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Effect of sowing dates on productivity and seed quality on some wheat varieties

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ABSTRACT

Optimum sowing dates proposed a suitable atmosphere to achieve an outstanding yield. Field and laboratory experiments were performed to evaluate the effect of three sowing dates, namely, November 15th, November 30th, and December 15th, and four cultivars, i.e., Sakha 95, Sakha 94, Misr 3, and the Chinese cultivar Jinqiang 7, on potential yield and wheat seed quality. A split-plot design with three replicates was used. According to the results, late sowing on December 15 caused a great reduction in flag leaf area, number of days to physiological maturity, plant height, number of spikes/m2, number of grains/spike, spike length, 1000 kernel weight, grain yield, wet and dry gluten, as well as crude protein percentage in both seasons. estimated reduction in grain yield of about 31 and 30% in both seasons, respectively. The Sakha 95 cultivar had a significant difference in plant height, number of spikes per m2, grain yield, and wet and dry gluten compared to other cultivars in both seasons. Jinqiang 7 recorded early days to heading, high leaf area, early maturity, and high crude protein. Also, Sakha 94 recorded a high grain yield, thousand kernel weight, and spike length. Tested cultivars could be descendingly arranged according to their grain yield or feddan as follows: Sakha 95, Sakha 94, Misr 3, and Jinqiang 7. The highest grain yield/feddan resulted from sowing the Sakha 95 cultivar on all sowing dates. Significant wheat seed quality parameters were obtained by Sakha 95 when sowing on November 30 in both seasons. These results indicated that sowing Sakha 95 maximizes wheat crop productivity, while delayed sowing recommended sowing Sakha 94 or Misr 3 maximizes yield and wheat seed quality in this experimental environment.

Key words: Bread wheat; sowing dates; grain quality; grain yield; wheat cultivars; gluten content; protein.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is a major cereal food crop and has special protein characteristics in Egypt. It is effectively cultivated in Egypt in more than 3.1 million feddan with a production of 9.8 million tons (FAOSTAT, 2017). Egypt's average wheat yield is 3 tonnes/feddan. Due to population pressure, the amount of wheat required increases gradually each year, but it still covers less than half of the local consumption (Abd El-Rahman and El-Saidy, 2016). Wheat production can be increased by boosting either planted area or crop yield productivity. Recently, the wheat crop planted area is difficult to expand due to competition with other winter crops and a lack of reclaimed lands and water. There are many factors which are responsible for low average yield of wheat (Silva *et al.,* 2014). Thus, some efforts have been made to increase the yield by the introduction of high-yielding cultivars, balanced fertilizer application and efficient use of irrigation facilities. There are still many factors which are responsible for low average yield. The sowing date is one of the more important factors that determine yield. hence, it is very important to the choice of suitable sowing date and there are enough possibilities to increase wheat yield through developing new high-yielding cultivars and by adopting proper sowing dates. Therefore, the sowing date and cultivars are the most important factor that affects grain quality (El-Kalla *et al.,* 2010; EL-Sayed *et al.* (2018). Wheat sowing dates late usually face high temperatures during its grain filling period which ultimately results in lower crop yield. The higher yield and improvement in various yield components were recorded at normal sowing as compared to late sowing (Sial *et al.,* 2010). Sohail *et al.* (2014) reported that late sowing of wheat reduced grain yield by up to 29%. Wheat yield is quite sensitive to late sowing. Cultivars also showed significant variation regarding grain yield production under both normal and late sowing dates. The chemical composition of mature wheat grain is dominated by high starch content, typically about 72% of the total dry weight and protein content between 6-16%. Starch is only found in the endosperm, but protein is found throughout the grain. So, in order to grow healthy crops, it is necessary to use

optimal sowing dates as well as provide balanced nutrition to the plants. Sowing dates significantly influence the yield and other yield-attributing characteristics. Delay in sowing affects the quality due to the short duration for growth and grain filling (Silva *et al.,* 2014). El Hag (2019) emphasized that sowing dates significantly influence the yield and other yield attributing characteristics and affected the wheat grain quality. Thus, the objective of this study is to determine the yield and wheat grain quality under different sowing dates. Guide us to choose the best cultivar for the most appropriate dates through early or late sowing, reconsidering some agricultural practices, including re-examining agricultural dates and their suitability with current climatic changes, which may be a sustainable agricultural practice to face climate change.

MATERIALS AND METHODS

Experiment site:

The present study was done at Tag Al-Ezz demonstration Farm, Agriculture Research Center, Dakahlia governorate, Egypt during (2020/21 and 2021/22).

Experiment factors:

A. Sowing dates: 15th November, 30th November and 15th December

B. Wheat cultivars: Sakha 95, Sakha 94, Misr 3 and Jinqiang 7 Chinese cultivar

Experimental design:

The experiment was laid out under split plot design with three replications. Sowing dates and wheat cultivars were allocated in main and sub plots, respectively.

Plant material:

The source and pedigree of the studied cultivars in Table 1 were obtained from the Field Crops Research Institute, Wheat Research Department, Agricultural Research Center, ARC. Chinese cultivar Jinqiang 7 was obtained from the Institute of Crop Sciences (ICS), Chinese Academy of Agricultural Sciences (CAAS).

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

Cultivars	Origin	Released year	Pedigree
Sakha 95	Egypt	2013	SKAUZ*2_SRMA-CMBW91MO2694P-0T0PY-7M-010Y -010M-010Y-5
Sakha 94	Egypt	2004	OPATA / RAYON // KAUZ.CMBW 90Y3180-OTOPM-3Y-010M-010M-010Y-10M-015-OY-OAP-0S.
Misr 3	Egypt	2010	Oasis/SKauz//4* Bcn/3/2*pastor
Jinquiang 7	China	2014	Dongfeng701 / Xiaobingmai 33 // Jinqiang 1 / Liaochun 10

Table 2. Chemical and physical properties of the experimental site

Characters	2020/2021	2021/2022
Soulable Cations,meq/lit		
Na^+	11.0	12.00
K^+	0.36	0.30
$Ca^{++}+ Mg^{++}$	6.20	7.20
Soulable Anions, meq/lit		
$Co3^-$	-	-
$Hco3^-$	2.60	2.20
Cl^-	13.00	14.00
So_4	1.35	1.30
PH	7.80	7.97
EC ds/m	1.80	2.00
O.M.%	1.10	1.20
N (ppm) available	9.00	8.00
P (ppm) available	28.00	30.00
Physical Properties:		
Sand %	11.5	12.6
Silt %	32.9	35.0
Clay %	55.4	52.3
Texture class	Clay	Clay

Agricultural practices:

Wheat was preceded by rice crop. The experimental sites were prepared as recommended of ministry of agriculture and reclaimed land. As a recommended package both of phosphorus and nitrogen fertilizer were

applied. The other practices for growing wheat were applied. The analyses of the experimental soil are show in Table 2. The air temperature during both growing seasons are show in Table 3. The wheat plot area was 10.5 m^2, 3.5 m in long, 3 m in wide and 20 cm apart. Wheat were sown at rate of 400 grain m^{-2}

Table 3. Meteorological data of experimental site during 2020/2021 and 2021/2022 growing wheat seasons

	Air Temp °C				Relative humidity	
	2020/2021		2021/2022		2020/2021	2021/2022
	Min	Max	Min	Max	Average	Average
Nov.	15.52	25.54	16.47	28.68	64.94	66.14
Dec.	11.71	23.46	10.85	20.28	65.02	71.63
Jan.	9.95	22.05	6.96	17.60	67.07	71.22
Feb.	9.73	22.24	7.97	19.89	68.2	70.13
Mar.	10.30	23.36	8.73	21.39	65.64	59.13
April.	12.08	29.84	13.47	31.533	56.22	51.87
May.	17.86	37.14	16.79	33.87	46.37	51.22

Sources: Climate Change Information Center & Renewable Energy-CCICRE

Studied traits:

Heading date: It was calculated based on the number of days from sowing up to 50% of flowering for the experimental units by field observation.

Flag leaf area: It was estimated using the ruler for ten plants taken randomly from each unit at the end of the flowering stage when the leaf area reaches its maximum limits and according to the law: length of flag leaf × width × 0.95

Maturity date: Were counted from the date of sowing to physiological maturity of the plant.

Plant height: was measured from the base of the plant to the top of ear head of main tiller at maturity.

Number of spikes m^{-2}: The number of spikes after reaching full maturity for plants was calculated from two middle lines and converted on square meter

Number of kernels $spike^{-1}$: It was calculated from the average number of grain for ten spike after severing these ears manually

Spike length (cm): Was measured from the base of spike to the top at the time of maturity

Thousand kernel weight (g): 1000 grain were counted taken randomly and then each sample was weighed using the sensitive scale

Grain yield (ton/fed.): The grain yield of the group of harvested plants was estimated from the two middle lines (40 x 200 cm) after manual threshing of the plants from each experimental unit, and after isolating the straw from the grain, it was weighed and the grain yield was extracted, ton/fed

Crude protein: The grain from each treatment in three replicates were dried at 105 °C and grinned into fine powder, estimated according to the improved Kjldahl method by (Liu *et al.,* 2015). and multiplying the crude nitrogen by 5.7 cofactor

Wet and dry gluten: Wet and dry gluten were determined in fine air-dried grain by hand-washing the meal until starch was not detected in washing water, then dried and weighed. Wet and dry gluten were calculated as percentage of air dry grains

Statistical analysis:

All data were statistically analyzed as a Randomized Complete Block Design (RCBD) with split plot arrangements with three replications. Means were compared using the least significant differences at 0.05 level. Statistical analysis was performed using analysis of variance technique (ANOVA) by means of Statistix 8.0 programme computer software Tulsa, USA).

RESULTS

Sowing dates:

Data listed in Tables 4 and 5 revealed that late sowing had negative effects on dates, number of days to heading, the flag leaf area, number of days to physiological maturity, plant height, number of spikes m-2, number of kernels per spike, spike length, 1000 kernel weight, grain yield t/fed, wet gluten, and dry gluten, while crude protein was increased during both seasons. The highest values of yield and yield parameters were produced when wheat was sow on November 15, November 30, and December 15. The lowest values of number of days to heading (69 and 68.3 days) were produced from sowing on December 15 in both seasons, compared with the other sowing dates. Also, the lowest values of the flag leaf area (39.8 and 36.9) were in late sowing on December 15th. The lowest values of days to maturity (123.7 and 128.8) were produced on December 15 in the first and second seasons, respectively, and plant height (102.7 and 103.5 cm) in both

seasons were obtained from sowing on December 15. The tallest plant heights (114.3 and 115.8 cm) were produced from sowing on November 30 in the first and second seasons, respectively. The lowest values of number of spikes m-2 (231.3 and 222.4) were produced from sowing on December 15th in both seasons, respectively, compared with the other sowing dates.

Wheat cultivars performance:

With respect to cultivar performance, it was found that the four tested cultivars significantly differed in earliness, flag leaf, days to maturity, plant height, number of spikes m-2, number of kernels per spike, spike length, 1000 kernel weight, grain yield t/fed, wet gluten, and dry gluten, while crude protein was increased during both seasons. Jinqiang-7 was the earliest heading and maturity cultivar compared with the other cultivars. These results were 62.0 and 61.3 for days to heading during the first and second seasons, respectively. The tallest plants (116 and 115 cm) were Sakha 95 and Sakha 94, respectively. while the shorter plants (105.8 cm) were recorded by Jinqiang 7 cultivar (Table 4). Data presented in Table 5 showed that Sakha 95 surpassed other cultivars in 1000 kernel weight, grain yield, and grain quality, followed by Sakha 94, Misr 3, and Jinqiang 7 in two seasons.

Table 4. Effect of sowing dates and wheat cultivars on heading date, flag leaf, maturity, plant height, number of spikes m^{-2} during 2021 and 2022 seasons

Treatments	Heading (days)		Flag leaf (cm^2)		Days to maturity		Plant height(cm)		Spikes m^{-2}		No of kernels/spike	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
A.Sowing dates												
15 Nov.	87.8	88.0	46.5	47.1	148	151	113	115	325	320	68	68
30 Nov.	78.9	79.3	42.2	43.8	135	136	114	115	250	255	64	65
15 Dec.	69.0	68.3	39.8	36.9	123	128	102	103	231	222	60	64
F test	**	**	*	**	**	**	**	**	**	**	**	**
LSD 0.05	0.79	0.55	5.21	2.55	0.32	0.99	0.65	1.17	11.7	19.1	2.46	1.238
B.Cultivars												
Sakha 95	85.7	84.8	40.0	43.33	140.3	140.4	115.4	116.0	290.2	278.0	63	65
Sakha 94	84.0	84.7	38.3	39.6	141	142	112	114	266	264	65	66
Misr 3	82.6	83.3	42.8	36.5	141	141	107	108	257	261	66	67
Jinqiang 7	62.0	61.3	50.1	50.7	120	131	105	107	261	262	63	64
F test	**	**	*	**	**	**	**	**	**	NS	NS	**
LSD 0.05	0.57	0.40	7.94	1.76	0.285	0.33	1.22	2.00	13.57	-	-	1.634
C.Interactions												
A× B	**	**	*	**	**	**	**	**	**	*	**	NS

Interactions effects:

respecting the interaction effects between the sowing dates and wheat cultivars on the number of days to heading, flag leaf area, days to physiological maturity, plant height, and number of spikes m-2 in both seasons (Table 6). Table 7 revealed a great reduction in grain yield of about 31 and 30% in both seasons, respectively. It can also be observed that there was a significant increase due to the interaction between the two factors (Table 7). At the three sowing dates, cultivar Sakha 95 recorded the highest grain yield as compared with other cultivars, followed by Sakha 94, Misr 3, and Jinqiang 7. Table 7 showed that the interaction between sowing dates and wheat cultivars had a highly significant effect on crude protein and wet and dry gluten during both seasons. The highest values were produced by the Sakha 95 cultivar sown on November 30, followed by Sakha 94 on November 30, but cultivar Misr 3 achieved the highest wet and dry gluten grain wheat quality at sowing date November 30 with the Sakha-95 wheat cultivar. Jinqiang 7 gave the lowest values for wet and dry gluten at late sowing on December 15^{th}.

Table 5. Effect of sowing dates and wheat cultivars on spike length, thousand kernel weight, grain yield, crude protein, wet and dry gluten in both seasons

Treatments	Spike length (cm)		1000 kernel weight (gm)		Grain yield t/fed.		crude protein %		Wet gluten		Dry gluten	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
A.Sowing dates												
15 Nov.	12.3	12.6	40.3	44.30	4.449	3.957	13.52	14.09	7.77	7.96	5.75	6.12
30 Nov.	11.9	12.3	39.75	39.66	3.633	3.371	15.42	16.04	8.71	9.36	6.23	7.05
15 Dec.	11.9	12.2	35.1	34.83	3.058	2.764	13.5	14.05	3.07	3.41	2.41	2.78
F test	NS	NS	**	*	**	**	**	**	**	**	**	**
LSD 0.05	-	-	1.40	0.99	0.20	0.15	0.30	0.24	0.39	0.12	0.12	0.31
B.Cultivars												
Sakha 95	11.8	12.1	39.7	41.22	4.149	3.932	13.99	14.47	11.01	11.50	7.72	8.77
Sakha 94	12.3	12.6	38.5	39.8	4.27	3.63	14.2	14.8	2.57	2.97	1.89	2.42
Misr 3	12.3	12.5	38.1	38.00	3.315	2.993	13.79	14.45	8.73	9.20	6.67	6.98
Jinqiang 7	12.0	12.2	37.11	37.66	3.112	2.898	14.62	15.19	3.74	3.96	2.90	3.09
F test	NS	NS	**	**	**	**	**	**	**	**	**	**
LSD 0.05	-	-	1.19	1.01	0.20	0.12	0.24	0.28	0.18	0.19	0.19	0.29
C.Interactions												
A×B	*	**	**	*	**	**	*	**	**	**	**	**

Table 6. Heading date, flag leaf, days to maturity, plant height and number of spike m^{-2} as affected by the interaction between sowing dates and wheat cultivar

Sowing dates	Cultivars	Heading date		Flag leaf (cm2)		Days to maturity		Plant height (cm)		Spikes/m^{-2}	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
15 Nov.	Sakha 95	96	97	40.0	40.3	152.0	153.3	116.0	115.7	320.3	321.6
	Sakha 94	96	97	51.9	53.3	155.0	158.0	118.0	121.0	344.6	335.3
	Misr 3	93	93	49.1	48.3	155.0	156.0	115.0	117.3	321.3	324.0
	Jinqiang 7	87	84	45.0	46.3	133.0	140.0	104.0	107.0	314.0	300.0
30 Nov.	Sakha 95	82	84	32.1	34.3	140.0	138.0	121.0	120.6	274.3	276.3
	Sakha 94	80	84	27.8	26.0	140.0	138.0	115.0	117.3	236.6	237.6
	Misr 3	74	73	42.2	31.3	140.0	138.0	105.3	108.3	234.0	238.6
	Jinqiang 7	74	73	57.0	56.0	120.0	130.0	116.0	117.0	256.0	268.6
15 Dec.	Sakha 95	74	73	47.8	55.3	129.0	130.0	109.3	111.7	276.0	235.3
	Sakha 94	66	65	35.3	39.6	129.0	130.0	103.3	104.3	217.6	219.0
	Misr 3	66	65	37.1	30.0	129.0	130.0	100.6	101.0	217.0	219.3
	Jinqiang 7	54	54	48.3	50.0	108.0	125.0	97.3	97.0	214.3	216.0
F test		**	**	**	**	**	**	**	**	**	*
LSD 0.05		0.99	0.70	13.75	3.05	0.49	0.57	2.12	3.18	23.51	28.64

Table 7. 1000 kernel weight, grain yield t/fed, wet gluten, dry gluten, and crude protein as affected by the interaction between sowing dates and wheat cultivar

Sowing dates	Cultivars	1000 kernel weight g		Grain yield t/fed		Crude protein %		Wet gluten		Dry gluten	
		2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
15 Nov.	Sakha 95	42.00	44.33	5.5820	4.6475	13.260	13.867	7.797	7.893	5.900	6.373
	Sakha 94	40.1	43.00	5.0376	4.4382	13.567	14.193	2.473	3.093	1.683	2.620
	Misr 3	40.3	43.00	4.1439	3.9067	13.043	13.507	17.873	18.117	13.007	13.513
	Jinqiang 7	39.33	42.30	3.0356	2.8358	14.207	14.823	2.937	2.717	2.397	1.960
30 Nov.	Sakha 95	41.81	42.00	3.8457	3.5024	15.507	15.890	19.070	19.703	12.287	13.827
	Sakha 94	41.33	41.66	3.8378	3.4357	15.440	15.107	3.750	4.003	2.950	3.320
	Misr 3	39.33	37.00	3.8856	3.7873	15.200	15.207	6.017	6.743	5.110	5.503
	Jinqiang 7	36.33	37.66	3.0647	2.7602	15.520	15.967	6.000	6.977	4.563	5.547
15 Dec.	Sakha 95	36.33	37.00	3.6662	3.8556	13.213	13.653	6.167	6.893	4.963	6.117
	Sakha 94	33.3	35.00	3.4123	2.8138	13.597	14.133	1.493	1.803	1.047	1.327
	Misr 3	35.66	34.00	2.7390	2.3134	13.143	13.647	2.307	2.740	1.890	1.920
	Jinqiang 7	34.667	33.33	2.4164	2.0735	14.140	14.773	2.293	2.190	1.747	1.763
F test		**	**	**	**	*	**	**	**	**	**
LSD 0.05		2.068	1.754	0.3486	0.2135	0.432	0.491	0.315	0.3346	0.3377	0.5185

DISCUSSIONS

The obtained results showed that the main cause of the decrease in wheat crop growth is the sowing date. Results of the current study reflected the negative effect of delay sowing on heading time, flag leaf area, plant height, physiological maturity, number of spikes/m^2, number of kernel/spike, 1000 kernel weight, and wheat seed quality**.** Abd El-Rahman and El-Saidy (2016) and EL-Sayed *et al.* (2018) reported that a decrease in plant height on late sowing was due to a shorter growing period. High temperatures damage photosynthetic membranes, causing chlorophyll loss, lowering the photosynthetic rate of leaves, and increasing embryo abortion. Early-sown crops may have benefited from better environmental conditions, resulting in tallest plants. Also, less number of grains/spike in delay planting was due to low production of photosynthates due to shorter growing time (Shahzad *et al.,* 2002). El-Areed *et al.* (2017) revealed that the effects of photoperiod before and after flowering and found that they were different, as a result of their date, the growth period of wheat was largely extended by shorter (Photoperiod before flowering), particularly the number of days from tillering to jointing and from jointing to heading. They also found that the period from flowering to maturity was extended shorter (Photoperiod after flowering). Longer photoperiod leads to high light energy input and longer time of photosynthesis provided high photosynthetic and boost yield. Differences in plant height and number of grains/spikes among cultivars might be attributed to their genetic diversity (Ahmad, 1991; Haider, 2004). The early sowing resulted in better development of the grains due to a longer growing period (Shahzad *et al.,* 2002), who had also reported decreased 1000-grain weight with delay in sowing. Lower grain yield in late sowing was mainly due to lower germination count/m^2, less number of tillers/m^2, less number of grains/spike and lower 1000-grain weight. These results are by those of Aslam *et al.* **(**2003) and Sattar *et al.* **(**2015) who agree with planting at inappropriate time may cause a drastic reduction in wheat yield. They also reported that late sowing results in less grain yield per hectare. Hossain *et al* **(**2012**)** reported a 58% yield penalty in late-planted wheat (25th Dec) than wheat planted on 10th Nov due to severe cutback in entire yield-related traits. November, 30th might be improved photosynthesis rate and assimilates as a result of optimum thermal accumulative and sunshine duration. The variation among wheat cultivars might be attributed to their genetic diversity. Confirming results in this respect were cited by Shahzad *et al.,* (2007). The grain protein content of wheat is a critical factor in bread making and the high protein content of wheat is associated with good bread making characteristics. The protein content of wheat was mainly dependent upon genotype (Tayyar and Gul, 2008), which was reflected in this study too with differences in gluten content among different varieties.

CONCLUSION

In this study, the yield and quality of different wheat cultivars were significantly affected by delaying sowing dates. It could be concluded that the Sakha 95 cultivar could be selected to obtain plants with high yield and wheat grain quality when planted under all sowing dates. In general, better grain yield and quality were obtained when Sakha 95, Sakha 94, and Misr 3 were sown from November 15 to November 30.

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تأثُّير مواعُيد الزراعة على إنتاجية وجودة تقاوى بعض أصناف القمح

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يعتمد تحديد مواعيد الزراعة المثلى علي الظروف الجوية المناسبة لتحقيق أقصي محصول. لذلك تم إجراء تجارب حقلية ومعملية بمحطة البحوث الزراعية بتاج العز ومعمل وحدة بحوث تكنولوجيا البذور بالمنصورة خلال موسمي 2022/2021 2021/2020 لدراسة تأثير ثلاثة مواعيد زراعة في 15 نوفمبر و 30 نوفمبر و 15 ديسمبر علي انتاجية محصول وجودة تقاوي أربعة أصناف من قمح الخبز هي سخا 95 ، سخا 94 ، مصر 3 والصنف الصيني Jinqiang-7. تم استخدام تصميم القطع المنشقة بثلاث مكررات حيث احتوت القطع الرئيسية على معاملات مواعيد الزراعة وتضمنت القطع المنشقة على أصناف القمح الأربعة. كانت أهم النتائج المتحصل عليها كما يلي: أظهرت النتائج أن انخفاض مساحة ورقة العلم، عدد أيام النضج الفسيولوجي، ارتفاع النبات، عدد السنابل لكل متر مربع، عدد الحبوب لكل سنبلة، طول السنبلة، وزن 1000 حبة، محصول الحبوب، نسبة الجلوتين الرطب والجاف و % للبروتين الخام في الموسمين عند الزراعة في 15 ديسمبر و يقدر الانخفاض في محصول الحبوب بحوالي 31٪ و 30٪ في كلا الموسمين على التوالي. اختلفت أصناف القمح بشكل كبير في جميع الصفات تحت الدراسة حيث سجل الصنف سخا 95 تفوق معنويا في صفات ارتفاع النبات، عدد السنابل لكل متر مربع، محصول الحبوب و النسبة المئوية للجلوتين الرطب والجاف عند المقارنة بالأصناف الأخرى في كلا الموسمين. بينما سجل الصنف الصيني Jinqiang-7 تبكيرا في الطرد وزيادة مساحة ورقة العلم، النضج المبكر وارتفاع نسبة البروتين بينما سجل صنف سخا 94 معدل أعلي لمحصول الحبوب للفدان , وزن ألف حبة و طول السنبلة. ويمكن ترتيب الأصناف حسب إنتاجية الحبوب للفدان على النحو التالي: سخا 95 ، سخا 94 ، مصر 3 و Jinqiang-7. أظهرت النتائج أن تأثير التفاعل بين مواعيد الزراعة والاصناف كان معنويا حيث سجل صنف سخا 95 أعلي معدل لمحصول الحبوب لجميع مواعيد الزراعة، كما أعطي أعلى قيم لجودة الحبوب عند الزراعة في 30 نوفمبر في كلا الموسمين. **لذا توصي الدراسة** بزراعة الصنف سخا 95 بهدف تعظيم إنتاجية وحدة المساحة وفي حالة التأخير في موعد الزراعة يوصي بزراعة الصنف سخا 94 أو مصر 3 لتعظيم وحدة المساحة من حبوب القمح كما وجودة تحت ظروف محافظة الدقهلية.

الكلمات المفتاحية: قمح الخبز ،مواعيد الزراعة، جودة الحبوب، محصول الحبوب، أصناف القمح، محتوي الجلوتين والبروتين.