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EFFECT OF PLANTING DATE ON PHENOLOGY, PRODUCTIVITY AND FLOUR QUALITY OF SOME WHEAT CULTIVARS.

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ABSTRACT

A field experiment was conducted to determine the effect of two planting dates ; early (25th Oct.) and late (15th Dec.) in addition to the control planted at 20th Nov. on phenology, growth, yield (yield components and yield quality) of four bread wheat (*Triticum aestivum* L.) cultivars ; Sakha 93, Sakha 94 ,Gemmeiza 9 and Giza 168 at Sakha Agricultural Research Station. In general, the obtained data showed that, the requirement of days and Growing degree days (GDD) to attain different phenological stages (seedling, booting, heading, anthesis and maturity) decreased with delay in sowing date . Also, planting on the control date (20th Nov.) surpassed the other sowing dates in all yield studied parameters and flour quality. However , late sowing date (15th Dec.) caused an increase in most technological properties (protein , wet and dry gluten) of the yielded grains .

Keywords : Planting date , bread wheat cultivars, phenology, productivity , flour quality .

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop as the main stable food for the Egyptian people and as a major source of straw for animal feeding (Doggett, 1988).

The cultivated area reached about 2.6 million feddan wheat in the winter season of 2007 and 2008, produced an average of 18.1 ardab/fed. of the grain production averaged about 220 tons in the same season. However , total wheat consumption has increased drastically due to overall population growth of about 2.5 % per year. Egypt, therefore imports about 45 percent of wheat requirements. This reflects the size of the problem and the needed efforts to increase wheat production (FAO STAT, 2008).

One of the important ideas developed over the past several years is that plant development can be described and determined quantitatively by following the development of leaves , tillers and roots. This development under field conditions can be described using a unit called a cumulative "growing degree days". In this respect, Seleiman *et al*.(2011) determined the effect of different sowing dates i.e. 1st November,15th November, 1st December and 15th December on growth, grain filling traits and yield and its components as well as grain quality and rheological properties of bread wheat (*Triticum aestivum* L.) cultivar Gemmeiza 9 . The results revealed that sowing date on 15th November surpassed the other sowing dates in all of yield studied parameters, grain filling rate, flour percentage. However, sowing

date on 15th December caused an increase in most of technological properties (protein as well as wet and dry gluten percentage). Similar results were, more or less obtained by Khokhar *et al.*(2010) and El-Kalla *et al.*(2010).

Twenty wheat (*Triticum aestivum* L.) genotypes were evaluated at different sowing dates (15 October, 1 November and 15 November) to test the effect of sowing date and genotypes on grain yield, stalk yield and harvest index. The results revealed that no significant differences in the genotypes or the interaction were found between genotypes and sowing date. However, planting date had a highly significant effect on grain yield, stalk yield and harvest index. Planting on the onset of November resulted in the highest grain yield (2.48 t/ha), stalk yield (2.203 t/ha) and harvest index (23.27%) (Yassin and Kittani 2009).

Also, Ouda *et al.* (2005) studied the effect of six sowing dates (1st Oct. 15th Oct. 1st Nov., 15th Nov. , 1st Dec. and 30th Dec.) on anthesis date, physiological maturity date, grain number/m^2, grains number/spike, grain, straw and biological yield. Results indicated that, sowing wheat in Oct. reduced grain yield by about 10% . Whereas, delay of sowing date till the end of December decreased yield by about 16% . The highest grain yield was obtained when wheat was sown on the first of December followed by 15th of November, compared with other sowing dates. The same results were obtained by Rahman *et al.(*2009) .

MATERIALS AND METHODS

The present study was carried out at the experimental farm of Sakha Agricultural Research Station, Agricultural Research Center (A.R.C.), Egypt, during two successive seasons of 2009/2010 and 2010/2011, to study the effects of two planting dates ; early (25th Oct.) and late (15th Dec.) in addition to the control of the recommended date (20th Nov.) on phenology, growth, yield, yield components and yield quality of four wheat **(***Triticum aestivum* L.) cultivars ; Sakha 93, Sakha 94, Gemmeiza 9 and Giza 168 .

Experiments and treatments:

The experiment was conducted using a split plot design in four replicates. The main plots were devoted for planting dates (20th Nov. 25th Oct., and 15th Dec.).The sub plots were allocated with the used six wheat cultivars . The area of each plot was 10.5m^2 (3 m width and 3.5 m length) and contains 21 rows with 15 cm apart. Plots were separated by 60 cm allays. The sowing was done using hand drill machine in both seasons at the rate of 50 kg grains/fed. The soil was irrigated after the sowing immediately. Nitrogen fertilizer (75 kg N/fed.) in the form of ammonium nitrate (33.5%N) was supplied in two equal split doses, the first dose 21days after sowing and the second was 21 days later (i.e. 42 days after sowing).

Phosphorus fertilizer in the form of calcium super phosphate (15.5 kg P_2O_5/fed.) was applied during seedbed preparation. Other agricultural practices were applied during both growing seasons as recommended. The daily meteorological data were collected from Ministry of Agriculture ,

Agricultural Research Center (ARC), Central Management of Agriculture Guideline (Meteorological Station in Sakha district) as follow :

Table A. : Mean of temperature degree (ºC) , relative humidity (R.H.%) and rain fall(mm/day), at the experimental sites during 2009/2010 and 2010/2011 seasons.

Months.	Temperature(ºC)				R.H.(%)				Rain (mm/day)	
	S1		S2		S1		S2		S1	S2
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Aver.	Aver.
October	30.3	16.2	30.7	17.0	75.5	48.0	72.0	45.0	0.00	0.00
November	26.00	10.5	26.8	11.0	77.7	50.0	82.0	54.2	0.00	0.00
December	22.2	8.8	22.0	8.3	76.5	52	85.0	55.7	0.00	0.29
January	21.5	7.8	20.3	5.8	83.5	55.0	84.2	54.0	0.00	0.6
February	24.5	9.4	23.4	7.4	84.2	55.7	87.0	54.0	1.2	0.8
March	24.3	10.00	21.8	6.8	76.3	44.0	86.3	49.5	0.00	0.4
April	28.2	11.00	26.5	10.0	96.00	40.7	85.0	47.7	0.00	0.00
May	32.3	15.2	30.5	14.4	99.00	45.6	98.2	43.2	0.00	0.00

S1: 2009/2010 S2: 2010/2011

Studied Characters and growth analysis :-

Representative plant samples from 20 cm were taken randomly from each plot at age of 50, 65 and 80 days after sowing , which representive to tillering , heading & anthesis stages respectively. The days of the previous stages were recorded when 50% of the plants in all the replications reached the respective stages.

Growing degree days (GDD) :was calculated according to the following formulae : **(GDD) =** $\sum [(T_{max} + T_{min})/2 - T_b]$ (T_b= base temperature=10˚c) as recommended by Rajput (1980).

Phenothermal index (PTI) equal to GDD ÷ Growth days according to Rajput (1980).

Relative water content (RWC) was measured by the method of Weatherly (1950) and its modification by Weatherly and Barrs (1962) as adopted, by El-Sharkawy and Salama (1973) by the following equation : RWC(%) =(FW-DW / TW-DW) X 100

Determination of saturation water deficit (SWD %):

Saturation water deficit was calculated according to Weatherly and Barrs (1962) from the following equation: **(SWD %) =** 100 – RWC %

Yield and its components:

At harvest time ,one square meter was taken randomly from each plot to determine the following traits: Plant height at harvest time, number of spikes/m^2, grain index, grain yield (ton/fed.), straw yield (ton/fed.), biological yield and harvest index (Beadle,1993).

Quantitative and technological traits

Flour quality : was carried out according to the official methods of A.A.C.C.(1983).

250 g of wheat grains were taken and washed from impurities and any weeds associated with it. The grains were wetted even absorbed amount of water and then dried about 6 hours under normal room condition, the

grains were weighted and adjusted the humidity that doesn't exceed 16-18 % . Then, the grains grinded and the weight of output flour were taken.

flour No.1: by using sieves with narrow holes, the weight of output flour was taken

Flour No. 1 % = (weight of flour No.1 / total flour weight) x 100

flour No.2 : by using sieves with large holes then the weight of output flour was taken

Flour No. 2 % = (weight of flour No.2 / total flour weight)x100

from the previous two equations the percentage of bran could be calculated :

Bran % =100- (weight of flour No.1+ weight of flour No.2)

Wet gluten : was determined by mixing about 25 g of grain flour with 17 ml of tap water , the paste was left for an hour and then washed under weak current of tap water, then weighted and calculated by the following equation :

$$\text{Wet gluten \%} = \frac{\textbf{weight of wet gluten}}{\textbf{sample weight}} \times 100$$

Dry gluten: wet gluten was dried for 24 hours under 105°c and then weighted , dry gluten was calculated by the following equation:

$$\text{Dry gluten \%} = \frac{\textbf{weight of dry gluten}}{\textbf{sample weight}} \times 100$$

Estimation of Protein content :

The method of protein extraction was adopted by Scarponi and Perucci(1986), whereas protein content was determined spectrophotometrically according to the method adopted by Bradford(1976).

Determination of carbohydrate content : The method used for estimation of polysaccharides in the present study was that of Thayermanavan and Sadasivam (1984).

The full data of the different treated groups were statistically analysed and comparison among means was carried out by computer programming methods (statgraphic- vers-4-2- Display ANOVA), as described by Snedecor and Cochran (1982).

RESULTS AND DISCUSSION

Changes in phenology (days from sowing)

It is cleared from Table (1) that, the number of days required to attain different phenological stages (seedling, booting, heading, anthesis and maturity) at the early planting date increased significantly as compared to the control values except with Sakha 93 and Gemmeiza 9cvs. which increased non-significantly at seedling stage.

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On the other hand, the late planting date showed significant decrease in number of days required to attain the previous stages. The highest number of days required to attain the previous stages was found in Gemmeiza 9 sown in the early date . In this respect, Haider *et al*.(2003) studied the effect of sowing dates (early and late) on phenology and accumulated heat units of four cultivars of bread wheat. They showed that, the late sown plants had significantly shorter phenological stages and lower growing degree days than early sown plants in all cultivars . Moreover, Ghosh and Patra (2004) observed the effect of sowing dates (20 Nov., 4 Dec., 18 Dec. and 1 Jan.) on four wheat cultivars and indicated that, delay in sowing from 20 Nov. to 1Jan.shortened the life cycle by 26.7 days. In addition, Rahman *et al.(*2009) determined the effect of two planting dates optimum (17 Nov.) and late (21 Dec.) on ten wheat cultivars , and they indicated that under optimum sown condition, differences among the genotypes were found to be significant in respect to days required to anthesis, maturity and flag leaf emergence. The same results were more or less observed by Soleymani *et al*.(2011) on barley (*Hordeum vulgare* L.) .

Changes in growing degree days (GDD)

Perusal of the data in Table (1) showed that, as compared with control date (20th Nov.) GDD requirement to attain the different phenological stages significantly increased and decreased at the early and late date of planting respectively at the five growth stages ; seedling, booting, heading , anthesis and maturity during the two growing seasons. In general, the lowest (GDD) requirement was observed during seedling stage and the highest GDD requirement was observed at maturity stage with all cultivars, specially Gemmeiza 9 which needed the highest GDD at all the phenological stages . These results are in harmony with Khichar and Niwas(2005) who studied the impact of two sowing dates (20 Nov. and 20 Dec.) on growing degree days and observed that, wheat sown on 20 Nov. consumed more growing degree days than those sown on 20 Dec. Also, Singh *et al.*(2008) observed the influence of different planting dates sown on 5 November , 20 November and 5 December to assess the heat unit requirement for phenophases of wheat genotypes, and they found that the wheat sown on 5 and 20 November recorded higher accumulated growing degree days at all the phenophases over sowing performed on 5 December, which had higher yield of wheat. These results are in agreement with the results of Qasim *et al*.(2008).

Changes in Phenothermal Index (PTI)

As shown in Table (1) Phenothermal index from sowing to seedling, booting, heading , anthesis and maturity of the used four wheat cultivars showed significant increase under early planting date in the all cultivars as compared to the control date. On the other hand, the late sowing date caused a noticeable decreases in PTI at all stages except with Sakha 93 at anthesis and maturity stages in all the used cultivars which showed significant increases in PTI . These results are in harmony with Sikder (2009) who studied accumulated heat unit and phenology of wheat cultivars under normal (30 Nov.) and late (30 Dec.) sowing dates and recorded that, at the earlier phenological stages phenothermal indices decreased with late sowing compared to normal sowing but increased at the latter stages.

Changes in relative water content (RWC%) and saturation water deficit(SWD%)

As compared to the control values, both early and late dates showed a noticeable significant decrease in RWC% at the growth stages; tillering, heading and anthesis . In comparison to the control cultivar (Sakha 93), Gemmeiza 9cv. tended to contain the highest RWC% when sown in the control planting date (20th Nov.) followed by Sakha 94 and Giza 168. Also, both early and late sowing dates led to significant increases in SWD% at tillering , heading and anthesis stages . The highest SWD% was recorded by Sakha 93 in case of late planting date at the three growth stages, in relation to control values (Table 2).

Table 2 : Relative water content (RWC%) and saturation water deficit (SWD%)of different wheat cultivars as influenced by planting date during the growing season 2009/2010.

Cultivars	Parameters	RWC%			SWD%		
	Stages	Tillering	Heading	Anthesis	Tillering	Heading	Anthesis
							Date
Sakha 93	Control	88.75	87.13	83.64	11.25	12.87	16.36
	Early	86.75*	82.16*	79.25*	13.25*	17.84*	20.75*
	Late	86.66*	80.96*	78.36*	13.34*	19.04*	21.64*
LSD at P≤ 0.05		0.06	0.22	0.03	0.06	0.22	0.23
Sakha 94	Control	90.57	89.34	84.84	9.43	10.66	15.16
	Early	89.69*	83.00*	80.54*	10.31*	17.00*	19.46*
	Late	88.36*	82.36*	79.35*	11.64*	17.64*	20.65*
LSD at P≤ 0.05		0.04	0.03	0.20	0.04	0.03	0.06
Gem.9	Control	93.51	91.27	86.38	6.49	8.73	13.62
	Early	90.66*	83.93*	81.96*	9.34*	16.07*	18.04*
	Late	89.87*	84.81*	82.74*	10.13*	15.19*	17.26*
LSD at P≤ 0.05		0.10	0.84	0.16	0.10	0.84	0.35
Giza 168	Control	89.46	88.31	84.14	10.54	11.69	15.86
	Early	88.39*	82.88*	79.86*	11.61*	17.12*	20.14*
	Late	87.44*	81.47*	79.54*	12.56*	16.86*	20.46*
LSD at P≤ 0.05		0.34	0.20	0.05	0.34	0.20	0.05

Changes in yield attributes

Perusal of the data in Table (3) cleared that, significant differences was observed in response to the two sowing dates as compared to the control date, whereas the control date tended to produce highest values in yield attributes (plant height, number of spikes/m^2 , grain index ,yield , straw and biological yield/fed.) . Concerning wheat cultivars, the results revealed that, significant differences were observed between the used cultivars as compared to the control cultivar (Sakha 93) . Thus, Gemmeiza 9 gave the highest values of the previous characters . These results are partially in line with that obtained by El-Kalla *et al.*(2010) who studied the effect of three sowing dates (20th Nov., 5th Dec. and 20th Dec.) on yield and some yield contributing characters, and stated that, sowing dates had significant effect on plant height , number of spikes/m^2, spike length, 1000-grain weight , number of grains/spike and grain yield. Sowing on 20th Nov. resulted in

highest grain yield and its contributing. Sowing on 5th Dec. caused reduction in grain yield and its contributing estimated by 22-23% in both seasons. Sowing on 20th Dec. caused reduction in grain yield by about 25-44% in both seasons.

Table 3 :Yield and yield components of different four wheat cultivars as influenced by planting date during the growing season 2009/2010.

Cultivars	Parameters / Date	Plant height(cm)	No. of Spikes/m^2	1000-grain wt(g)	Grain yield(t/fed.)	Straw yield (t/fed.)	Biological yield(t/fed.)	Harvest index (%)
Sakha 93	Control	99.40	375.3	47.25	2.75	3.86	6.61	41.70
	Early	97.33*	340.0*	44.21*	2.06*	3.06*	5.12*	40.36*
	Late	87.00*	369.3*	44.25*	2.52*	3.38*	5.90*	40.20*
LSD at P≤ 0.05		1.17	10.25	0.04	0.05	0.33	0.25	0.35
Sakha 94	Control	103.67	387.7	49.86	2.84	3.98	6.82	41.57
	Early	100.77*	359.7*	45.63*	2.13*	3.37*	5.50*	38.86*
	Late	93.00*	380.3*	45.65*	2.56*	3.74*	6.30*	40.89*
LSD at P≤ 0.05		1.22	6.21	0.03	0.42	0.21	0.39	0.27
Gem.9	Control	109.57	394.7	51.45	3.02	4.46	7.48	40.39
	Early	106.80*	374.7*	47.33*	2.26*	3.63*	5.89*	38.50*
	Late	98.53*	381.3*	46.60*	2.62*	3.95*	6.57*	39.92*
LSD at P≤ 0.05		1.77	6.04	1.52	0.04	0.36	0.39	0.22
Giza 168	Control	101.73	384.7	47.66	2.76	3.87	6.63	41.67
	Early	100.27	363.3*	44.73*	2.06*	3.26*	5.32*	38.79*
	Late	91.40	380.0	44.65*	2.53*	3.64*	6.17*	40.63*
LSD at P≤ 0.05		1.12	3.40	0.04	0.14	0.15	0.37	0.26

Recently, El-Hag (2012) studied the effect of three planting dates (20th Nov., 10th Dec. and 1st Jan.) on yield and its components and grain quality of six bread wheat cultivars ; Gemmeiza 11, Sids 12, Sids 13, Shandaweel 1, Sakha 93, and Giza 168 and two durum wheat genotypes ; Bani Sweef 4, and Bani Sweef 5 . She reported that, sowing in a normal recommended time (20th Nov.) recorded the highest plant height, numbers of spikes/m^2, number of grains/spike, number of spikelets/spike, spike length, biological , grain and straw yields/fed.

Changes in harvest index

Data presented in Table (3) showed that, growing wheat plants in early or late planting date led to significant decrease in harvest index with the four cultivars as compared to the control values . In this respect,(Yassin and Kittani 2009) studied the effect of twenty wheat (*Triticum aestivum* L.) genotypes planted at different sowing dates (15 October, 1 November and 15 November) to test the effect of sowing dates and genotypes on grain yield and harvest index. The results revealed that, either genotypes or the interaction between genotypes and sowing dates had a highly significant effect on grain yield and harvest index.

Changes in flour No.1 , flour No.2 and bran %

The results in Table (4) indicated that , in relation to the control values, flour No.1 and flour No.2 from the yielded grains decreased significantly where bran % increased significantly when wheat plants sown on either early or late planting date with the used cultivars . The highest percentage of flour No. 1&2 was obtained by Gemmeiza 9 grown in the control date (20th Nov.) These results are in agreement with those of Seleiman *et al*.(2011) who determined the effect of different sowing dates i.e. 1st November, 15th November, 1st December and 15th December on grain quality . The results revealed that, sowing date on 15th November surpassed the other sowing dates in flour percentage . Also, Sato *et al*.(2003) reported the effect of sowing dates (early and late) to obtain high flour quality of wheat and found that, late sowing increased protein content due to less starch accumulation but decreased grain yield owing to less grains per spike and lodging, but early sowing decreased gluten index and maximum viscosity.

Table 4: Quantitative and technological trait of four wheat cultivars as influenced by planting date during the growing season 2009/2010

Cultiv-ars	Parameters / Date	Flour No.1(%)	Flour No.2(%)	Bran(%)	Wet gluten	Dry gluten	Crude protein	Grain carbohydrate
Sakha 93	Control	70.48	11.20	18.31	26.22	11.65	11.71	72.85
	Early	68.47*	10.33*	21.20*	23.73*	10.63*	10.79*	73.67*
	Late	66.36*	9.44*	24.20*	27.35*	12.45*	11.97*	71.50*
LSD at P≤ 0.05		0.07	0.05	0.10	0.27	0.05	0.04	0.09
Sakha 94	Control	71.59	12.53	15.88	29.68	12.65	13.97	67.48
	Early	70.19*	11.53*	18.28*	26.64*	11.44*	12.31*	68.33*
	Late	67.49*	10.62*	21.89*	30.95*	14.05*	14.16*	66.20*
LSD at P≤ 0.05		0.02	0.02	0.03	0.22	0.08	0.06	0.64
Gem.9	Control	73.74	14.55	11.71	27.92	12.34	12.82	70.88
	Early	72.34*	13.31*	14.36*	25.33*	11.15*	11.61*	71.15*
	Late	69.43*	12.39*	18.18*	29.08*	13.63*	13.07*	69.88*
LSD at P≤ 0.05		0.01	0.04	0.03	0.26	0.06	0.10	0.26
Giza 168	Control	70.86	11.37	17.78	28.42	12.44	13.20	67.75
	Early	68.73*	10.63*	20.64*	26.46*	11.34*	12.05*	68.37*
	Late	66.74*	9.75*	23.52*	29.28*	12.95*	13.86*	66.29*
LSD at P≤ 0.05		0.04	0.06	0.04	0.16	0.05	0.11	0.07

Changes in wet and dry gluten

Results in Table (4) showed that, in relation to control values, different cultivars of wheat plants grown in the early date showed significant decrease in wet and dry gluten in the two growing seasons . While, planting in late date led to significant increases in wet as well as dry gluten in all cultivars especially with Sakha 94cv. These results are in line with those of Seleiman *et al*.(2011) who stated that, different sowing dates i.e. 1st November,15th November, 1st December and 15th December led to change in wet and dry gluten percentage . Thus, sowing date on 15th December recorded the highest wet and dry gluten content.

Changes in total protein content

As compared with control values, the data presented in Table (4) cleared that, early and late planting dates induced a marked decrease and increase in crude protein content, respectively in the yielded grains of the used four cultivars . The highest value of protein content was observed by Sakha 94 planted in the late date (15th Dec.) followed by Giza 168 and Gemmeiza 9,as compared to the control cultivar (Sakha 93). These results are in agreements with the results of Xuexia *et al.*(2008) who detected the effect of four different planting dates (25 Sep., 2 Oct., 9 Oct., and 16 Oct.) in protein content and they reported that, high quality of wheat increases with the delay of sowing date and decreases with other dates. The same results were more or less obtained by Seleiman *et al*.(2011) .

Changes in carbohydrate content

As shown from the tabulated data (Table 4) the early and late planting dates showed a noticeable increase and decrease in carbohydrate content respectively, as compared with the control values during the two studied seasons of the four wheat cultivars. These results are partially in line with Mostafa *et al*.(2010) who reported that, delaying the date of sowing for one month in wheat plants induced a marked reduction in carbohydrate percentage as a result of exposing the wheat plants to the natural high temperature of environment during different developmental processes as compared with those sown at normal date

REFERENCES

A.A.C.C, (1983) : American association of cereal chemists. Approved Methods of the A.A.C.C., 8th ed. The Association : St. Paul, MN.

Beadle, C.L. (1993) : Growth analysis. In: Photosynthesis and production in a changing environment. A field and laboratory manual (eds.DC Hall, J M O Scurlock, H R Bolhar-Nordenkampf, R C Leegod, S P Long), Champman and Hall, London.pp 36-46.

Bradford,M.M.(1976): A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein dye-binding.Anal. Biochem., 72 : 248-251.

Doggett,H.(1988) : Sorghum 2nd ed. London, New York: Longman; published by Wiley.

El-Hag, Dalia,A.A.(2012) : Effect pf planting date and nitrogen level on yield and quality of bread and durum wheat. Ph. D. Thesis, Fac. Agric., Kafr El-Sheikh Univ., Egypt.

El-Kalla,S.E. ; Leillah, A.A. ; El-Emery, M.I. and Kishk, A.M.S. (2010) : Performance of some wheat (*Triticum aestivum* L.) cultivars under late sowing in newly reclaimed soils. J. Plant Production, Mansoura Univ., Vol. 1(5):689-697.

El-Sharkawy,H.M. and Salama, F.M.(1973): Response of olive and almond orchards to partial irrigation under dry farming practices in semi arid regions.Π- Plant soil water relations in olive during the growing season. Plant and Soil, 41:13-32.

FAO STAT,(2008) : Food and Agriculture Organization statistical data.

Ghosh,M. and Patra, B.C. (2004) : Effect of sowing date on heat unit and yield of wheat varieties at Raghunathpur. Indian J. , 48(1/2) : 137-139.

Haider, S.A. ; Alam, M.Z. ; Alam, M.F. and Paul, N.K. (2003) : Influence of different sowing dates on phenology and accumulated heat units in wheat .J. of Biol. Sci., Vol. 3(10): 932-939.

Khichar,M.L. and Niwas,R.(2005): Impact of sowing environment on growing degree days, phenology, growth and yield of wheat. J. Agron., 21(2):122-124.

Khokhar,Z. ; Hussain,I. ; Khokhar,B. and Sohail,M.(2010) : Effect of planting dates on yield of wheat genotypes in Sindh. Pakistan J. Agric.Res.23(3-4): 103-107.

Mostafa, H.A.M. ; Hassanein, R.A. ; Khalil, S.I. ; El-Khawas, S.A. ; El-Bassiouny, H.M.S. and Abd El-Monem, A.A. (2010): Effect of Arginine or Putrescine on Growth, Yield and Yield Components of Late Sowing Wheat. J. of Applied Sci., Res., 6(2): 177-183, 2010.

Ouda, S.A. ; El- Marsafawy, S.M. ; El-Kholy, M.A. and Gaballah, M.S. (2005) : Stimulating the effect of water stress and different sowing dates on wheat production in South Delta. J . of Appl. Sci., Res.1(3):268-276.

Qasim, M. ; Faridullah, M.Q. and Alam,M.(2008) : Dates effect on yield and yield components of different wheat varieties. J. Agric. Res., 6(2):135-140.

Rajput, R.P.(1980) : Response of soyabean crop to climatic and soil environments. Ph.D. Thesis, Lari ,New Delhi, India.

Rahman, M.M.; Hossain,A. ; Hakim, M.A. and Shah, M.M.R.(2009) :Performance of wheat genotypes under optimum and late sowing condition. Ind. J. Sustain. Crop Prod.4(6) : 34-39.

Sato,H. ; Uchimura,Y. and Matsue,Y.(2003): Flour characteristics of wheat influenced by sowing time. J. Crop Sci., 72(1): 43-49.

Scarponi,L. and Perucci,M.(1986) : The effect of a number of S-triazines on the activity of maize delta aminolivulinate dehydratase. Agrochimica,30:36-44.

Seleiman, M. ; M. Ibrahim ; Abdel-Aal, S. and Zahran, G.(2011) : Effect of sowing dates on productivity ,technological and rheological characteristics of bread wheat . J. Agro.Crop Sci. 2(1): 1- 6.

Sikder,S. (2009): Accumulated heat unit and phenology of wheat cultivars as influenced by late sowing heat stress condition. J. Agric. Rural DEV.7(1&2) 57-64.

Singh,A.K. ; Tripathi,P. and Shabbd,A.(2008): Heat unit requirements for phenophases of wheat genotypes as influenced by sowing dates. J. Agron., Vol. 10(2):209-212.

Snedecor,G.W. and Cochran, W.G. (1982) : Statistical Methods 6th Ed., Iowa state college press. Ams. Iowa, U.S.A.

Soleymani, A. ; Shahrajabian, M.H. and Naranjani, L. (2011) : Determination of the suitable planting date and plant density for different cultivars of barley (*Hordeum vulgare* L.) in Fars. African J. of Plant Sci., Vol. 5(3), pp. 284-286.

Thayermanavan, V. and Sadasivam,S.(1984) : Qual Plant Foods. Hum. Nuttr., 34,253:257. Quoted from Biochemical Methods.(Sadasivam, S. and A. Manikam, eds) 2 nd ed., 11-12. New Ag. Inter. Limit. Publ. New Delhi, India.

Weatherly,P.E.(1950) : Studies on the water relations of the cotton plants. I. The field measurement of water deficits in leaves. New Phytol., 49:81-97.

Weatherly,P.E. and Barrs,C.(1962) : Are-examination of relative turgidity technique for estimating water deficits in leaves. Aust. J. Bio. Sci., 15:413-428.

Xuexia,P. ; Jiaoai,W. ; Jiayou,D. and Dingyi,Z.(2008) : Characteristics of grain filling and flag leaf photosynthesis of high quality wheat under different planting dates. Chinese J. of Eco-Agric., 16(1):121-128.

Yassin, M. I. and Kittani, H.F. (2009): A multivariate analysis of the effects of planting dates on productivity of some wheat genotypes. J. Sci. Tech., Vol. 10 (2) : 46-59.

تأثير ميعاد الزراعة على تطور مراحل وإنتاجية وجودة بعض أصناف القمح

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أجريت تجربة حقلية بمحطة البحوث الزراعية بسخا – مركز البحوث الزراعية وذلك لدراسة تأثير الزراعة المبكرة (٢٥ أكتوبر) والمتأخرة (١٥ ديسمبر) بالإضافة إلى الميعاد الموصى به (٢٠ نوفمبر) على أربعة أصناف من قمح الخبز وهى (سخا ٩٣ ، سخا ٩٤ ، جميزة ٩ ، جيزة ١٦٨).

ويمكن تلخيص أهم النتائج فيما يلى :

متطلبات النبات من درجات الحرارة المتجمعة للوصول إلى المراحل العمريه المختلفة تقل مع التأخير فى ميعاد الزراعة حيث سجل الصنف جميزة ٩ أعلى قيمة لدرجات الحرارة المتجمعة عند زراعته فى ميعاد الزراعة المبكر، بينما سجل الصنف سخا ٩٣ أقل قيمة لدرجات الحرارة المتجمعة وذلك عند زراعته فى ميعاد الزراعة المتأخر .

أدت الزراعة فى الميعاد الموصى به إلى زيادة معنوية فى المحصول وروافده (طول النبات عند الحصاد، عدد السنابل/م^2 ، طول السنبلة، وزن ١٠٠٠ حبة ، محصول الحبوب ، محصول القش ، المحصول البيولوجى، دليل الحصاد) خاصة مع الصنف جميزة ٩.

تفوق الصنف جميزة ٩ فى نسبة استخلاص الدقيق نمرة١ ، نمرة ٢ من الحبوب الناتجة عند زراعة هذا الصنف فى الميعاد الموصى به ، بينما سجل الصنف سخا ٩٣ أعلى نسبة للنخالة. وقد أعطى الصنف سخا ٩٤ أعلى كمية للجلوتين الرطب والجاف وكذلك المحتوى البروتينى للحبوب الناتجة عند زراعته فى ميعاد الزراعة المتأخرة بينما سجل الصنف سخا ٩٣ أعلى نسبة للكربوهيدرات الكلية وذلك عند زراعته فى ميعاد الزراعة المبكرة.

قام بتحكيم البحث

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Table 1: Days from sowing (DFS), Growing degree days (GDD) and Phenothermal index (PTI) of four wheat cultivars as influenced by planting date .

Cultiv-ars	Stages	Seedling			Booting			Heading			Anthesis			Maturity		
	Parameters	DFS	GDD	PTI	DFS	GDD	PTI	DFS	GDD	PTI	DFS	GDD	PTI	DFS	GDD	PTI
																Date
Sakha 93	Control	18.3	133.66	7.30	72.7	424.58	5.84	78.7	448.53	5.70	85.7	470.41	5.49	132.8	814.28	6.13
	Early	19.0	183.41*	9.65*	78.3*	553.51*	7.07*	84.7*	584.82*	6.90*	91.0*	606.16*	6.66*	141.0*	968.86*	6.87*
	Late	16.7*	92.83*	5.55*	58.7*	282.66*	4.82*	66.0*	337.61*	5.12*	73.0*	408.70*	5.60*	116.0*	778.95*	6.71*
LSD at P≤ 0.05		1.29	11.33	0.21	3.34	15.23	0.13	2.56	7.22	0.25	0.93	9.88	0.08	3.78	17.25	0.10
Sakha 94	Control	6.95	141.00	6.95	76.3	444.86	5.83	85.7	474.61	5.54	91.0	553.58	6.08	140.3	870.11	6.20
	Early	9.44*	195.33*	9.44*	88.0*	599.91*	6.82*	94.0*	624.33*	6.64*	101.0*	659.60*	6.53*	151.7*	1013.36*	6.68*
	Late	5.67*	107.66*	5.67*	69.7*	312.45*	4.92*	77.0*	418.53*	5.44*	84.0*	477.86*	5.69*	128.3*	847.70*	6.61*
LSD at P≤ 0.05		0.20	16.75	0.20	0.26	7.97	0.12	2.38	9.05	0.08	1.30	13.22	0.31	1.77	8.12	0.13
Gem.9	Control	20.7	142.75	6.90	82.7	457.11	5.53	88.7	501.70	5.66	95.7	582.33	6.08	144.3	900.36	6.24
	Early	21.3	200.16*	9.40*	89.7*	605.16*	6.75*	95.7*	633.55*	6.62*	102.0*	662.35*	6.45*	155.0*	1036.78*	6.69*
	Late	19.3*	108.00*	5.60*	72.7*	342.86*	4.30*	78.7*	424.53*	5.39*	85.0*	488.95*	5.75*	132.3*	887.61*	6.71*
LSD at P≤ 0.05		0.76	11.16	0.21	1.31	27.22	0.12	1.60	5.33	0.25	0.76	9.22	0.30	0.76	11.56	0.12
Giza 168	Control	19.7	137.08	6.96	74.7	435.21	5.82	80.7	451.20	5.59	86.7	509.25	5.87	134.3	863.78	6.43
	Early	20.4*	194.32*	9.52*	82.3*	576.41*	6.84*	88.3*	600.00*	6.69*	95.3*	628.46*	6.59*	149.0*	994.18*	6.67*
	Late	18.7*	107.00*	5.72*	62.3*	306.95*	4.66*	69.0*	369.78*	5.36*	75.0*	418.53*	5.58*	123.0*	811.36*	6.60*
LSD at P≤ 0.05		0.76	14.23	0.22	4.69	12.52	0.13	4.78	24.12	0.23	1.52	24.98	0.03	4.40	19.56	0.14