rate in No. tillers/m^2:

As shows in Table (7) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T , (R)= 14.7 cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 14.7 cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7 cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 14.7 cm row spacing at the tow seeding rates.

Table (7): Effect of tillage systems, row spacing and seeding rate in No. tillers/m^2.

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	a 517.00	a 525.80	a 521.40		
	14.7+29.4	c 332.83	c 341.50	c 337.17		
	29.4	fg 219.50	e 247.57	e 231.03		
C.T	14.7	b 484.50	b 484.27	b 484.38		
	14.7+29.4	ef 241.93	d 294.20	d 268.07		
	29.4	g 206.87	efg 228.03	e 217.45		
(P) x (S) interaction	Z.T	b 354.77	a 371.62		a 363.20	
	C.T	d 311.10	c 335.51		b 323.30	
(R) x (S) interaction	14.7	a 500.75	a 505.03			a 502.89
	14.7+29.4	c 287.38	b 317.85			b 302.61
	29.4	e 210.68	d 237.80			c 224.24
(S) mean		b 332.93	a 353.56			

7- Effect of tillage systems, row spacing and seeding rate in No. spikes/ m^2:

As shows in Table (8) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 14.7 cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 14.7 cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7 cm row spacing under 100 kg/ha seeding rate, (P×R×S)= Z.T under 14.7 cm row spacing at 100 kg/ha seeding rate.

Table (8): Effect of tillage systems, row spacing and seeding rate in No. spikes/m^2.

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	b 83.1	a 112.65	a 97.88		
	14.7+29.4	c 58.25	c 59.27	b 58.76		
	29.4	de 30.67	de 31.0	c 30.84		
C.T	14.7	c 69.42	c 59.41	b 64.42		
	14.7+29.4	de 35.80	d 41.96	c 38.88		
	29.4	e 23.66	d 39.09	c 31.38		
(P) x (S) interaction	Z.T	b 57.34	a 67.64		a 62.49	
	C.T	c 42.96	c 46.82		b 44.89	
(R) x (S) interaction	14.7	b 76.26	a 86.03			a 81.15
	14.7+29.4	cd 47.02	c 50.61			b 48.82
	29.4	e 27.17	e 35.05			c 31.11
(S) mean		b 50.15	a 57. 23			

8- Effect of tillage systems, row spacing and seeding rate in No. grains / spike:

As shows in Table (9) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= (N.S.), (S)= (N.S), (P×R)= Z.T under the three row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7 and 29.4 cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 14.7 and 29.4cm row spacing at the tow seeding rates.

Table (9): Effect of tillage systems, row spacing and seeding rate in No. grains / spike.

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	ab 24.77	a 28.33	a 26.55		
	14.7+29.4	bc 20.93	a 28.60	a 24.77		
	29.4	a 27.77	ab 25.63	a 26.70		
C.T	14.7	d 15.07	e 9.57	b 12.32		
	14.7+29.4	de 13.07	de 13.93	b 13.50		
	29.4	de 13.37	cd 17.17	b 15.27		
(P) x (S) interaction	Z.T	b 24.49	a 27.52		a 26.00	
	C.T	c 13.83	c 13.56		b 13.69	
(R) x (S) interaction	14.7	ab 19.92	ab 18.95			a 19.43
	14.7+29.4	b 17.00	a 21.27			a 19.13
	29.4	a 20.57	a 21.40			a 20.98
(S) mean		a 19.16	a 20.53			

9- Effect of tillage systems, row spacing and seeding rate in weight of 1000 grains(gm):

As shows in Table (10) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 29.4cm row spacing, (S)= (N.S.), (P×R)= Z.T under 29.4cm row spacing, (P×S)= Z.T under the tow seeding rates, (R×S)= 29.4cm row spacing under the tow seeding rates, (P×R×S)= Z.T under 29.4cm row spacing at the tow seeding rates.

Table (10): Effect of tillage systems, row spacing and seeding rate in weight of 1000 grains(gm).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	bc 15.69	bc 15.67	b 15.68		
	14.7+29.4	bc 15.04	b 16.26	b 15.65		
	29.4	a 18.32	a 15.15	a 18.23		
C.T	14.7	d 12.63	d 12.42	d 12.52		
	14.7+29.4	d 13.34	d 13.00	cd 13.17		
	29.4	c 14.83	d 13.50	c 14.17		
(P) x (S) interaction	Z.T	a 16.35	a 16.69		a 16.52	
	C.T	b 13.60	b 12.97		b 13.29	
(R) x (S) interaction	14.7	b 14.16	b 14.04			b 14.10
	14.7+29.4	b 14.19	b 14.63			b 14.41
	29.4	a 16.58	a 15.82			a 16.20
(S) mean		a 19.97	a 19.83			

10- Effect of tillage systems, row spacing and seeding rate in grain yield (gm/m^2):

As shows in Table (11) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 14.7 cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 14.7cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7cm row spacing under 100 kg/ha seeding rate, (P×R×S)= Z.T under 14.7cm row spacing at 100 kg/ha seeding rate.

Table (11): Effect of tillage systems, row spacing and seeding rate in grains yield (gm/m^2).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	b 32.31	a 50.13	a 41.22		
	14.7+29.4	c 18.36	b 27.63	b 22.99		
	29.4	c 15.58	cde 12.09	c 13.81		
C.T	14.7	cd 13.19	def 7.07	d 10.13		
	14.7+29.4	ef 6.23	def 7.55	e 6.89		
	29.4	f 4.68	def 9.07	e 6.87		
(P) x (S) interaction	Z.T	b 22.08	a 31.37		a 26.73	
	C.T	c 8.03	c 7.89		b 7.96	
(R) x (S) interaction	14.7	b 22.75	a 28.60			a 25.68
	14.7+29.4	d 12.29	c 17.59			b 14.94
	29.4	d 10.13	d 10.55			c 10.34
(S) mean		b 15.06	a 19.63			

11- Effect of tillage systems, row spacing and seeding rate in straw yield (gm/m^2):

As shows in Table (12) the higher significant results of this trait in factors and interactions are summarized: (P)= Z.T, (R)= 14.7 cm row spacing, (S)= 100 kg/ha seeding rate, (P×R)= Z.T under 14.7cm row spacing, (P×S)= Z.T under 100 kg/ha seeding rate, (R×S)= 14.7cm row spacing under 100 kg/ha seeding rate, (P×R×S)= Z.T under 14.7cm row spacing at 100 kg/ha seeding rate.

Table (12): Effect of tillage systems, row spacing and seeding rate in straw yield (gm/m^2).

Tillage systems (P)	Row spacing (cm) (R)	Seeding rate(kg/ha) (S)		(P) x (R) interaction	(P) mean	(R) mean
		80	100			
Z.T	14.7	b 116.37	a 156.03	a 136.20		
	14.7+29.4	cd 60.47	c 89.16	b 74.81		
	29.4	d 47.52	d 41.17	c 44.34		
C.T	14.7	cd 62.47	cd 62.20	b 62.38		
	14.7+29.4	d 43.09	d 45.92	c 44.50		
	29.4	d 36.01	d 39.40	c 37.71		
(P) x (S) interaction	Z.T	b 74.78	a 95.45		a 85.11	
	C.T	c 47.19	c 49.17		b 48.18	
(R) x (S) interaction	14.7	b 89.42	a 109.12			a 99.27
	14.7+29.4	cd 51.78	c 67.54			b 59.66
	29.4	d 41.76	d 40.28			c 41.02
(S) mean		b 60.98	a 72.31			

ZT significantly decrease fuel consumption and weeds/m^2 and significantly increase plant height, flag leaf area, No. of tillers and spikes /m^2, grains and straw yield/m^2 comparing with CT planting method. 100 kg/ha seeding rate and 14.7 cm row spacing factors increased significantly No. of plants, tillers and spikes/m^2, grains and straw yield/m^2 comparing with 80kg/ha and 29.4 cm row spacing respectively. The highly significant value in grain and straw yields were in the triple interaction between ZT planting method ,100 kg/ha seeding rate and 14.7 cm row spacing, this results due to the highly seeding rate in 14.7 row spacing in combined with the highly seeding rate, ZT

Discussion: ZT significantly decrease fuel consumption this is due to direct drilling without pre plowing that used in CT., furthermore sharp tine in ZT penetrate soil easily comparing with bird tongue tine in CT seeder so fuel consumption will less in ZT comparing with CT, this results agree with Christin, (2002) and Paul, (2011) results which obtained that ZT planting method minimized fuel consumption to 33 % of fuel consumption by CT planting method, ZT also decreased No. weeds/m^2, this result agree with Stephen, (2011) whom mentioned that 5 years of continues ZT application was enough to solve weed control comparing with CT. This result could be due to that un plowing soil make soil surface too solid, this is lead to minimized water penetration in soil except seed rows so the rain water harvesting in ZT tillage systems is more active than CT. planting method ,in the same times weed seed in between seed row will not received enough water to germinate so the weed density will be reduced under ZT planting method.

ZT also significantly increase plant height , flag leaf area , No. of tillers and spikes/m^2, grains and straw yield/m^2 comparing with CT planting method. this results agree with Anderson et al, (2005) , Alrijabo and Hassan, (2011) , Alrijabo, (2012 a) , Alrijabo, (2012 b), all these positive results due to that ZT planting method was highly active in water harvesting comparing with CT. planting method.

100 kg/ha seeding rate and 14.7 cm row spacing factors increased significantly No. of plants, tillers and spikes/m^2, grains and straw yield/m^2 comparing with 80 kg/ha and 29.4 cm row spacing respectively.

The highly significant value in grain and straw yields were in the triple interaction between ZT planting method, 100 kg/ha seeding rate and 14.7 cm row spacing, this results due to the highly seeding rate in 14.7 row spacing in combined with the highly seeding rate.

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تأثير الزراعة بدون حراثة ومعدل البذار ومسافة الزراعة في النمو والحاصل ومكوناته لحنطة الخبز *Triticum aestivum* L. في المنطقة متوسطة الأمطار في محافظة نينوى

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الخلاصة

تحت تصميم RCBD طبقت تجربة عاملية بثلاث عوامل باستخدام split split block design في الموسم الزراعي ٢٠١١-٢٠١٢ في حقل ديمي في منطقة تلكيف (معدل الأمطار الموسمي بلغ ١٨٣ ملم – موسم شديد الجفاف) وذلك لمقارنة أداء حنطة الخبز صنف شام-٦ تحت طريقتين للزراعة هما الزراعة بدون حراثة والزراعة التقليدية وثلاث مسافات زراعة هي ١٤,٧ و ٢٩,٤ و١٤,٧+٢٩,٤ سم ومعدلي بذار هما ٨٠ و١٠٠ كغم/هكتار.

أدت طريقة الزراعة بدون حراثة إلى تحقيق انخفاض معنوي في استهلاك الوقود وفي عدد الأدغال في المتر المربع في حين حققت هذه الطريقة زيادة معنوية في صفات ارتفاع النبات ومساحة ورقة العلم وعدد الأشطاء وعدد السنابل وحاصل الحبوب وحاصل القش في المتر المربع مقارنة بطريقة الزراعة التقليدية. حقق كل من معدل البذار ١٠٠ كغم/هكتار ومسافة الزراعة ١٤,٧ سم زيادة معنوية في عدد النباتات و الأشطاء والسنابل في المتر المربع كما حققا زيادة معنوية في حاصل الحبوب والقش مقارنة مع معدل البذار ٨٠ كغم/هكتار ومسافة الزراعة ٢٩,٤ سم على التوالي. حقق التداخل الثلاثي بين طريقة الزراعة بدون حراثة ومعدل البذار ١٠٠ كغم/هكتار و مسافة الزراعة ١٤,٧ سم أعلى قيمة معنوية لكل من صفتي حاصل الحبوب وحاصل القش في المتر المربع. ان هذه النتيجة ترجع إلى معدل البذار العالي في كل من معدل البذار ١٠٠كغم/ هكتار بالترافق مع معدل بذار مسافة الزراعة ١٤,٧ سم العالي. إن طريقة الزراعة بدون حراثة كانت فاعلة جدا في حصاد مياه الأمطار تحت ظرف الموسم الزراعي الجاف لذا فان نتائجها كانت واضحة تماما في تحسين جميع مكونات الحاصل.