Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Impact of Different Planting Techniques on Yield and its Component of Six Bread Wheat Cultivars

Hanan E. Ghanem[1*] and E. M. A. Gebrel[2]

[1]Wheat Research Department, Field Crops Research Institute, Ismailia Agriculture Research Station, Agriculture Research Centre, Egypt

[2]Wheat Research Department, Field Crops Research Institute, El-Gemmiza Agriculture Research Station, Agriculture Research Centre, Egypt

Cross Mark

ABSTRACT

Agronomic practices must be continuously reevaluated to enhance crop performance and the sustainability of bread wheat production, especially in light of changing genetic and climatic conditions. The bread wheat planting techniques and cultivars recommended for typical climatic conditions might not be appropriate in the current era of increased climate variability. As a result, a field study was carried out at El-Gemmeiza Agricultural Research Station, Agricultural Research Center, Egypt, during the two succeeding growing seasons, 2021–2022, and 2022–2023. The objective of this study was to explore the impact of three different planting techniques, broadcasting, drilling, and raised beds, on six bread wheat cultivars: Giza 171, Misr 3, Misr 4, Sakha 95, Nubaria 2, and Sids 14, by yield and yield components. The wheat cultivar Misr 3 produced the highest grain yield (10.51 and10.29 t/ha), surpassing other studied cultivars. In comparison to the drilling technique (9.94 and 9.30 t/ha) and the broadcasting technique (9.49 and 8.72 t/ha), the raised beds technique (10.59 and 10.59 t/ha) proved to be the most effective planting technique respectively. In terms of interaction, the Misr 4 wheat cultivar with the raised beds technique yielded the highest grain yield (11.67 and 11.45 t/ha). However, when using the broadcasting technique, the wheat cultivar Nubaria 2 produced the lowest grain yield (8.27 and 8.11 t/ha) in the consecutive year.

Keywords: Wheat; Planting Techniques; Yield; Cultivars

INTRODUCTION

Wheat constitutes one of the greatest widely grown grain crops and is crucial to human food security, providing 18% of the world's calories (Erenstein *et al.*, 2022). It has roughly 13% protein and 55% starch, along with some dietary fats, iron, zinc, calcium, and vitamin B (Sramkova and Gregová 2009).

The use of agronomic techniques to increase the yield of energy, feed, and food crops has long been studied (Dong *et al.*, 2021). This is anticipated to persist, and with the introduction of new cultivars, agronomic practices must be regularly refined. Even though the agronomic practices of various wheat genotypes have been studied over several decades (Eltaher *et al.*, 2021), some of these practices may be impacted by climate change, which would justify new recommendations for these practices.

This may aid in closing the yield gap that exists between the actual yield and the maximum yield possible for a given crop cultivar. A potential area of future research in agronomy is planting techniques for recently developed cultivars. According to earlier studies, planting technique is crucial for ensuring that grain is placed at the proper depth, which in turn influences plant growth (Sikander *et al.*, 2003). However, an improper planting technique may result in a decrease in grain yield.

In Egypt, wheat is cultivated by broadcasting, which results in a lower plant density; in contrast, drilling and raised bed planting techniques are advised due to their standard seed distribution and higher plant density (Soomro *et al.*, 2009). One of the key elements affecting a crop's capacity to absorb resources is its plant density. One effective planting technique that reduces weed infestation and crop lodging while increasing the efficiency of water and fertilizer use is the raised bed technique (Hobbs and Morris, 2011).

This study aimed to investigate the effects of three distinct planting techniques (broadcasting, drilling, and raised beds) on six cultivars of bread wheat (Giza 171, Misr 3, Misr 4, Sakha 95, Nubaria 2, and Sids 14) about yield and yield components.

MATERIALS AND METHODS

This field study was carried out in the years i.e. 2021–2022 and 2022–2023 at El-Gemmeiza Agricultural Research Station, El Santa District, El-Gharbiya Governorate, Egypt. The experiment was set up using a split-plot layout in Randomize Complete Block Design (RCBD) with four replications. Six Egyptian bread wheat cultivars (Giza 171, Misr 3, Misr 4, Sakha 95, Nubaria 2, and Sids 14) were assigned to the main plots, and three planting techniques (broadcasting, drilling, and raised beds) were assigned to the sub-plots.

The origin and pedigree of the wheat cultivars under investigation is presented in Table 1 were provided by the Wheat Research Department of the Field Crops Research Institute, Agricultural Research Center, ARC.

* **Corresponding author.**
E-mail address: hanein_eg@yahoo.com
DOI: 10.21608/jpp.2024.267795.1309

Table 1. Wheat cultivars, origin, and its pedigree.

Genotypes	Pedigree	Origin
Giza 171	SAKHA93 /GEMMEIZA 9 S.6-1GZ- 4GZ- 1GZ- 2GZ-0S	Egypt
Misr 3	ATTILA*2/ABW65*2/KACHU CMSS06Y00258 2T-099TOPM-099Y-099ZTM-099Y-099M-10WGY-0B-OGZ	Egypt
Misr 4	NS732/HER/3/PRL/SARA//TSI/VEE 5/6/FRET 2/5/WHEAR/SOKOLL	Egypt
Sakha 95	PASTOR//SITE/MO/3/CHEN/AEGILOPS SQUARROSA (TAUS)//BCN/4/WBLL1 CMA01Y001585-040POY-040M-030ZIM-040SY26M- 04-OM-OY-OSY-OS	Egypt
Nubaria 2	FRET2*2/4/SNI/TRAP#1/3/KAUZ*2/TRAP//KAUZ*2/5/BOW/URES//2*WEAVER/3/CRO C_1/AE.SQUARROSA(213)//PGO/CGSS05B00144T-099TOPY-099M-099NJ-099NJ- 7WGY-0B-5Y-0B-0NUB	Egypt
Sids 14	BOW"S"/VEE"S"//BOW"S"/TSI/3/BANI SUEF 1	Egypt

The seeds in the broadcasting technique were spared by hand and then thoroughly covered. In the drilling technique, the seeds were planted using a seed drill with 15 cm between rows. Lastly, planting was done in raised beds using hilling bed planting, which was 120 cm (row center to row center) wide, six rows/bed, with 15 cm between rows and 10 cm between hills, and 40 cm high beds.

The Ministry of Agriculture and reclaimed land recommendations were followed in preparing the experimental field. As instructed, fertilizer with both nitrogen and phosphorus was applied. Table 2 displays the analyses of the experimental soil conducted before the 2021–2022 and 2022–2023 wheat sowing seasons. Table 3 displays the experimental site's meteorological data for both seasons.

The studied yield characters

The following parameters were noted during the experiment seasons: plant height (cm), heading date (days), maturity date (days), number of spikes/m^2, number of grains/spike, 1000-kernel weight (g), and grain yield (t/ha).

Statistical analysis

All the data were statistically analyzed using a randomized complete block design (RCBD) with split plot arrangements and four replications. According to Steel *et al.* (1997), the means were compared using the least significant differences (LSD) at $p \leq 0.05$. Statistical analysis was performed using the CoHort/CoStat software, Version 6.311, and the analysis of variance technique (ANOVA).

Table 2. The experimental site's physical and chemical characteristics before 2021/2022 and 2022/2023 wheat sowing seasons

Parameters	2021/2022	2022/2023
	Mechanical Analysis	
Clay %	49.89	50.85
Silt %	29.91	30.05
Sand %	8.55	7.90
Texture grade	Clay	Clay
	Chemical Analysis	
pH (1:25)	8.11	8.05
EC (dSm^{-1})	0.86	0.73
Organic Matter (%)	1.70	1.63
CaCO3	0.32	0.33
	Soluble anion meq/l	
CO_3^{2-}	-	-
HCO_3^-	4.01	3.09
Cl^-	3.25	2.25
SO_4^{2-}	1.14	1.66
	Soluble cation meq/l	
Ca^{2+}	1.85	1.90
Mg^{2+}	2.20	1.65
Na^+	4.00	3.20
K^+	0.35	0.25
	Available N P K (ppm)	
N	43.45	41.65
P	6.01	4.69
K	389	420

Table 3. Meteorological data of experimental site during both growing wheat seasons.

Parameter	Max. Temperature		Min. Temperature		Relative Humidity		Rainfall (mm/day)		Wind Speed	
Season Month	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**
November	28.64	24.84	16.47	15.36	66.14	60.51	1.39	0.089	9.83	8.33
December	20.29	24.18	10.86	13.03	71.63	67.23	0.72	0.41	7.93	6.38
January	17.60	22.02	6.96	13.60	71.22	70.09	1.68	1.29	5.81	6.01
February	19.90	20.85	7.97	8.65	70.13	68.25	0.45	0.35	6.20	5.99
March	20.78	23.45	8.18	9.45	65.32	61.99	1.03	0.86	5.96	6.45
April	30.80	29.43	13.17	9.91	57.24	58.95	0.00	0.01	7.44	7.65
May	34.10	35.21	16.77	16.98	50.77	49.58	0.00	0.00	8.41	9.05

*** Source: Water Requirement and Field Irrigation Res., Dept**

RESULTS AND DISCUSSION

Impact of wheat cultivars

Regarding grain yield and yield component, there were noteworthy distinctions between the bread wheat cultivars. The results displayed in Tables 4 and 5 made it clear that wheat cultivars had a major impact on grain yield and yield traits.

Misr 3 surpassed Giza 171, Misr 4, Sids 14, Sakha 95, and Nubaria 2 in terms of days to heading (100.75 and 102.25 days), and days to maturity (161.42 and 161.83 days). However, Misr 3 surpassed Misr 4, Giza 171, Sakha 95, Sids 14, and Nubaria 2 in plant height (115.99 and 116.39 cm), number of spikes/m2 (496.58 and 491.92), and number of kernels/spike (65.42 and 63.50), 1000-kernel weight (53.58 and 53.07g) in both seasons. Moreover, Misr 3 produced the maximum grain yield in both seasons (10.51 and 10.29 t/ha).

In contrast, the Nubaria 2 wheat cultivar yielded the minimum values of 1000-kernel weight of (47.03 and 47.28 g) and grain yield (9.17 and 8.70 t/ha) in both seasons. These findings align with the findings of Amal *et al.* (2016). Therefore, differences between wheat cultivars may be due to the cultivar's genetic makeup. This finding suggests that there is a discernible level of genetic variation that might be most important for flexibility and adaptation to a range of environmental circumstances.

These findings coincide with those of Khaliq *et al.* (1999). Furthermore, Gomaa *et al.* (2018) verified that the genotypes' substantial main effects and their interactions with environments suggest that these genotypes carry genes with variable additives that appear unstable and tend to rank differently depending on the environment.

Impact of planting techniques

Regarding the planting techniques, Tables 4 and 5 illustrate that there were discernible differences in yield and yield components among the planting techniques. In the two seasons, the drilling technique (99.88 and 100.88 days) came in next to the broadcasting technique (97.13 and 99.50 days) for early heading. On the contrary, the raised bed technique showed the latest heading (100.83 and 102.08 days) in both seasons.

Furthermore, in the first season, the broadcasting technique demonstrated notable early days to maturity (156.67 days), and in the second season, there were no appreciable variations (159.25 days). On the other hand, the raised beds recorded the highest days to maturity in the first season (160.63 days), with no appreciable variations in the second season.

In comparison to broadcasting and drilling techniques, the raised beds technique may have produced delayed heading and maturity because it provided a better environment for the wheat on the beds, reduced competition for all essential elements, and more shading from one another. These findings concur with those reported by Chauhdary *et al.* (2015), who found that raised bed sowing produced more spikes than broadcasting and drilling techniques.

In terms of plant height, there were no substantial variations found between all three techniques in either of the two seasons. Although plant height appears to be relatively high with the raised beds technique (159.92 and 115.56), followed by the drilling technique (114.28 and 115.23) and broadcasting technique (114.74 and 115.76) in both seasons.

The raised beds technique (499.50 and 503.00) produced the highest number of spikes/m^2, followed by the drilling technique (486.25 and 467.79), and the broadcasting technique, which produced the lowest number of spikes/m^2 (450.92 and 449.63) in both seasons. In comparison to broadcasting and drilling techniques, the raised bed techniques produced the maximum number of spikes/ m^2. This could have been attributed to various factors, such as the improved microenvironment for wheat on the beds, precise and consistent seed distribution, and an appropriate amount of irrigation water. The findings of Shailendra *et al.* (2021) are consistent with our data, which showed that raised bed sowing produced more spikes than broadcasting and drilling techniques.

The findings presented in Table 5 demonstrated a statistically significant variation in the number of kernels or spikes, weight of 1000 kernels, and grain yield between the three planting techniques. Significantly fewer kernels or spikes (56.79 and 58.42), 1000-kernel weight (46.49 and 46.68g), and grain yield (9.49 and 8.72 t/ha) were recorded by the broadcasting technique. However, the highest values of grain yield (10.59 and 10.59 t/ha), 1000-kernel weight (54.05 and 54.51g), and number of kernels/spike (63.25 and 61.63) were recorded in the raised beds. The number of kernels/spike (62.04 and 60.21), the weight of 1000 kernels (52.46 and 51.14 g), and the grain yield (9.94 and 9.30) were recorded with the drilling technique. These findings are consistent with Tanveer *et al.* (2003).

The best root development in raised beds, as opposed to broadcasting and drilling techniques, may be the result of higher water and nutrient use efficiency. Ozberk *et al.* (2009) support these findings. They claimed that, compared to traditional sowing techniques, bed sowing produced a noticeably higher number of kernels and spikes.

Additionally, the lighter grains produced by the broadcasting technique may be the result of poor growth, whereas the heavier grains obtained from raised beds may be due to the best sunlight access in the canopy to the lower leaves, which gives more ability for grain filling.

Furthermore, compared to other planting techniques, the raised beds technique may have a higher grain yield because it has more spikes/m^2 and kernels/spike (Tables 4 and 5). Chauhdary *et al.* (2015), who noted that wheat cultivated on beds gave a higher yield than flat-cultivated wheat, support these results.

Table 4. Impact of planting techniques and wheat cultivars on heading, maturity, plant height and number of spikes/ m^2 during both growing seasons.

Parameters	Heading (days)		Maturity (days)		Plant height (cm)		No. of Spikes/m^2	
Season	2021/2022	2022/2023	2021/2022	2022/2023	2021/2022	2022/2023	2021/2022	2022/2023
				A. Cultivars				
Giza 171	100.70^a	101.50^b	160.08^b	161.00^a	115.36^b	115.95^b	491.17^b	481.17^b
Misr 3	100.75^a	102.25^a	161.42^a	161.83^a	115.99^a	116.39^a	496.58^a	491.92^a
Misr 4	99.17^b	100.83^c	160.25^b	160.75^b	115.52^{ab}	116.15^{ab}	491.75^b	482.83^b
Sakha 95	98.25^c	100.33^c	159.00^c	159.83^c	114.53^c	115.29^{bc}	471.92^c	468.25^c
Nubaria 2	97.83^d	99.67^d	155.08^e	155.75^e	113.30^d	114.0^c	455.75^e	447.17^d
Sids 14	98.92^c	100.33^c	157.25^d	158.08^c	114.46^c	115.28b^c	466.17^d	469.50^c
F test	**	**	*	**	**	**	**	**
				B. Planting techniques				
Broadcasting	97.13^c	99.50^b	156.67^c	159.25	114.28	115.23	450.92^c	449.63^c
Drilling	99.88^b	100.88^b	159.25^b	159.46	114.74	115.76	486.25^b	467.79^b
Raised Beds	100.83^a	102.08^a	160.63^a	159.92	115.56	115.55	499.50^a	503.00^a
F test	**	**	**	ns	ns	ns	**	**
				C. Interaction				
A * B	**	*	**	**	*	*	**	**

The CoHort/CoStat software Version 6.31 indicates that distinct letters prove significant variations between ctreatments at p ≤ 0.05. Levels of significance at p ≤ 0.05 ns not significant, * significant, and **significant.

Table 5. Impact of planting techniques and wheat cultivars on No. kernel/spike, 1000 kernel weight, and grain yield during both growing seasons.

Parameters	No. of Kernels/Spike		1000-kernel weight (g)		Grain yield (t/ha)	
Season	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**
			A. Cultivars			
Giza 171	60.92^{b}	61.08^{b}	51.79^{bc}	50.97^{b}	10.30^{bc}	9.71^{bc}
Misr 3	65.42^{a}	63.50^{a}	53.58^{a}	53.07^{a}	10.51^{a}	10.29^{a}
Misr 4	64.92^{a}	62.42^{ab}	52.81^{b}	52.93^{a}	10.46^{ab}	9.80^{b}
Sakha 95	58.42^{c}	59.92^{c}	50.49^{c}	49.62^{c}	9.84^{c}	9.42^{c}
Nubaria 2	55.83^{d}	53.83^{d}	47.03^{d}	47.28^{d}	9.17^{d}	8.70^{d}
Sids 14	58.67^{c}	59.75^{c}	50.30^{c}	50.80^{b}	9.75^{c}	9.31^{cd}
F test	**	**	**	**	**	**
			B. Planting techniques			
Broadcasting	56.79^{b}	58.42^{b}	46.49^{b}	46.68^{b}	9.49^{b}	8.72^{c}
Drilling	62.04^{a}	60.21^{a}	52.46^{a}	51.14^{a}	9.94^{b}	9.30^{b}
Raised Beds	63.25^{a}	61.63^{a}	54.05^{a}	54.51^{a}	10.59^{a}	10.59^{a}
F test	*	*	**	**	*	**
			C. Interaction			
A * B	*	*	*	**	*	**

The CoHort/CoStat software Version 6.31 indicates that distinct letters prove significant variations between treatments at $p \leq 0.05$. Levels of significance at $p \leq 0.05$. t/ha: ton/hectare * significant, and **significant.

Interactive Impact of cultivars and planting techniques

The interaction between planting techniques and cultivars had a significant effect on wheat grain yield, as indicated by the results in Tables 6 and 7. According to our data, the raised beds technique developed the maximum grain yields and yield attributes for all wheat cultivars (with cultivars order Misr 4 > Misr 3 > Giza 171 > Sakha 95 > Sids 14 > Nubaria 2), followed by the drilling technique (with cultivars order Misr 3 > Misr 4 > Giza 171 > Sakha 95 > Sids 14 > Nubaria 2), and the broadcasting technique (with cultivars order Giza 171 > Misr 3 > Sids 14 > Sakha 95 > Misr 4 > Nubaria 2).

Table 6. Impact of di-interaction between planting techniques and wheat cultivars on plant height and number of spikes/ m^2 during both growing seasons.

Planting technique	Parameters Cultivars	Heading (days)		Maturity (days)		Plant height (cm)		No. Spikes/ m^2	
	Season	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**
Broadcasting	Giza 171	99.00^{bcd}	99.50^{fgh}	158.75^{ef}	160.75^{bcd}	114.85^{cde}	115.23^{defg}	483.50^{g}	458.50^{fg}
	Misr 3	98.75^{bcd}	101.75^{abc}	159.25^{cdef}	162.25^{ab}	115.95^{abc}	116.18^{bcd}	476.00d^{e}	475.00^{e}
	Misr 4	95.50^{e}	99.00^{gh}	157.75^{f}	163.25^{a}	114.10^{def}	116.15^{bcd}	437.50^{f}	451.25^{gh}
	Sakha 95	96.00^{e}	99.25^{gh}	158.50^{ef}	160.50^{cd}	114.00^{ef}	114.93^{fgh}	437.75^{f}	455.50^{gh}
	Nubaria 2	95.50^{e}	98.50^{h}	152.00^{h}	153.00^{h}	112.75^{g}	113.50i	430.00^{f}	416.25^{i}
	Sids 14	98.00^{d}	99.00^{gh}	153.75^{gh}	155.75^{g}	113.48^{fg}	114.58^{gh}	440.75^{f}	441.25^{h}
Drilling	Giza 171	101.50^{a}	102.50^{ab}	160.75^{bc}	162.25ab^{c}	115.05^{bcde}	115.93^{cde}	486.25^{bcde}	478.75^{de}
	Misr 3	101.75^{a}	102.50^{ab}	161.00^{bc}	161.00^{bcd}	115.98^{abc}	116.45^{bc}	503.75^{bc}	477.25^{de}
	Misr 4	100.00^{b}	100.75^{cde}	161.25^{b}	158.00^{f}	115.33^{bcd}	117.70^{a}	502.75^{bc}	471.50^{ef}
	Sakha 95	98.75^{bcd}	100.00^{efg}	158.50^{ef}	159.50^{def}	114.30^{def}	115.13^{efgh}	483.50^{cde}	455.50^{gh}
	Nubaria 2	98.50^{cd}	99.00^{gh}	155.00^{g}	156.00^{g}	113.30^{fg}	114.23^{hi}	467.50^{e}	447.75^{gh}
	Sids 14	98.75^{bcd}	100.50^{def}	159.00^{def}	160.00^{de}	113.95^{efg}	115.10^{efgh}	473.75^{de}	476.00^{e}
Raised Beds	Giza 171	101.75^{a}	102.50^{ab}	160.75^{bcd}	160.00d^{e}	116.18^{ab}	116.68^{bc}	503.75^{bc}	506.25^{b}
	Misr 3	101.75^{a}	102.50^{ab}	161.75^{b}	161.00^{bcd}	116.05^{abc}	114.60^{gh}	510.00^{b}	523.50^{a}
	Misr 4	102.00^{a}	102.75^{a}	164.00^{a}	162.25^{ab}	117.13^{a}	116.55^{bc}	535.00^{a}	525.75^{a}
	Sakha 95	100.00^{b}	101.75^{abc}	160.00^{bcde}	159.50^{def}	115.30^{bcd}	115.80c^{def}	494.50^{bcd}	493.75b^{c}
	Nubaria 2	99.50^{bc}	101.50^{bcd}	158.25^{ef}	158.25^{f}	113.85^{efg}	114.33^{ghi}	469.75^{e}	477.50^{de}
	Sids 14	100.00^{b}	101.50^{bcd}	159.00^{def}	158.50^{ef}	115.95^{ab}	116.15^{ab}	484.00^{cde}	491.25^{cd}

The CoHort/CoStat software Version 6.31 indicates that distinct letters prove significant variations between treatments at $p \leq 0.05$.

Table 7. Impact of di-interaction between planting techniques and wheat cultivars on No. kernel/spike, 1000 kernel weight, and grain yield during both growing seasons.

Planting technique	Parameters	No. kernel/Spike		1000-kernel weight (g)		Grain yield (t/ha)	
	Season	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**	**2021/2022**	**2022/2023**
Broadcasting	Giza 171	66.75^{ab}	62.75^{ab}	52.70^{fg}	52.80^{bcde}	10.05^{cde}	9.23^{defg}
	Misr 3	63.75^{bcde}	61.50^{ab}	47.13^{e}	47.80^{f}	9.99^{cde}	8.97^{fghi}
	Misr 4	50.25^{ij}	54.75^{ab}	44.81^{ef}	44.31^{gh}	9.39^{e}	8.26^{hi}
	Sakha 95	53.75^{hi}	59.00^{ab}	46.00^{e}	46.38^{fg}	9.44^{cde}	8.79^{ghi}
	Nubaria 2	49.75^{j}	51.25^{b}	41.80^{g}	42.17^{h}	8.27^{f}	8.11^{bcd}
	Sids 14	56.50^{gh}	61.25^{ab}	46.52^{e}	46.62^{fg}	9.78^{cde}	8.94^{fghi}
Drilling	Giza 171	63.50^{bcde}	62.00^{ab}	52.92^{bcd}	50.99^{e}	10.27^{cd}	9.10^{efgh}
	Misr 3	67.00^{ab}	64.00^{a}	55.93^{a}	56.20^{gh}	10.34^{cd}	10.51^{abc}
	Misr 4	63.75^{bcd}	63.50^{a}	54.12^{abcd}	52.40^{cde}	10.32^{cd}	9.69^{cdefg}
	Sakha 95	60.50^{def}	60.25^{ab}	52.70^{cd}	48.01^{f}	9.93^{cde}	9.41^{defg}
	Nubaria 2	58.00^{fg}	53.50^{ab}	47.19^{e}	47.89^{f}	9.31^{e}	8.11^{defg}
	Sids 14	59.50^{fg}	58.00^{ab}	51.92^{d}	51.37^{e}	9.49^{de}	9.00^{fghi}
Raised Beds	Giza 171	64.50^{bc}	62.50^{ab}	55.13^{abc}	55.00^{abc}	10.59^{bc}	10.80^{ab}
	Misr 3	65.50^{ab}	65.00^{a}	55.37^{ab}	55.20^{ab}	11.19^{ab}	11.39^{a}
	Misr 4	68.75^{a}	65.00^{a}	56.43^{a}	56.20^{a}	11.67^{a}	11.45^{a}
	Sakha 95	61.00^{cdef}	60.50^{ab}	52.78^{cd}	54.47^{abcd}	10.14^{cde}	10.05^{bcde}
	Nubaria 2	59.75^{efg}	56.75^{ab}	52.11^{d}	51.79^{de}	9.94^{cde}	9.88^{bcdef}
	Sids 14	60.00^{defg}	60.00^{ab}	52.45^{d}	54.40^{abcd}	9.98^{cde}	9.98^{bcde}

The CoHort/CoStat software Version 6.31 indicates that distinct letters prove significant variations between treatments at $p \leq 0.05$. t/ha: ton/hectare.

Regarding the interaction effect of planting techniques and cultivars on heading, maturity, plant height, and number of spikes/m^2, results in Table 6 showed that, for Misr 4, the maximum values of days to heading (102.00 & 102.75 days), days to maturity (164.00 & 162.25 days), plant height (117.13 & 116.55 cm), and number of spikes/m2 (535.00 & 525.75) were found with the raised beds technique in both seasons. Conversely, in the broadcasting technique, Nubaria 2 wheat cultivar yielded the minimum values for days to heading (95.50 and 98.50 days), days to maturity (152.00 and 153.00 days), plant height (112.75 and 113.50 cm), and number of spikes/m^2 (430.00 and 416.25) in both seasons. The findings in Table 7 demonstrated that the interaction between planting techniques and cultivars had a significant impact on the number of kernels/spike, 1000-kernel weight, and grain yield of wheat. According to our data, the raised beds technique yielded the highest grain yields for Misr 4 (11.67 and 11.45 t/ha) in the two seasons, as well as the highest numbers of kernels/spike (68.75 and 65.00) and 1000-kernel weight (56.43 and 56.20 g).

Conversely, Nubaria2 wheat cultivar, with broadcasting technique, yielded the minimum numbers of kernels/spike (49.75 and 51.25), 1000-kernel weights (41.80 and 42.17g), and grain yields (8.27 and 8.11 t/ha) during both seasons. Hence, the effective use of nutrients, space, and solar radiation under raised beds as opposed to broadcasting could be the cause.

CONCLUSION

It is recommended that raised beds technique was the best planting technique that produced the highest grain yields and yield components for all studied wheat cultivars (with order Misr 4 > Misr 3 > Giza 171 > Sakha 95 > Sids 14 > Nubaria 2), followed by drilling technique (with order Misr 3 > Misr 4 > Giza 171 > Sakha 95 > Sids 14 > Nubaria 2), and broadcasting technique (with order Giza 171 > Misr 3 > Sids 14 > Sakha 95 > Misr 4 > Nubaria 2) under El-Gemmeiza Agricultural Research Station conditions.

REFERENCES

Amal G., M. Ali, M.A. Omar, I.A. Nawar and S.S. El-Tabbakh (2016). Effect of sowing date and nitrogen fertilization level on growth and productivity of some durum and bread wheat varieties. Alex. Sci. Exchange J. 37(4), 541-549.

Chauhdary J.N., U.D. Khan, Shah, S.H.H., Shahid, M.A., and M.Arsalan, (2015). Effect of sowing techniques and seed rates on wheat yield and water productivity. Quality Assurance and Safety of Crops & Foods, 8 : 267-272.

Dong S., X. Zhang, J. Chu, F. Zheng, L. Fei, X. Dai, and M. He (2021). Optimised seeding rate and nitrogen topdressing ratio for simultaneous improvement of grain yield and bread-making quality in bread wheat sown on different dates. J. of Sci. of Food and Agric., 102: 360-369.

Eltaher S., P.S. Baenziger, V. Belamkar, H.A. Emara, A.A. Nower, K.F. Salem, A.M. Alqudah, and A. Sallam, (2021). GWAS revealed effect of genotype environment interactions for grain yield of Nebraska winter wheat. BMC Genomics, 22: 2.

Erenstein, O., M. Jaleta, K.A. Mottaleb, K. Sonder, J. Donovan, and H. Braun (2022). Global trends in wheat production, consumption and trade. Springer International Publishing, 47–66.

Hobbs, P., and M.Morris (2011). Meeting South Asia's Future Food Requirements from Rice-Wheat Cropping System, Priority Issues Facing Researchers in the Post-Green Revolution Era, pp. 1–46, Natural Resource Group, Minneapolis, MN, USA.

Gomaa, M.R., M.EL.M. EL-Badawy, A.A.A. El Hosary, S.R.M., El-Areed, and A. Amer, (2018) Stability analysis for yield and its components in wheat. Egy. J. of Plant Breeding, 22(7), 1535-1550

Khaliq, A., M. Iqbal, and S.M.A. Basra. (1999). Optimisation of seeding densities and nitrogen application in wheat cv. Inqalab-91 under Faisalabad conditions. Inter. J. of Agric. and Bio, 1: 241-243.

Ozberk, C.O., Y. kun, A. lkhan, M. Koten, B. Karli, and J. Ryan (2009). Comparison of bed planting-furrow irrigation with conventional planting-flood irrigation in durum wheat (*Triticum durum* Desf) in Southeastern Turkey. Pak. J. of Biol. Sci., 12: 772-778.

Shailendra, K.S., P.J. George, A.K. Singh, D. Kumar, and A.K. Singh (2021). Productivity and profitability of wheat (*Triticum aestivum* L.) as influenced by planting techniques and nutrient resources under Eastern Uttar Pradesh. Inter. J. of Curr. Microbio. and Appli. Sci., 10: 616-626.

Sikander, K.T., I. Hussain, M. Sohail, N.S Kissana, and S.G. Abbas (2003). Effect of different planting techniques on yield and yield components of wheat. As. J.of Plant Sci., 2: 811-813.

Soomro, U.A. Rahman, M.U. Odhano, E.A. Gul, S., and A.Q Tareen (2009). Effects of planting technique and seed rate on growth and yield of wheat (*Triticum aestivum*). World J. of Agric. Sci., 5 : 159-162.

Sramkova Z., and E.Gregová (2009). Chemical composition and nutritional quality of wheat grain, Acta Chim. Slovaca, 2: 115–138.

Steel, R.G.D., J.H. Torrie, and D.A. Dicky (1997) Principles and Procedures of Statistics, A Biometrical Approach. 3rd Edition, McGraw Hill, Inc. Book Co., New York, 352-358.

Tanveer, S.K., I. Hussain, M. Sohail, N.S. Kissana, and S.G. Abbas (2003). Effect of different planting methods on yield and its components of wheat., Asi. J. Plant Sci., 2(10), 811-813.

تأثير تقنيات الزراعة المختلفة على المحصول ومكوناته لستة أصناف من قمح الخبز

حنان عيسى غانم[١] و عصام الدين معوض علي جبريل[٢]

[١]بقسم بحوث القمح – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – محطة البحوث الزراعية بالإسماعيلية – مصر
[٢]بقسم بحوث القمح – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – محطة البحوث الزراعية بالجميزة – مصر

الملخص

من الضروري إعادة تقييم الممارسات الزراعية بشكل مستمر من أجل تعزيز أداء المحاصيل واستدامة إنتاج قمح الخبز، خاصة في ظل الظروف الوراثية والمناخية المتغيرة. ونتيجة لذلك، تم إجراء دراسة حقلية في محطة البحوث الزراعية بالجميزة ، مركز البحوث الزراعية، مصر، خلال الموسمين الزراعيين المتتاليين، ٢٠٢١-٢٠٢٢، و٢٠٢٢-٢٠٢٣. كان الهدف من هذه الدراسة هو دراسة تأثير ثلاث تقنيات زراعة مختلفة، الزراعة بطريقة النقر، الزراعة بطريقة البدار و الزراعة بطريقة التسطير، على ستة أصناف من قمح الخبز: جيزة ١٧١، مصر ٣، مصر ٤، سخا ٩٥، نوبارية ٢ وسدس ١٤، وفقا للمحصول ومكوناته. وبناء على النتائج فإن صنف القمح مصر ٣ أنتج أعلى إنتاجية حبوب متجاوزا صنف جيزة ١٧١ ومصر ٤ ، سدس ١٤ ، سخا ٩٥ ونوبارية ٢. وعند مقارنة الزراعة بطريقة النقر (٩,٩٤ و ٩,٣٠ طن/هكتار) ، الزراعة بطريقة البدار (٩,٤٩ و٨,٧٢ طن/هكتار) أثبتت الزراعة بطريقة التسطير (١٠,٥٩ و١٠,٥٩ طن/هكتار) أنها أكثر تقنيات الزراعة فعالية. ومن حيث التفاعل، حقق صنف القمح مصر ٤ بزراعته بطريقة التسطير أعلى إنتاجية للحبوب (١١,٦٧ و١١,٤٥ طن/هكتار). ومع ذلك، عند استخدام الزراعة بطريقة البدار ، أنتج صنف القمح نوبارية ٢ أقل إنتاجية للحبوب (٨,٢٧ و ٨,١١ طن/هكتار).