

IMPACT OF PLANTING METHOD ON GRAIN YIELD AND YIELD COMPONENTS OF DIFFREENT BREAD WHEAT GENOTYPES

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ABSTRACT

*A field experiment was carried out during the two consecutive years 2012/13 and 2013/14 at Sids Agricultural Research Station, Agricultural Research Center, Egypt. The objective of the study was to evaluate the effect of different planting methods on grain yield and yield components of 24 genotypes of spring wheat (*Triticum aestivum* L.). Planting methods evaluated were raised bed and flat planting. The results across years of the study revealed significant effect of planting methods on yield and yield contributing characters. Interactions between planting methods and genotypes were also significant for some of the yield components. The number of grains per spike and 1000 grain weight were significantly higher in raised bed planting method in comparison with flat planting method. Although number of spikes per square meter was significantly higher in flat planting method in comparison with raised bed planting method, the maximum grain yield (11.12 tons per ha) was obtained through raised bed planting method. The twenty four wheat genotypes under study differed significantly in their days to heading, plant height, number of spikes per square meter, 1000 grain weight, number of grains per spike and grain yield in the two season of the study. Based on the obtained results, it may be concluded that raised bed planting method could be recommended for wheat sowing in Middle Egypt region.*

Key words: *Bread Wheat, Planting method, Grain yield*

INTRODUCTION

Wheat crop is considered as one of the essential strategic cereal crops and provides more than 30% of calories intake for the Egyptians. It is the world's single most important food crop in terms of tones of grain produced each year. The wheat trade represents a significant component of the trade balance of national economy. It is utilized and processed for a many products, reflecting the large quantities produced by people of diverse cultures and social groups (Faridi and Faubion, 1995). In Egypt, the cultivated area in 2013/2014 season was nearly 1.26 million hectares, including bread and durum wheat, produced 9.2 million tons of grain with an average of 7.3 tons per hectare. Bed planting has shown improved water distribution and efficiency, fertilizer use efficiency, reduced weed infestation, reduced crop lodging and reduced seed rate without sacrificing yield (Hobbs *et al* 2000). Of photosynthetically active radiations had also been found to be influenced by planting methods (Lal *et al* 1991). In general, modified planting technique, bed sowing gave more grain yield as compared to conventional flat sowing (Waraich, 2010)

Previous studies show that different planting methods had varying response under different experimental conditions. Hassan and Hassan (1994) have shown that wheat planted in furrows gives maximum 1000-grain weight, straw yield and grain yield. Drilling in lines and cross planting was found to be the best at Johart, Assam as reported by Gogoi and Kalita (1995). Abdul Majeed (2015) showed that wheat planting on beds using nitrogen application of 120 kg ha⁻¹ produced 15.06% higher grain yield than flat planting at the same nitrogen rate. Dawelbeit and Babiker (1997) reported higher yield for seed drilling and ridging after broadcasting than broadcasting alone. In Egypt, wheat is planted through broadcasting on a large area after maize, cotton and rice harvesting. This method not only requires higher seed rate but also results in lower plant population. Recently, the Egyptian farmers started to change wheat planting method to raised bed system. Evaluation of improved planting methods is critical for subsequent recommendation. Thus the present study was conducted to evaluate the effectiveness of different planting methods on grain yield of different wheat genotypes.

MATERIALS AND METHODS

Two experiments were conducted at Sids Agricultural Research Station, Agricultural Research Center, Egypt during the two consecutive years 2012/13 and 2013/14, to evaluate the effect of two planting methods on grain yield and yield components of 24 bread wheat promising lines and cultivars. The genotypes were selected from ICARDA-ARC wheat improvement program (ICARC-WIP). ICARC-WIP is a joint project between ICARDA and Agricultural Research Center (ARC) of Egypt starting in 2009. The program was conducted at Sids Agricultural Research Station, 150 km south Cairo. The experiment was laid out in a randomized complete blocks design with three replications. The tested genotypes are listed in Table(1). The treatments of the experiment were as following: T₁ = raised bed planting: (Plot consisted of two beds, bed spacing was 75 cm, center-to-center, and 5 m long) each bed consisted of two rows 20cm apart). T₂ = flat planting: (Plot consisted of 6 rows, 20 cm apart and 5 m long). Sowing dates were on November 20, 2012 (the first season) and November 25, 2013 (the second season). Seed rates of 85 kg ha⁻¹ and 120 kg ha⁻¹ were used in raised bed and flat planting treatments, respectively. Recommended dose of NP was applied, as 70 kg P₂O₅ ha⁻¹ during seed bed preparation and 175 Kg Nitrogen ha⁻¹ was applied in the form of Ammonia by injection in soil after land preparation and before raising beds and sowing. Six irrigations were applied for both treatments during the season at 20 day intervals. The crop was maintained weed free using the following practices.

Table 1. Cross name and pedigree of 24 bread wheat genotypes used in the study.

Entry	Name/Cross	Pedigree
101	ATTILA-7	CM85836-50Y-0M-0Y-3M-0Y-0SY-0AP
102	HAMAM-2/DEEK-2	ICW03-0092-7AP/0TS-0AP-0AP-1AP-0AP
103	HAMAM-2/DEEK-2	ICW03-0092-7AP/0TS-0AP-0AP-2AP-0AP
104	PASTOR-2//ACSAD 685/ACSAD 639	ICW03-0117-4AP/0TS-0AP-0AP-5AP-0AP
105	PASTOR2/8/VEE'S'/7/CEBECO148/3/RO N/CHA//BB/NOR67/5/HK/38MA/4/4777//R EI/Y/3/KT/6/TUCAN'S'	ICW03-0118-27AP/0TS-0AP-0AP-1AP-0AP
106	HUBARA-2/QAFZAH-21	ICW03-0153-1AP/0TS-0AP-0AP-8AP-0AP
107	GIRWILL-13/2*PASTOR-2	ICW03-20004-10AP-2AP/0TS-0AP-0AP-10AP-0AP
108	SHAM-8	CM67458
109	GIRWILL-13/2*PASTOR-2	ICW03-20004-12AP-7AP/0TS-0AP-0AP-12AP-0AP
110	GIRWILL-13/2*PASTOR-2	ICW03-20004-4AP-16AP/0TS-0AP-0AP-12AP-0AP
111	GIRWILL-13/2*PASTOR-2	ICW03-20004-7AP-10AP/0TS-0AP-0AP-5AP-0AP
112	GIRWILL-13/2*PASTOR-2	ICW03-20004-9AP-15AP/0TS-0AP-0AP-7AP-0AP
113	GIRWILL-13/2*PASTOR-2	ICW03-20004-9AP-15AP/0TS-0AP-0AP-8AP-0AP
114	QAFZAH-25/ANGI-1//HAIEL-1	ICW03-20008-1AP-14AP/0TS-0AP-0AP-2AP-0AP
115	HUBARA-16/2*SOMAMA-3	ICW03-20019-1AP-17AP/0TS-0AP-0AP-4AP-0AP
116	SIDS-12	SD7096-4SD-1SD-1SD-0SD
117	BOW#1/FENGGKANG 15//MASSIRA	ICW01-00507-0AP-1AP-0AP-0AP-16AP-7AP-0AP
118	BOW#1/FENGGKANG 15//MASSIRA	ICW01-00507-0AP-1AP-0AP-0AP-4AP-7AP-0AP
119	BOW#1/FENGGKANG 15//MASSIRA	ICW01-00507-0AP-1AP-0AP-0AP-6AP-16AP-0AP
120	BOW #1/FENGGKANG 15//NESMA*2/261-9/3/DUCULA	ICW02-20369-22AP-0AP-0AP-0AP-11AP-0AP
121	ACHTAR*3//KANZ/KS85-8-4/3/KATILA-17/4/MON'S'/ALD'S'//ALDAN'S'/IAS58	ICW02-20458-9AP-0AP-0AP-0AP-11AP-0AP
122	ACHTAR*3//KANZ/KS85-8-4/3/KATILA-17/4/MON'S'/ALD'S'//ALDAN'S'/IAS58	ICW02-20458-9AP-0AP-0AP-0AP-5AP-0AP
123	MOUKA-4/RAYON	ICW03-0151-27AP/0TS-0AP-0AP-4AP-0AP
124	GIZA-168	CM93046-8M-0Y-0M-2Y-0B-0SH

Grassy weeds were controlled by spraying of Tobik at 320 g a.i. ha⁻¹ after 30 days from planting, and broad leaf weeds were controlled using Granstar at 19 g a.i. ha⁻¹. The observations on days to heading, plant height (cm), number of spikes m⁻², number of grains spike⁻¹, 1000-grain weight (g) and grain yield (ton ha⁻¹) were recorded during the course of the experimentation. The collected data were statistically analyzed through a computer run program MSTATC. The treatment means were compared through least significant difference test at 5% probability level (Steel *et al.*, 1997).

RESULTS AND DISCUSSION

Days to heading

Data in Tables 2 and 3 indicated that there were significant differences among the raised bed and flat planting method in number of days to heading in the first season. Average number of days to heading under raised flat and bed planting method was 107.8 and 106.9 days in the first season and 98.9 and 104.8 days in the second season, respectively. Number of days to heading ranged from 101 to 112 days in the first season and from 101 to 107 days for raised beds in the second season. The longest period of days to heading was recorded for lines 107, 106, 111 and 120 with a number of days to heading of 112, 111.7, 111.7 and 111 days, respectively, with flat planting method followed by li 111 and 106 under raised bed planting method.

Table 2. Mean squares for days to heading, plant height and number of spikes per square meter.

SOV	df	Days to heading		Plant height		Number of spikes m ⁻²	
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Planting method (PM)	1	24.174 ns	1248.44 **	321.007 **	50.17 **	218556.2 **	169126.5 **
Genotype (G)	23	10.439 **	3.419 **	131.091 **	27.52 **	1892.72 **	2961.26 ns
PM x G	23	1.536 **	6.386 ns	17.021 **	44.37 **	3041.03 ns	2382.2 **

*, ** significant at 0.05 and 0.01 levels of probability, respectively, ns= non-significant

Table 3. Effect of planting methods on days to heading of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1 st season		2 nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	107.0	105.7	98.0	105.7	102.5	105.7	106.3	101.8	104.1
102	104.0	104.0	99.3	102.7	101.7	103.3	104.0	101.0	102.5
103	101.7	101.3	98.7	101.3	100.2	101.3	101.5	100.0	100.8
104	106.3	103.0	98.0	104.3	102.2	103.7	104.7	101.2	102.9
105	109.3	110.0	100.3	107.0	104.8	108.5	109.7	103.7	106.7
106	111.7	112.3	99.7	106.3	105.7	109.3	112.0	103.0	107.5
107	112.0	111.3	99.7	107.0	105.8	109.2	111.7	103.3	107.5
108	106.0	106.0	97.7	106.0	101.8	106.0	106.0	101.8	103.9
109	108.3	109.7	100.0	105.7	104.2	107.7	109.0	102.8	105.9
110	110.3	110.3	97.3	102.7	103.8	106.5	110.3	100.0	105.2
111	111.7	112.7	99.3	104.7	105.5	108.7	112.2	102.0	107.1
112	109.7	109.7	99.7	103.0	104.7	106.3	109.7	101.3	105.5
113	109.3	109.0	99.3	101.7	104.3	105.3	109.2	100.5	104.8
114	106.3	107.3	100.0	105.7	103.2	106.5	106.8	102.8	104.8
115	105.7	101.0	98.7	101.0	102.2	101.0	103.3	99.8	101.6
116	107.3	106.0	98.7	106.0	103.0	106.0	106.7	102.3	104.5
117	108.0	106.3	97.0	106.3	102.5	106.3	107.2	101.7	104.4
118	108.0	107.0	100.7	107.0	104.3	107.0	107.5	103.8	105.7
119	108.0	105.7	100.0	105.7	104.0	105.7	106.8	102.8	104.8
120	111.0	109.3	100.0	105.7	105.5	107.5	110.2	102.8	106.5
121	108.7	105.3	98.0	105.3	103.3	105.3	107.0	101.7	104.3
122	108.7	107.0	97.3	107.0	103.0	107.0	107.8	102.2	105.0
123	103.3	104.7	97.3	104.7	100.3	104.7	104.0	101.0	102.5
124	104.0	102.0	98.3	102.0	101.2	102.0	103.0	100.2	101.6
LSD 0.05	2.5942				1.8084		1.8628		0.8049
Average	107.8	106.9	98.9	104.8	103.3	105.9	107.4	101.8	-
LSD 0.05	0.8049				0.5028		0.7926		-

On the contrary, lines 103 and 124 recorded the shortest period of heading with a number of days to heading of 101.3 and 102 days produced by raised bed method followed by line 103(101.7 days) with flat method, respectively in the first season. In the second season, the longest period of days to heading was recorded from lines 118, 122, 107, 106 and 117 with a number of days to heading of 107, 107, 107, 106.3 and 106.3 days, respectively under raised bed planting method. While genotypes 118, 105, 109, 114, 119 and 120 recorded the longest period to heading with a number of days to heading of 100.7, 100.3, 100, 100, 100 and 100 days, respectively with flat method.

Plant height

The results showed that genotypes and the interaction between planting methods and genotypes differed significantly in plant height in both seasons (Tables 2 and 4). In the season 2012/13, the maximum plant height of 131.7 cm was recorded when wheat was sown by flat method, however, raised bed (130 cm) was also statistically significant at par. The minimum plant height of 96.7cm was recorded at raised bed. Results also, showed that mean squares due to genotypes and the interaction between planting methods and genotypes were significant for plant height. The tallest plants were recorded for genotypes no. 106 and 122 followed by no.114 and was recorded by flat method (131.7, 126.7 and 125 cm respectively), However, genotype no.106 recorded (130 cm) when wheat was sown in raised bed, while genotypes 105 and 108, recorded the shortest plants with raised bed planting method followed by genotype 105 by flat planting method in 2012/13 season. During 2013-14, average plant height of all genotypes under raised bed and flat planting method, were 112.1 and 110.9 cm respectively. The maximum plant height of 128.3 cm was recorded when wheat was sown by flat method, however, raised bed (118.3cm). The minimum plant height (96.7cm) was recorded by raised flat. Results also, showed that mean squares due to genotypes and the interaction between planting methods and genotypes were significant for plant height. The tallest plants were recorded from genotype no. 106 (128.3 cm) was recorded by flat method, followed by no.114, no.109, no.9 and no.110 (121.7, 120 and 118.3 cm respectively), was recorded when wheat was sown by flat method, while genotypes no.105, 108 and 124 recorded the shortest plants with flat planting method followed by genotype 124 recorded by raised bed planting method in 2012/13 season. These results are in agreement with previous results of Abbas *et al* (2009), who reported that the minimum plant height was recorded in flat at 15 cm row spacing. Naresh *et al* (2014), have shown that better plant height was noted in drill planting.

Table 4. Effect of planting method on plant height (cm) of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1st season		2nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	108.3	103.3	111.7	113.3	110.0	108.3	105.8	112.5	109.2
102	113.3	113.3	113.3	118.3	113.3	115.8	113.3	115.8	114.6
103	111.7	108.3	108.3	116.7	110.0	112.5	110.0	112.5	111.3
104	115.0	110.0	111.7	116.7	113.3	113.3	112.5	114.2	113.3
105	100.0	96.7	96.7	110.0	98.3	103.3	98.3	103.3	100.8
106	131.7	130.0	128.3	115.0	130.0	122.5	130.8	121.7	126.3
107	118.3	118.3	116.7	110.0	117.5	114.2	118.3	113.3	115.8
108	103.3	100.0	96.7	111.7	100.0	105.8	101.7	104.2	102.9
109	121.7	115.0	120.0	111.7	120.8	113.3	118.3	115.8	117.1
110	120.0	115.0	118.3	110.0	119.2	112.5	117.5	114.2	115.8
111	115.0	106.7	111.7	116.7	113.3	111.7	110.8	114.2	112.5
112	110.0	111.7	106.7	110.0	108.3	110.8	110.8	108.3	109.6
113	121.7	115.0	111.7	111.7	116.7	113.3	118.3	111.7	115.0
114	125.0	126.7	121.7	110.0	123.3	118.3	125.8	115.8	120.8
115	108.3	101.7	105.0	108.3	106.7	105.0	105.0	106.7	105.8
116	111.7	106.7	105.0	115.0	108.3	110.8	109.2	110.0	109.6
117	115.0	115.0	110.0	108.3	112.5	111.7	115.0	109.2	112.1
118	113.3	115.0	111.7	108.3	112.5	111.7	114.2	110.0	112.1
119	110.0	103.3	105.0	118.3	107.5	110.8	106.7	111.7	109.2
120	116.7	111.7	110.0	110.0	113.3	110.8	114.2	110.0	112.1
121	118.3	118.3	113.3	108.3	115.8	113.3	118.3	110.8	114.6
122	126.7	123.3	116.7	116.7	121.7	120.0	125.0	116.7	120.8
123	116.7	116.7	110.0	110.0	113.3	113.3	116.7	110.0	113.3
124	111.7	110.0	101.7	105.0	106.7	107.5	110.8	103.3	107.1
LSD 0.05	8.15				5.795		5.796		4.137
Average	115.1	112.2	110.9	112.1	113.0	112.1	113.6	111.5	-
LSD 0.05	4.137				3.521		3.524		-

Number of spikes per square meter

Data regarding number of spikes m⁻² are shown in Tables 2 and 5. Analysis of the data revealed that planting method significantly affected number of spikes m⁻² in both seasons.

Table 5. Effect of planting methods on number of spikes per square meter of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1 st season		2 nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	353.3	528.3	481.7	387.5	417.5	457.9	440.8	434.6	437.7
102	366.7	466.7	441.7	356.5	404.2	411.6	416.7	399.1	407.9
103	348.3	471.7	475.0	359.0	411.7	415.4	410.0	417.0	413.5
104	346.7	478.3	396.7	480.5	371.7	479.4	412.5	438.6	425.6
105	428.3	415.0	485.0	379.0	456.7	397.0	421.7	432.0	426.8
106	358.3	480.0	493.3	377.0	425.8	428.5	419.2	435.2	427.2
107	381.7	498.3	443.3	459.5	412.5	478.9	440.0	451.4	445.7
108	370.0	425.0	478.3	446.5	424.2	435.8	397.5	462.4	430.0
109	371.7	405.0	480.0	375.5	425.9	390.3	388.4	427.8	408.1
110	435.0	506.7	473.3	414.0	454.2	460.4	470.9	443.7	457.3
111	390.0	468.3	446.7	413.5	418.4	440.9	429.2	430.1	429.6
112	463.3	475.0	458.3	399.5	460.8	437.3	469.2	428.9	449.0
113	390.0	485.0	460.0	446.5	425.0	465.8	437.5	453.3	445.4
114	388.3	445.0	488.3	445.0	438.3	445.0	416.7	466.7	441.7
115	391.7	441.7	478.3	377.0	435.0	409.4	416.7	427.7	422.2
116	380.0	513.3	496.7	366.0	438.4	439.7	446.7	431.4	439.0
117	390.0	441.7	458.3	408.5	424.2	425.1	415.9	433.4	424.6
118	416.7	476.7	468.3	409.5	442.5	443.1	446.7	438.9	442.8
119	390.0	466.7	483.3	398.5	436.7	432.6	428.4	440.9	434.6
120	418.3	430.0	496.7	406.5	457.5	418.3	424.2	451.6	437.9
121	410.0	461.7	438.3	364.0	424.2	412.9	435.9	401.2	418.5
122	338.3	478.3	496.7	374.5	417.5	426.4	408.3	435.6	422.0
123	421.7	438.3	500.0	416.5	460.9	427.4	430.0	458.3	444.1
124	365.0	486.7	478.3	385.0	421.7	435.9	425.9	431.7	428.8
LSD 0.05	81.04				56.47		58.18		22.03
Average	388.1	466.0	470.7	401.9	429.4	433.9	427.0	436.3	-
LSD 0.05	22.03				10.88		22.28		-

Maximum number of spikes m^{-2} was recorded by raised bed method (528 spikes) followed by flat method (463.3spikes), while minimum number of spikes was recorded by flat method of planting (338.3spikes) in the first season. In 2013/2014 season the average number of spikes m^{-2} of all genotypes under raised bed and flat planting method was 401.9 and 470.7, respectively. In both seasons, highly significant mean squares were found for the genotypes and interaction under investigation. In 2012-13 season, the highest value of number of spikes m^{-2} was obtained from genotypes no. 101, 116, and 110 (528.3, 513.3, 506.7, respectively) the three genotypes which did not differ significantly in their averages from each other followed by genotypes no. 107 with raised bed planting method . The lowest number was obtained from genotype no. 122 followed by no. 104 and no103 (338.3, 346.7 and 348.3, respectively), when wheat was sown in flat method. In 2013/14 season, the highest number was obtained from genotypes no.123 followed by genotypes no.116 and no.120 (500, 496.7 and 496.7 respectively), under flat planting method. The lowest number was that of genotype no.102 followed by genotype no.103 (356.5 and 359 spikes respectively) with raised bed planting method. These results are in agreement with Attaullah *et al* (2007) who reported that maximum number of spikes m^{-2} 164 was recorded by seed planted in 30cm apart lines followed by double row on ridge (150). Sikander *et al* (2003) reported that number of spikes m^{-2} 164 was significantly higher in raised bed planted wheat in comparison with flat planted wheat

Number of grains per spike

It is clear from the data shown in Tables 6 and 7, that the number of grains spike⁻¹ was produced in raised bed planting method during 2012-13, 2013-14 years (59.1 and 54.8, respectively).

Table 6. Summary of analysis of variance of number of kernels spike-1, 1000 grain weight and grain yield (t ha-1) of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

SOV	df	Number of Grains spike ⁻¹		1000-grain weight		Grain yield	
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Planting method (PM)	1	1965.44 **	115.56 **	947.10 **	2497.9 **	91.378 **	21.37 **
Genotype (G)	23	57.082 ns	143.44 ns	20.561 ns	35.66 **	0.422 *	0.427 **
PM x G	23	40.227 ns	141.21 ns	8.836 **	26.27 **	0.292 ns	1.03 *

*, ** significant at 0.05 and 0.01 levels of probability, respectively, ns= non-significant

Table 7. Effect of planting method on number of grains per spike of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1st season		2nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	47.5	50.0	50.9	49.5	49.2	49.8	48.7	50.2	49.5
102	50.7	64.6	48.5	54.9	49.6	59.7	57.6	51.7	54.7
103	48.5	62.2	43.0	52.2	45.7	57.2	55.4	47.6	51.5
104	48.3	55.1	48.5	56.1	48.4	55.6	51.7	52.3	52.0
105	53.6	55.1	53.3	64.3	53.5	59.7	54.4	58.8	56.6
106	56.5	64.7	45.9	43.0	51.2	53.9	60.6	44.4	52.5
107	52.8	62.0	60.8	54.9	56.8	58.5	57.4	57.9	57.6
108	52.4	60.9	47.3	53.5	49.9	57.2	56.6	50.4	53.5
109	53.7	53.5	55.3	66.7	54.5	60.1	53.6	61.0	57.3
110	50.6	60.1	55.5	49.2	53.1	54.6	55.3	52.4	53.8
111	56.0	52.2	53.0	57.0	54.5	54.6	54.1	55.0	54.6
112	44.3	55.8	59.9	51.5	52.1	53.6	50.0	55.7	52.9
113	46.1	54.2	51.3	60.5	48.7	57.4	50.2	55.9	53.0
114	55.3	56.8	40.2	67.8	47.8	62.3	56.0	54.0	55.0
115	50.2	53.9	49.7	62.7	50.0	58.3	52.0	56.2	54.1
116	55.1	69.5	68.7	51.9	61.9	60.7	62.3	60.3	61.3
117	47.2	66.3	51.3	51.1	49.2	58.7	56.7	51.2	54.0
118	50.8	62.5	65.7	61.1	58.2	61.8	56.6	63.4	60.0
119	49.8	63.1	46.5	50.5	48.2	56.8	56.4	48.5	52.5
120	57.0	66.3	49.1	59.3	53.1	62.8	61.7	54.2	57.9
121	57.2	63.6	52.6	46.3	54.9	55.0	60.4	49.5	54.9
122	56.0	58.3	55.9	58.7	56.0	58.5	57.1	57.3	57.2
123	49.0	52.2	55.7	35.2	52.4	43.7	50.6	45.5	48.0
124	51.3	55.0	63.5	57.6	57.4	56.3	53.1	60.5	56.8
LSD 0.05	14.887				10.294		10.774		4.851
Average	51.7	59.1	53.0	54.8	52.3	56.9	55.4	53.9	-
LSD 0.05	4.851				2.275		4.917		-

However, flat planting method (51.7 and 53, respectively). However, maximum number of grains spike⁻¹ was recorded in raised bed method (69.5) while minimum number of grains spike⁻¹ were recorded in raised bed method (35.2). Across the two planting methods, mean squares due to genotypes and interaction were significant in both seasons in number of grains spike⁻¹. Data indicated that in the first season, genotype no. 116, was the highest in number of grains spike⁻¹ with an average of 69.5, followed by

genotypes no.117, no.120 and no.106 with averages of 66.3, 66.3 and 64.7, respectively when the wheat was sown in raised bed method. The lowest value (44.3, 46.1, 47.2 grains/spike) was obtained from genotype no.112, 113 and 117, respectively with flat planting method. In the second season, the highest number of grains spike⁻¹ (69.9) was obtained from genotype no.112, followed by genotype no.1116 under flat planting method. Genotypes no.114 and no.109 did not differ significantly in their means from each other with raised bed planting method.

The lowest values (35.2 grains/spike) was obtained from genotype no.123, with raised bed planting method. These results are in agreement with Sikander *et al* (2003) who reported that number of grains spike⁻¹ was significantly higher in raised bed planted wheat in comparison with flat planted wheat. But, Shaalan *et al* (1977) and Tanveer *et al* (2003), reported more number of grains spike⁻¹ for improved planting method as compared to broadcasting.

1000-grain weight

It is clear from the data shown in Tables 6 and 8, that 1000-grain weight was recorded in raised bed planting method during 2012-13, 2013-14 years (46.9 and 54.5, respectively) and in flat planting method (41.7 and 46.12, respectively). However, maximum 1000-grain weight was recorded in raised bed method (62.7g) while minimum number of weight grains were recorded in raised bed (35.70g). Overall the two planting methods, mean squares due to genotypes and genotypes x planting method interaction were significant for 1000-grain weight, in both seasons. In the first season, the highest value of 1000-grain weight (53.7 g) was obtained from genotype no.123, followed by genotypes no. 114, no.106, no.112, no.104 and no.113 under raised bed planting method, followed by genotype no. 123 with flat method. While the lowest value for 1000-grain weight was obtained from Line no. 118 with an average 1000-grain weight of 35.7g under flat method, followed by genotype no. 119 with flat method. In the second season, the highest value for 1000-grain weight was obtained from genotype no. 121, followed by genotypes no.102 and 111 with averages of 62.70, 59.6 and 59.2 g when the wheat sown in raised bed method. The lowest value (39.50 g) was obtained from genotype no.115 followed by genotype no.118 with flat planting method. Our results are in line with previous results of Hassan and Hassan (1994) and Tanveer *et al* (2003) who reported smaller 1000-grain weight for broadcast planted wheat as compared to wheat planted with other planting methods.

Table 8. Effect of planting method on 1000 kernels weight (g) of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1 st season		2 nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	41.0	45.8	45.4	56.0	43.2	50.9	43.4	50.7	47.1
102	43.2	45.5	48.5	59.6	45.8	52.6	44.3	54.0	49.2
103	42.2	43.0	40.2	57.9	41.2	50.4	42.6	49.0	45.8
104	44.8	49.2	48.0	55.5	46.4	52.4	47.0	51.8	49.4
105	40.5	44.7	46.6	50.7	43.6	47.7	42.6	48.7	45.6
106	45.9	50.3	47.9	51.3	46.9	50.8	48.1	49.6	48.8
107	42.7	44.3	48.8	47.7	45.7	46.0	43.5	48.2	45.9
108	37.3	43.7	41.5	54.3	39.4	49.0	40.5	47.9	44.2
109	39.3	47.8	43.2	55.5	41.2	51.7	43.5	49.4	46.5
110	42.6	47.8	50.1	47.6	46.4	47.7	45.2	48.9	47.0
111	44.6	49.2	48.4	59.2	46.5	54.2	46.9	53.8	50.4
112	46.2	49.8	51.7	50.8	49.0	50.3	48.0	51.2	49.6
113	45.0	49.2	49.9	53.6	47.4	51.4	47.1	51.8	49.4
114	44.7	54.0	49.6	51.3	47.1	52.6	49.4	50.4	49.9
115	43.9	47.9	39.5	54.6	41.7	51.3	45.9	47.1	46.5
116	41.7	48.9	50.4	50.3	46.1	49.6	45.3	50.4	47.8
117	37.5	39.9	44.8	56.7	41.1	48.3	38.7	50.8	44.7
118	35.7	43.5	40.3	52.8	38.0	48.2	39.6	46.5	43.1
119	36.0	43.1	41.9	58.4	39.0	50.8	39.6	50.2	44.9
120	36.2	42.7	43.3	58.1	39.7	50.4	39.4	50.7	45.1
121	40.8	45.0	44.8	62.7	42.8	53.8	42.9	53.8	48.3
122	42.9	48.7	45.0	55.3	44.0	52.0	45.8	50.2	48.0
123	49.0	53.7	44.6	50.6	46.8	52.1	51.3	47.6	49.5
124	38.4	47.5	52.6	56.4	45.5	51.9	42.9	54.5	48.7
LSD 0.05	7.025				4.99		4.945		1.484
Average	41.7	46.9	46.1	54.5	43.9	50.7	44.3	50.3	-
LSD 0.05	1.484				1.411		1.056		-

Grain yield (kg ha⁻¹)

The data presented in Tables 6 and 9 for grain yield revealed that during 2012-13, the maximum grain yield of 11.3 t ha⁻¹ was recorded when wheat was sown in raised bed planting method.

Table 9. Effect of planting method on grain yield (ton ha⁻¹) of 24 wheat genotypes at Sids Agricultural Research Station during 2012/2013 and 2013/2014 seasons.

Genotype	1 st season		2 nd season		Planting method		Season		Entry mean
	Flat	Beds	Flat	Beds	Flat	Beds	1 st	2 nd	
101	9.2	10.4	8.6	10.0	8.9	10.2	9.8	9.3	9.6
102	8.8	10.4	9.0	9.8	8.9	10.1	9.6	9.4	9.5
103	9.2	10.3	9.1	10.3	9.1	10.3	9.7	9.7	9.7
104	8.6	10.0	9.1	9.8	8.8	9.9	9.3	9.5	9.4
105	9.2	10.4	9.2	9.7	9.2	10.0	9.8	9.4	9.6
106	8.7	10.6	8.8	10.0	8.8	10.3	9.6	9.4	9.5
107	9.1	10.5	9.3	9.0	9.2	9.8	9.8	9.1	9.5
108	9.2	11.0	9.2	10.4	9.2	10.7	10.1	9.8	9.9
109	9.0	10.1	8.9	9.3	8.9	9.7	9.5	9.1	9.3
110	8.8	10.7	8.4	10.0	8.6	10.3	9.8	9.2	9.5
111	8.9	10.5	9.4	10.0	9.2	10.2	9.7	9.7	9.7
112	8.8	10.9	9.1	10.0	8.9	10.5	9.8	9.6	9.7
113	9.0	10.6	9.1	10.1	9.1	10.4	9.8	9.6	9.7
114	8.7	11.3	8.7	10.3	8.7	10.8	10.0	9.5	9.8
115	9.5	10.0	9.3	10.6	9.4	10.3	9.8	10.0	9.9
116	9.5	11.2	8.9	11.1	9.2	11.2	10.3	10.0	10.2
117	8.8	10.2	8.7	10.4	8.8	10.3	9.5	9.5	9.5
118	8.3	10.2	8.9	9.0	8.6	9.6	9.3	9.0	9.1
119	8.1	10.1	9.6	8.4	8.9	9.3	9.1	9.0	9.1
120	8.6	10.6	9.7	8.3	9.2	9.5	9.6	9.0	9.3
121	9.5	10.7	9.2	9.3	9.4	10.0	10.1	9.3	9.7
122	9.3	11.2	8.5	8.9	8.9	10.0	10.2	8.7	9.5
123	8.4	9.9	8.5	9.0	8.5	9.4	9.1	8.7	8.9
124	9.4	10.9	7.8	9.7	8.6	10.3	10.1	8.7	9.4
LSD 0.05	0.8679				0.6232		0.605		0.2738
Average	8.9	10.5	9.0	9.7	8.9	10.1	9.7	9.3	-
LSD 0.05	0.2738				0.2686		0.1741		-

Average grain yield of all genotypes under raised bed and flat planting method was 10.5 and 8.9 t ha⁻¹ in the first season, respectively. During 2013-14 raised bed method recorded the maximum grain yield of 11.1 t ha⁻¹ but flat method recorded 9 t ha⁻¹ of grain yield. Average grain yield of all genotypes under raised bed and flat planting method was 9.7 and 9 t ha⁻¹ in the second season, respectively. The twenty four wheat genotypes

under study differed significantly in their grain yield as affected by the two planting method in the two seasons of the study. In 2012-13 season , genotypes no.114, 116, 112, 109 and no.108 were the highest in grain yield, with average yield of 11.3, 11.2, 11.2, 11.1 and 11 t ha⁻¹, respectively when the wheat was sown in raised bed method. The lowest value was that of genotypes no.119, 118 and no.104 with an average yield of 8.1, 8.3 and 8.6 t ha⁻¹, respectively with the flat planting method. In 2013-14 season, the highest mean grain yield (11.10 t ha⁻¹) was obtained from genotype no.116 followed by genotypes no. 115 and no.117 under the raised bed planting method. . The lowest mean (7.8 t ha⁻¹) was that of genotype no.124 when the wheat was sown in flat method. Bed planting has shown improved water distribution and efficiency, fertilizer use efficiency, reduced weed infestation and less crop lodging. In general, the modified planting technique bed sowing gave more grain yield as compared to conventional flat sowing (Waraich 2010). Assam during studies made by Gogoi and Kalita (1995). Abdul Majeed (2015) reported that wheat planting on beds and nitrogen application at 120 kg ha⁻¹ produced 15.06% higher grain yield than flat planting at the same nitrogen rate. Dawelbeit and Babiker (1997) reported higher yield for seed drilling and ridging after broadcasting than broadcasting alone

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تأثير طرق الزراعة على المحصول ومكوناته

في تراكيب وراثيه مختلفه من قمح الخبز

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اجريت التجريه فى محطه البحوث الزراعيه بسدس مركز البحوث الزراعيه فى موسمين ٢٠١٣/٢٠١٢ و ٢٠١٤/٢٠١٣ وذلك لدراسه تأثير طريقتين زراعه هما الزراعة تسطير على ارض مسطحه والزراعه تسطير على مصاطب على المحصول ومكوناته فى ٢٤ تركيبا وراثيا من قمح الخبز . كان التصميم المستخدم هو القطاعات الكامله العشوائيه فى ثلاث مكررات . اوضحت النتائج ان هناك فروق معنويه بين طريقتي الزراعه فى كلا الموسمين حيث تم الحصول على اعلى قيمه لمحصول الحبوب وهى (١١,١٢ طن للهكتار) وعدد حبوب السنبله ووزن الالف حبه واقل قيمه لعدد الايام حتى طرد السنابل تحت طريقه الزراعه تسطير على مصاطب بينما تم الحصول على اعلى قيمه لعدد السنابل فى المتر المربع مع طريقه الزراعه تسطير على ارض مسطحه. كما اوضحت النتائج ان هناك فروق معنويه بين السلالات فى كلا من محصول الحبوب و وزن الالف حبه وعدد السنابل فى المتر المربع وميعاد طرد السنابل بينما لا توجد فروق بين السلالات فى عدد حبوب السنبله فى كلا الموسمين. كما اوضحت النتائج ان التفاعل بين طرق الزراعه والتراكيب الوراثيه كانت معنويه فى جميع الصفات تحت الدراسه ما عدا صفه عدد الحبوب فى السنبله فى الموسمين.

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