J. Agric. Sci. Mansoura Univ., 30 (6): 2969 - 2980, 2005

STATISTICL STUDIES FOR EVALUATION SOME VARIETIES OF WHEAT

Mohamed, Samia. G. A.; S. M. G. Salama and A. M. Abd El- Aziz
Central Laboratory for Experimental Design and Statistical Analysis. Agriculture Research Center, Giza, Egypt.

ABSTRECT

Two field experiments were conducted at the Agricultural Research Station, Dakhlia Governorate of Tag El-Ezz during the two successive seasons of 2002/2003 and 2003/2004. Eight genotypes of wheat namely Sakha 8, Sakha 61, Sakha 69, Sakha 92, Giza 163, Giza 164, Gemmiza 3 and Gemmiza 7.The treatments were arranged in randomized complete blocks design with three replications. Analysis of variance, simple correlation coefficient, predication equations of full model and stepwise multiple regression and principle.

The most important results can be summarized as follows:

Results indicate that wheat varieties exhibited significant differences for grain yield per spike and grain yield per plant as well as all studied yield attributes.

Gemmiza 7, Sakha 92 and Gemmiza 3 had the highest grain yield per spike and number of grains/spiks. However, Gemmiza 7, Gemmiza 3 and Sakha 61 gave heavier weight of 1000 grain. Moreover, Gemmiza 3, Sakha 92 and Sakha 69 could be secured higher grain yield per plant.

Highly significant and positive correlation coefficients were found between grain yield per spike and each of all characters except for plant height (cm), extrusion length (cm), number of spikes and number of tillers. Grain yield per plant (g) was found to be highly significant and positive correlated with all characters except plant height (cm), extrusion length (cm), number of sipkelts and number of grains/ spike model regression including all factors ranged from 93.17% to 96.61% and 98.74% to 99.62%, while stepwise regression ranged from 80.15% to 94.02% and 81% to 96.09% with grain yield per spike and grain yield per plant, respectively. It found that the most important macro climatic factors and variables affecting i.e. grain yield per spike and grain yield per plant were spike length (X6), number of spikes, weight of 1000-grains (g) (X13), number of grain per spike (X10), soil mean temperature at depth of 20 cm from planting to end of anthesis (Mtepso4) and relative humidity from planting to end of grain filling (RH5%) and growing degree-days from planting to the end of booting (GDD3).

The principle component analysis grouped the studied variables in the component accounted for 100% of the total variation with grain yield per spikes. The result showed that two major components, which altogether accounted for 99.711% of total variation. The first component included to flag leaf length, flag leaf area, number of spikes, number of tillers and number of grain per plant. The second component included the remainder characters.

INTRODUCTION

Wheat is the major winter cereal crop in Egypt as well as in the world. Grain yield is the integrated effect of many variables that affect planted growth throughout the seasons. Hence, it is essential to detect characters having the greatest influence on yield and their relative contributions to variation in yield.

Mohamed (1999), found that Sids 3, Giza 167, and Sids 1 had the highest spike yield. Also Giza 167, Gemmezia 5 and Sids 3 gave heavier 1000- grain weight. However Giza 164, Gemmeiza 5 and Gemmeiza 1 loaded with the much number of kernels/ spike. Moreover, Sids 3, Sids 1 and Giza 167 could be secured higher grain yield. Spike yield, 1000- kernel weight and number of kernels/ spike are the most prominent effects on grain yield variation with R^2 value being 94%.

Leaf area influence both plant growth and final yield by determining the percentage of solar radiation by plant. Flag leaf area was significantly correlated with grain weight per plant, and 1000-grain weight Talwer and chadrappa (1983).

Halso and Weir (1974), as well as Angus and Moncur (1977) stated that little research has been conducted on the combination of temperature. They also reported that the higher temperature shortened duration of the vegetative and reproductive phases of development.

Nass and Reisert (1975), concluded that the length of grain-filling period was not important in determining yield in 10 wheat cultivars, while Ritchie (1980), found that the degree day was much more variable between Cultivars. Than the duration of reproductive phases. Moreover, Wiegand and Cueller (1981), found that high temperature during grain-filling in wheat usually reduces average kernel weight. The duration of grain filling period was also reduced Sofield *et.al.,* (1977), as well as growth rates with a net effect of lower final kernel weight

In Giza, Egypt, on studying wheat crop needs at each phonological stage in relation to microclimatic elements El-Shaer (1985), and Rady (1986), found that Giza 157 cv., required an average of 7.5, 85.3, 62.0, and 155.0 days and 95, 810, 919 and 1825 growing degree days for the four phonological stages, emergence, vegetative growth, reproductive phases and emergence to maturity, respectively. Morsi (1989), stated that the effective variable for the phonological stage from emergence to 50% heading was the growing degree days.

Temperature affect the duration of crop growth Wilhelm and McMaster, (1995) and consequently influence yield McMaster (1996). Number of tillers is usually decreased when wheat plants were exposed to high temperature Friend (1965).

The classical approach for prediction is the linear regression Draper and Smith, (1987), Which is employed in identifying the most important yield attributed that are used as components of predictions equations. Different equations can be developed to predict yield under different phonological stage.

El-Rasses and Rayes (1992) and El-Sergany Dawlat (1992) reported that stepwise multiple linear regression was more efficient than the full model regression. It is used to determine the best predictive equation for yield.

Sowlem *et.al*, (2004) used historical weather data to develop different prediction equation to predicate wheat in Delta Region.

The aim of this work is to find out wheat variable needs of growing degree days (GDD), Relative humidity (RH%) and soil mean temperature at depth of 5, 10 and 20 cm, and the number of days during each phonological stage and the whole life cycle in relation to microclimatic factors under some modification in soil temperature and the effect of these variables on seed yield and its components.

MATERIALS AND METHODS

The experiments of the present studies were carried out at Tag El-Ezz Research Station, Dakhlia Governorate in 2002/2003 and 2003/2004 seasons using eight genotypes of wheat (Triticum aestivm L.). These genotypes were Sakha 8, Sakha 61, Sakha 69, Sakha 92, Giza 163, Giza 164, Gemmiza 3 and Gemmiza 7 and their pedigree are showing in Table 1.

Table (1): Description of the studied parental wheat genotypes.

Serial	Genotype	Pedigree
1	Sakha 8	Indus/ Northeno "S"
2	Sakha 61	Inia/ RL 422// 7C/ Y r"S"
3	Sakha 69	Inia/ RL 4220// 7C/ Y r"S"
4	Sakha 92	Napo 63/ Inia 66// Wern "S"
5	Giza 163	T aestivum / Bon// Cno / 7C
6	Giza 164	Kvz / Buha "S" // kal / Bb
7	Gemmiza 3	Bb / 7C* z // Y 50 $_E$ / kal * 3x SAKHA 8 / 4 / PRv w w 15 /3/ B J "S" // on * 3 / BoN
8	Gemmiza 7	CMH 74 A. 630 / sx // seri 82 / 3 / Agent

The eight genotype are sown on November 5 ^{the} 2002/2003 and on November 10 ^{the} 2003/2004. A randomized complete block design with three replicates was used. Each plot consisted of 6 rows. The row length was 2 meter, row to row spacing was 20 cm and plant to plant distance was 10 cm, plot (2.4 m^2). The normal agricultural practices for wheat production were performed during the growing seasons. Before collecting data, 10 competitive individual plants for each of parental genotypes were labeled in each replicate to study. Furthermore, five growth stages (from planting to harvest, from planting to the end of tillering, from planting to the end of booting, from planting to the end of anthesis and from planting to the end of grain filling) were studied. Tillering occurs about 45-50 days after planting and booting occurs about 80-85 days after planting. Anthesis takes about 5-10 days and grain filling period occurs about 85-95 days after planting. Air mean temperature, Relative humidity (RH%) and soil mean temperature at depth of 5, 10 and 20 cm were summed for each growth stage and throughout the growing season. Data were collected on the following characters.

1- Flag leaf length.
2- Flag leaf width.
3- Flag leaf area.
4- plant height (cm).
5- Extrusion length.
6- Spike length (cm).
7- Number of spikes/plant
8- Number of tillers/plant.
9- Number of sipkeles/ spike.
10- Number of grains/ spike.
11- Grain yield/ spike (g).
12- Number of grains/ plant.
13- Weight of 1000 grains (g).
14- Grain yield/ plant (g).

Climatic factors recorded.

Maximum and minimum temperature were recorded during growing season to estimate Growing Degree Days (GDD) in the following growth stages as defined by Jones and Kiniry (1986).

1- From planting to harvest.
2- From planting to the end of tillering
3- From planting to the end of booting
4- From planting to the end of anthesis
5- from planting to the end of grain filling

Growing degree-days (GDD) were calculated as the average of daily mean temperature (maximum and minimum temperature) minus, threshold temperature for each growth stage:

$$\text{GDD} = \frac{T\max + T\min}{2} - \text{Tb}$$

Where:

Tmax: maximum temperture.

Tmin: minimum temperature.

Tb: the base temperature below which no appreciable growth occurs i. e. 4.8 ° C zero point of growth after (Peterson, 1965).

Statistical procedures:

1-Data were statistical analyzed according to Snedecor and Cocharan (1981) and treatment means were compared by using least significant difference test (L.S.D) at 0.05% level of significance.

2- Simple correlation coefficients were done according to Steel and Torrie (1987). Simple correlation coefficient between wheat yields and its components were calculated to determine the strength of the relationship between them. Furthermore, simple correlation coefficient between wheat yield attributes and weather parameters were also calculated.

3- Multiple linear regression analysis is a technique utilized to fit a line through a set of observation, and test how a single dependent variable is affected by the value of one or more independent variables. As a result, a prediction equation is developed and used to predict the performance of that dependent variables when values of these independent variables vary. Multiple linear regression analysis calculates two parameters, coefficient of determination (R^2) and stander error of estimates (SE%). In order to obtain a precise prediction, R^2 should be near to one and SE% should be near to zero. R^2 is the amount of variability due to all independent variables, and SE% is a measurement of precision i. e. closeness of predicted and observed yield to each other Draper and Smith, (1987)

4- Principal component analysis: Pearson (1901), Hotelling (1933) and Berenson *et al* (1983). It was supposed that we have (n) subjects responses to a questionnaire containing (p) items. A basic purpose of principal components is to account for the total variation of these n subjects in p dimensional space by forming a new set of orthogonal and uncorrected composite varieties. Thus, each member of the new set of varieties is a linear combination of the original set of measurements. The linear combination will be generated in such a manner that each successive composite variate will account for a smaller portion of total variation. Hence, the first composite (i.e., principal component) will have the largest variance, the second will have a variance smaller than the first but larger than the third, and so on. In general, the number of new composite variables that will be needed to account adequately for the total variation is less than p.

RESULTS AND DISCUSSION

1- Analysis of variance.

Varieties effect:

As shown in Table (2) results indicated that wheat genotypes differed significantly with respect to flag leaf area, extrusion length and number of grain per spike in the first season, whereas in the second season genotypes were found to be significant different for flag leaf length, flag leaf area, spike length, number of spikelets/spike, grain yield per spike (g), weight of 1000 grains (g) and grain yield /plant (g).

According to the results reported in Table (2) based on combined analysis of variance for two seasons it was found to be significant for flag leaf length, width flag leaf, area flag leaf, plant height (cm), extrusion length, pike length (cm), number of grains/spike, grain yield/ spike (gm), number of grain/ plant, weight of 1000 grains (g) and grain yield /plant (g), except for number of tillers and number of spikes where it was non-significant.

Data in Table (2) indicate clearly that grain yield per spike, 1000-grain weight and grain yield per plant were non significantly affected by tested genotypes in first season. Gemmiza 3 had the heaviest grain yield per spike followed Sakha 92 and Gemmiza 7 in the second season and combined, while Gemmiza 7 had heaviest weight of 1000 grain followed by Gemmiza 3 and Sakha 61 in the second season and combined. Accordingly, results of the present work show that Gemmiza 7, Gemmiza 3 and Sakha 92 had the highest number of grain per spike. Results in Table (2) demonstrate that Gemmiza 3 gave the heaviest grain yield per plant compared with the different genotypes followed by Sakha 92 and Sakha 69.

Simple correlation coefficients:

Simple correlation coefficients between grain yield per spike, grain yield per plant and their attributes are shown in Table (3). Results indicated that there was highly significant positive correlation between grain yield per spike (g) and each of flag leaf length, flag leaf width, flag leaf area, spike length, number of spikes/plant, number of grains per spike, weight of 1000 grains (g) and grain yield /plant (g). Grain yield per plant (g) was found to be significantly and positively correlated with each of flag leaf length, flag leaf width, flag leaf area, spike length, number of tillers/plant, number of spikes/plant, grain yield per spike, number of grains per spike and weight of 1000 grains (g). These results were agreement with Talwer and chadrappa (1983). Spagnoletti and Qualset (1990) and Salama *et. al* (2000).

Table (2): Effect of mean varieties on yield and its related characters in wheat during 2002/2003 and 2003/2004 seasons.

Characters	Mean genotypes									
	Season	Sakha 8	Sakha 61	Sakha 69	Sakha 92	Giza 163	Giza 164	Gemmi za 3	Gemmi za 7	L.S.D
Flag leaf length	S1	29.77	30.43	29.97	36.93	33.83	31.40	32.30	34.57	Ns
	S2	30.60	32.47	29.87	38.50	30.80	29.67	33.40	32.27	4.21
	Comb	30.18	31.45	29.92	37.72	32.32	30.53	32.85	33.42	3.58
Flag leaf width	S1	2.06	2.19	2.09	2.40	2.22	2.08	2.39	2.40	Ns
	S2	2.07	2.11	2.21	2.57	2.15	2.15	2.28	2.27	Ns
	Comb	2.06	2.15	2.15	2.48	2.19	2.12	2.34	2.33	0.27
Flag leaf area	S1	45.30	54.23	45.79	64.27	54.74	49.40	51.68	54.87	9.12
	S2	46.30	49.57	40.39	67.93	47.94	43.87	55.63	53.27	11.52
	Comb	45.80	51.90	43.09	66.10	51.34	46.63	53.66	54.07	7.14
Plant height (cm)	S1	132.6	128.40	121.60	124.4	125.00	122.93	129.07	121.07	Ns
	S2	133.53	130.00	122.70	127.87	125.53	129.47	130.27	125.9	Ns
	Comb	133.07	129.20	122.15	126.13	125.27	126.20	129.67	123.48	5.87
Extrusion length	S1	21.33	22.63	18.03	17.73	20.30	19.90	20.67	18.97	1.92
	S2	19.63	21.97	16.40	18.73	20.53	20.83	19.33	21.67	ns
	Comb	20.48	22.30	17.22	18.32	20.42	20.37	20.00	20.32	2.48
Spike length (cm)	S1	11.10	11.57	12.07	13.03	11.53	12.27	12.93	13.47	Ns
	S2	10.90	12.03	11.93	13.03	12.20	12.30	13.33	13.90	1.75
	Comb	11.00	11.80	12.00	13.03	11.87	12.28	13.13	13.68	1.17
Number of spikes/plant	S1	7.53	8.53	8.07	8.00	8.47	6.67	7.33	6.53	Ns
	S2	6.33	8.20	8.70	9.13	7.07	6.13	9.33	6.97	Ns
	Comb	6.93	8.37	8.38	8.57	7.77	6.40	8.33	6.75	Ns
Number of tillers/plant	S1	9.21	9.93	920	9.73	9.60	7.13	8.00	8.40	Ns
	S2	9.00	9.27	10.50	10.77	7.87	6.60	9.33	7.37	Ns
	Comb	9.10	9.60	9.85	10.25	8.73	6.87	8.67	7.88	Ns
Number of spikeles/ spike	S1	23.73	23.00	23.07	23.33	24.33	22.93	24.40	24.40	Ns
	S2	22.87	23.60	23.47	23.80	23.20	24.00	25.13	25.00	1.09
	Comb	23.30	23.30	23.27	23.57	24.27	23.47	24.77	24.70	1.14
Number of grains/spike	S1	61.87	67.33	67.87	76.73	72.27	75.40	77.93	83.73	10.24
	S2	57.87	68.80	70.37	77.07	73.60	74.73	76.33	78.17	ns
	Comb	59.87	68.07	69.12	76.90	72.93	75.07	77.13	80.95	7.78
Grain yield/ spike(gm)	S1	2.25	2.83	2.67	3.17	2.73	2.83	3.30	3.17	Ns
	S2	1.87	2.69	3.04	3.03	2.63	2.77	2.43	3.57	0.89
	Comb	2.06	2.76	2.85	3.13	2.68	2.80	2.37	3.37	0.51
Number of grains/ plant	S1	414.80	453.13	467.93	504.93	513.73	368.13	424.80	407.87	Ns
	S2	318.73	412.80	521.80	550.20	405.47	336.93	539.27	399.47	Ns
	Comb	366.77	437.47	494.87	527.57	459.60	352.53	482.03	403.67	106.82
Weight of 1000 grains (g)	S1	31.40	37.30	35.93	35.37	32.70	31.50	36.97	36.83	Ns
	S2	26.57	35.70	35.60	35.37	30.83	33.73	38.37	40.07	5.30
	Comb	28.98	36.50	35.77	35.37	31.77	32.62	37.67	38.45	1.99
Grain yield/ plant (g)	S1	12.97	17.03	16.43	17.90	16.90	12.70	16.87	12.90	Ns
	S2	8.87	16.03	18.53	19.50	12.80	11.47	20.77	10.73	5.32
	Comb	10.92	16.53	17.47	18.70	14.85	12.08	18.82	14.32	3.32

Stepwise multiple linear regression:

Prediction equation and additive component of multiple coefficient of determination, R^2, over the two seasons for both full model and stepwise analysis are given in Tables (4 and 5). Selecting prediction equations were done according to coefficient of determination, and standard error of estimate, SE%. Five phonological stages were shown in Tables (4 and 5).

Table (3);: Simple correlation coefficient between grain yield/spike and grain yield/plant of wheat and their yield attributes over both seasons.

Characters	(X1)	(X2)	(X3)	(X4)	(X5)	(X6)	(X7)	(X8)	(X9)	(X10)	(X11)	(X12)	(X13)	(X14)
Flag leaf length (X1)	1.00													
Width flag leaf (X2)	0.85**	1.00												
Area flag leaf (X3)	0.93**	0.80**	1.00											
Plant height (cm) (X4)	-.012	-0.03	0.07	1.00										
Extrusion length(X5)	-.0.27	-.030	-.0.07	0.41	1.00									
Spike length (cm) (X6)	0.55**	0.70**	0.52**	-0.15	-0.15	1.00								
Number of spikes (X7)	0.37	0.33	0.40	0.006	-0.24	0.04	1.00							
Number of tillers (X8)	0.38	0.30	0.35	-0.02	-0.39	-0.23	0.81**	1.00						
Number sipkeles (X9)	0.24	0.40	0.20	0.06	0.17	0.64**	0.08	-0.25	1.00					
Number of grains/spike (X10)	0.55**	0.70**	0.48**	-0.30	-0.16	0.89**	-0.007	-0.28	0.59**	1.00				
Weight of grains/spike (gm) (X11)	0.44*	0.70**	0.44*	-.20	-0.14	0.90**	0.29	-0.07	0.62**	0.85**	1.00			
Number of grain/ plant (X12)	0.75**	0.55**	0.49**	-0.25	-0.53**	0.209	0.88**	0.72**	0.25	0.28	0.46*	1.00		
Weight of 1000 grains (g) (X13)	0.28	0.51**	0.34	-0.16	0.02	0.73**	0.42*	0.09	0.50**	0.60**	0.87**	0.43*	1.00	
Weight of grain /plant (X14)	0.48*	0.55**	0.50**	-0.08	-0.28	0.42*	0.90**	0.60**	0.29	0.35	0.65**	0.89**	0.70**	1.00

***.and ** Significant at 0.05 and 0.01 levels of significance, respectively.**

The highest R^2 and the lowest SE% were observed for equation (2) and (3). (From planting to the end of tillering with grain yield/ spike) and (From planting to the end anthesis with grain yield/ plant) respectively. Regarding to full model analysis, for all studied stage, R^2 was ranged between (93.17 and 96.61), SE% ranged between (4.02 and 5.43%) for grain yield per spike. Whereas for stepwise R^2 was ranged between (80.17 and 94.02), SE% ranged between (4.39 and 6.90%) for grain yield per spike. The stepwise multiple regression analysis was used to determine the best variables that mostly reduced the variance of yield. This was done by introducing the variables in order of importance. Tables (4 and 5) demonstrate the accepted variables and reduction in yield variance caused by each variable. The accepted variables had the highest coefficient of multiple determination with the yield adjusted for variables already added. As seen in Table (4) the accepted variables were spike length (X6), weight of 1000-grains (g) (X13), number of grain per spike (X10), soil mean temperature at depth of 20 cm from planting to end of anthesis (Mtepso4) and relative humidity from planting to end of grain filling (RH5%). In Table (5) the accepted variables were number of spikes/plant (7), weight of 1000 grains (g)(13), spike length (cm) (X6) and growing degree-days from planting to the end of booting (GDD3).
These results are in agreement with those reported by El-Rassas and El-Rayes (1992), and El-Sergany Dawlat (1992) and Sowlem *et.al*, (2004)

The best prediction equation for grain yield/ spike was as follow:

Ý= -7.2442-0.0036GDD5**+ 4.74559E-05 RH 5 +1.0609 MtepS1*–1.0223 Mtep S2+ 0.8704 MtepS3.

R^2 = 74.79 SE% = 9.20%

Stepwise:

Ý= 2.3339 +6.90783E-05 RH 5 *

R^2 = 28.84 SE% = 13.06%

Ý= expected yield per spike

GDD5 =growing degree-days in (from planting to the end of grain filling).

RH% = relative humidity in (from planting to the end of grain filling).

MtepS1= soil mean temperature at depth of 5cm (from planting to end of grain filling)

MtepS2= soil mean temperature at depth of 10 cm (from planting to end of grain filling)
MtepS3= soil mean temperature at depth of 20 cm (from planting to end of grain filling)

Table (4): Full model and stepwise multiple regression equations of micro- climatic yield factors of wheat (Grain yield/ spike).

Prediction equation (full model)	R^2	SE%	Prediction equation (Stepwise)	R^2	SE%
1-from planting to harvest. Ẏ=13.6716+0.0878X6+0.0248X10+0.0660X13 **0.000917GDD1-0.2971MtempS10.2971 MtepS2-1.1057E-12 MtepS3.	93.17	5.05	Step(1): Ẏ = -2.6214+ 0.4450X6**	80.15	6.89
			Step(2): Ẏ=-2.5916+0.2735X6**+ 0.0603X13	90.55	4.94
			Step(3):Ẏ=-2.3361+0.105X6+0.0230 X10*+0.0646X13**	93.09	4.39
			Step(4):Ẏ=-2.0274+0.0328X10**+0.0 729X13**	92.41	4.41
2-from planting to the end of tillering Ẏ=-.1863+0.0967X6+0.0257X10+0.0580X13**-0.00736GDD2+0.0024RH2+0.0283MtempS1+ 0.0151MtepS2+0.0176 MtepS3.	96.61	4.02	Step(1):Ẏ = -2.6214+ 0.4450X6**	80.15	6.90
			Step(2):Ẏ=-2.5916+0.2735X6**+0.0603X13	90.55	4.93
			Step(3):Ẏ=-2.3361+0.105X6+0.0230 X10*+0.0646X13**	93.09	4.39
			Step(4):Ẏ=-2.0274+0.0328X10**+0.0 729X13	92.41	4.41
3- from planting to the end of booting Ẏ=-.6291+0.1195X6+0.0214X10+0.0625X13** -3.6574E04+1.59345GDD30.04RH3+0 .00853MtempS1-0.0407MtepS2+0.0823 MtepS3.	93.85	5.43	Step(1): Ẏ = -2.6214+ 0.4450X6**	80.15	6.90
			Step(2): Ẏ=-2.5916+0.2735X6**+ 0.0603X13	90.55	4.93
			Step(3): Ẏ=-2.3361+0.105X6+0.0230 X10*+0.0646X13**	93.09	4.39
			Step(4):Ẏ=-2.0274+0.0328X10**+0.0 729X13	92.41	4.41
4-from planting to the end of anthesis Ẏ=-.4937+0.1517X6+0.0206X10+0.0552X13*-3.7525E07GGD4-0.000917GDD4-2.222E-05RH4+0.0110MtempS1+0.0348 MtepS2+0.0182MtepS3.	95.22	4.79	Step(1): Ẏ = -2.6214+ 0.4450X6**	80.15	6.90
			Step(2): Ẏ=-2.5916+0.2735X6**+ 0.0603X13	90.55	4.93
			Step(3): Ẏ=-2.3361+0.105X6+0.0230 X10*+0.0646X13**	93.09	4.39
			Step(4):Ẏ=-2.0274+0.0328X10**+0.0 729X13	92.41	4.41
			Step(5):Ẏ=-2.5111+0.0340X10**+0.0 702X13**+0.0277Mtempso3	94.02	4.09
5-from planting to the end of grain filling Ẏ=-2.5433+0.0846X6+0.0217X10+0.0543X13-3.7045E04GDD5+1.13347E05RH5+0.0.1921M tempS10.1776MtepS2+0.0626MtepS3.	94.56	5.10	Step(1): Ẏ = -2.6214+ 0.4450X6**	80.15	6.90
			Step(2): Ẏ=-2.5916+0.2735X6**+ 0.0603X13	90.55	4.93
			Step(3): Ẏ=-2.3212+0.2432X6**+0.0582 X13**+2.26677E-05RH5**.	93.09	4.39

Principal component analysis:

Principal component analysis results over of 2002/2003 and 2003/2004 seasons are given in Table (6). The results showed one independent component was considered over the two seasons. The component accounted for 100% of the total variation. This component included grain yield per spike in addition to flag leaf length, flag leaf width, flag leaf area, spike length (cm), number of grain/ spike and weight of 1000 grains (g). Results in Table (7) showed that two independent components were considered component accounted for 99.711% of total variation. This component included grain yield per plant, in addition to flag leaf length, area flag leaf, number of spikes, number of tillers/plant and number of grain per plant. The second component accounted for flag leaf width, spike length, number of spikes and weight of 1000-grain (g).

Table (5): Full model and stepwise multiple regression equations of micro- climatic yield factors of wheat (Grain yield/ plant).

Prediction equation (full model)	R^2	SE%	Prediction equation (Stepwise)	R^2	SE%
1-from planting to harvest. Ý=-8.7858+0.1449X4+0.0108X5+0.1080X6+1.2899X7-0.6263X8-0.7065X9+0.3505X13-6.0404E-11GDD1- 1.0392E04RH1+0.2491MtempS1+5 6234E-12MtepS2-2.66816E-12 MtepS3.	98.74	4.03	Step(1): Ý =-6.5081+2.8582X7** Step(2): Ý=-23.2753+1.3922X6**+0.0603X13 Step(3):Ý=-21.6305+0.9103X6+2.5806X7**+0.1736X13	81.00 95.03 96.09	9.37 4.97 4.59
2-from planting to the end of tillering Ý=-51.8863+0.0729X4-0.0538X5+0.7878X6+0 2.4577X7**-0.2216X8+0.466X9+0.1482X13-0.0846GDD2+0.037RH2+0.5861 MtempS1+0.1136MtepS2+0.1148 MtepS3.	99.55	3.44	Step(1):Ý = -6.5081+2.8582X7** Step(2):Ý=23.2753+1.3922X6**+2.8029X7** Step(3):Ý=-21.6305+0.9103X6*+2.5806X7**+0.1736X13	81.00 95.03 96.09	9.37 4.97 4.59
3- from planting to the end of booting Ý=-6.5046+0.1487X4+0.2006X5+0.3092X6+0.7772X7-0.2788X8-2.1024X9+0.0368X12+0.4613X13-0.0029GDD3+0.0030RH3-0.1286 MtempS1-0.6857MtepS2+0.7740 MtepS3.	99.35	4.58	Step(1): Ý = -6.5081+2.8582X7** Step(2): Ý=-23.2753+1.3922X6**+2.8029X7 Step(3):Ý=-22.5075+1.4743X6**+2.7648X7**-0.0012GDD3	81.00 95.03 96.31	9.37 4.97 4.45
4-from planting to the end of anthesis Ý=-32.4291+0.1496X4+0.0921X5+0.4270X6+1.9417X7-0.8004X8-0.3321X9+0.0193X12+0.2252X13+2.68535E-06GGD4-2.3825E-04RH4-0.0759MtempS1+0.4255MtepS2+0.1087MtepS3.	99.62	3.49	Step(1): Ý = -6.5081+2.8582X7** Step(2); Ý=-23.2753+1.3922X6**+2.8029X7** Step(3): Ý=-21.6305+0.9103X6**+2.5006X7** 0.1736X13 729X13	81.00 95.03 96.09	9.36 4.96 4.59
5-from planting to the end of grain filling Ý=66.4887+0.1019X4+0.4306X5-0.5744X6-0.6636X7-1.1752X8-1.6067X9+0.0694X12+0.1453X13-0.0081GDD5+3.45488E04RH5+3.1720 MtempS1-0.4879MtepS2-4.4502MtepS3.	99.26	4.88	Step(1): Ý = -6.5081+2.8582X7** Step(2): Ý=-23.2753+1.3922X6**+2.8029X7** Step(3): Ý=-21.6305+0.9103X6**+2.5806X7**+0.1736X13**.	81.00 95.03 96.09	9.37 4.97 4.59

Where:
Ý= expected yield.
GDD1 = growing degree-days in (from planting to the end of harvest).
GDD2 = growing degree-days in (from planting to the end of tillering).
GDD3 = growing degree-days in (from planting to the end of booting).
GDD4 = growing degree-days in (from planting to the end of anthesis).
GDD5 = growing degree-days in (from planting to the end of grain filling).
RH1 = relative humidity in (from planting to the end of harvest).
RH2 = relative humidity in (from planting to the end of tillering).
RH3 = relative humidity in (from planting to the end of booting).
RH4 = relative humidity in (from planting to the end of anthesis).
RH5 = relative humidity in (from planting to the end of grain filling).
MtepS1, S2, S3, S4, and S5 = soil mean temperature at depth of 5, 10 and 20 cm (from five phonological stages)

Table (6): Results of principal component analysis for grain yield/ spike over both seasons 2002/2003 and 2003/2004.

Characters	Components	
	1	2
Flag leaf length	0.312	0.504
Flag leaf width	0.371	0.339
Flag leaf area	0.345	0.515
Spike length (cm)	0.430	-0.175
Number of grains/ spike	0.404	-0.262
Weight of 1000 grains (g)	0.425	-0.368
Grain yield/ spike (g)	0.341	-0.362
Percentage variance	100.00	0.00
Cumulative variance %	100.00	100.00

Table (7): Results of principal component analysis for grain yield/ plant over both seasons 2002/2003 and 2003/2004.

Characters	Components	
	1	2
Flag leaf length	0.313	0.210
Flag leaf width	0.274	0.347
Flag leaf area	0.309	0.291
Plant height (cm)	-0.083	-0.149
Spike length (cm)	0.195	0.457
Number of spikes/plant	0.388	-0.325
Number of tillers/plant	0.331	-0.406
Number sipkeles/ spike	0.037	0.298
Number of grains/ plant	0.432	-0.256
Weight of 1000 grains (g)	0.220	0.281
Grain yield/ plant (g).	0.437	-0.125
Percentage variance	99.711	0.289
Cumulative variance %	99.711	100.00

REFERENCES

Angus, J. F., and M. W. Moncur, (1977): Water stress and phonology in wheat Aust. J. Agric. Res 28:177-181.

Berenson, M. L., D. M. Levine; and M. Goldstein. (1983): Intermediate Statistical methods and application, Englewood Cliffs, N. J. PP: 424-429.

Draper, N. R. and J. Smith.(1987): Applied Regression Analysis. John Wilay and Sons, Imc. New York. Pp. 397-402.

El-Rassas, H. N., and F. M. El-Rayes (1992): Comparison between factor analysis and other statistical techniques of yield and yield components in soybean (*Glycine max L. Mer.*) Egypt. J. Agron. 17, No. 1-2, pp. 99-110.

El-Sergany, Z. Dawlat (1992): Comparative study between full model and stepwise regression analysis for maize and sugar beet yield components. J. Agric. Sci. Mansoura Univ. 17(7): 2291-2295.

El-Shaer, M. H. (1985): Microclimatology and phonological descriptive dating of growth events as criteria for cultural practices in some field crops of Egypt EMCIP Univ. Crants- project CA5.

Friend, D. J. C. (1965): Ear length and spikelets number of wheat grown at different temperatures and light intensities. Canda. J. Bot. 43:343-353.

Jones, C. A. and J. R. Kiniry (1986): CERES-Maize: A simulation model of maize growth and development. Taxes A & M University press college, TX. pp. 49-89.

Halso, N. J; and R. N. Weir, (1974): Effect of temperature on spikelet number of wheat. Aust. J. Agric, Res., 25:687-695.

Hotelling, H, (1933): Analysis of a complex of statistical variables into principal components. J. of Education Psychology. 24; 7; 41: 498-520.

McMaster, G. S. (1996): Phonology, development, and growth of wheat (Triticum aestivum L.) shoot apex: A review. Advaces in Agron. 59:63-118.

Mohamed, N. A. (1999): Curve analysis for evaluation of the response of some
wheat varieties to different nitrogen fertilization levels. J. Agric. Sci. Mansoura Univ., 24(4): 1559-1571.

Morsi, F. M. (1989): Studies on different relationships between macro and micro climatic factors and yield and its components in some field crops. M. Sc. Thesis, Agron, Dept. Fac. Of Agric, Cairo.

Naser, S. M. and H. G. M. Gewefel (1991): Evaluation of the relative contribution of peanut yield factors by using four statistical procedures. J. Agric. Sci. Mansoura Univ. 16 (7): 1483-1490.

Nass, H. G.; and B. Reisert (1975): Grain filling period and grain yield relationships in spring wheat. Can. J. plant Sci., 55:763-768.

Peorson, K. (1901): On lines and planes of clasest fit to a system of points in spac Philosophical Magazine 2:557-572.

Peterson, R.F. (1965). Wheat botany, cultivation and utilization world crop. Books Int. put Inc. N.Y.

Rady, M. A. (1986): Environmental studies on some field crops with respect to earliness of maturity and yield. Ph. D. Thesis, Fac. Agric. Cairo Univ.

Ritchie, J. T. (1980): Climatic-genetic interaction related to duration of the vegetative period of wheat and maize. Agronomy Abst. 72 and Annual Meeting, American Society of Agronomy, 15:1980.

Salama, S. M.; Samia G. A. Mouhamed and Samiha A. H. Ouda. (2000): Contribution of flag leaf area in yield of some wheat genotypes. J. Agric. Sci. Mansoura Univ., 25(10): 5973-5979.

Snedocor, G. W. and W.G. Cochran (1981): Statistical methods. Seventh Edition. Iowa State Univ. press, Ames, Iowa, U. S. A.

Sofield, I. Evans, L.T. and I.F. Wardlaw (1977): The effect of temperature and light on grain filling in wheat. R. Soc. N. Z. Bull. 12:909-915.

Sowlem, S. M, S.A. Ouda and M. M. El- Tantawy (2004): Predicting wheat yield at delta region under different sowing dates using historical weather data. Annals of Agric. Sc., Moshtohor, Vol.

Spagnolletti, Z. P., and C.O. Qualset. (1990): Flag leaf variation and the analysis of diversity in durum wheat. Plant Breeding. 105: 189-202.

Steel, R. G. D. and J.H. Torrie (1987): Priniciples and procedures of statistical. A Biomatrical Approach 2 nd , 6 th brinting. Mc Graw. Hill Book. Company, pp 272-277.

Talwer, S. N., and H. M. Chadrappa. (1983): Flag leaf relationship with yield and ear characters in tetraploid wheat. Madres Agric. J. 70: 333-339

Wiegand, C. L.; and J. A. Cuellar (1981): Duration of grain filling and kernel weight of wheat as affected by temperature. Crop Sci. 21:95-101.

Wilhelm, W. W. and G. S. McMaster. (1995). The important of phyllochron in studying the development of grasses. Crop Sci. 53:1-3.

دراسات إحصائية لتقييم بعض أصناف من القمح

سامية جودة عطية محمد - سليمان محمد جمعة سلامة و احمد مؤمن عبد العزيز
المعمل المركزي لبحوث التصميم والتحليل الإحصائي
مركز البحوث الزراعية- الجيزة - جمهورية مصر العربية

أقيمت تجربتان حقليتان بمحطة بحوث تاج العز بمحافظة الدقهلية خلال موسمي ٢٠٠٣/٢٠٠٢ ، ٢٠٠٤/٢٠٠٣ لتقييم بعض أصناف من القمح بالنسبة للمحصول ومكوناته وأستخدم تصميم القطاعات كاملة العشوائية في ثلاث مكررات وكانت الصفات المدروسة هي طول ورقة العلم، عرض ورقة العلم، مساحة ورقة العلم، طول النبات، طول حامل السنبلة، طول السنبلة، عدد السنابل، عدد الأفرع، عدد السنيبلات، عدد حبوب السنبلة الرئيسية، محصول السنبلة الرئيسية، عدد حبوب النبات الفردي، وزن الألف حبة و محصول النبات الفردي . أجريت التحليلات الإحصائية التالية: تحليل التباين، الارتباط البسيط، - استخدم معادلات التنبؤ بالمحصول لكل من النموذج الكامل والمرحلي للانحدار المتعدد وتحليل المكون .

أظهرت الدراسة النتائج التالية:

١- حققت كل من الأصناف جميزة ٧ و سخا ٩٢ وجميزة ٣ أعلي وزن لحبوب السنبلة وأعلى عدد من الحبوب للسنبلة، كما أعطت أصناف جميزة ٧ وجميزة ٣ وسخا ٦١ أثقل وزن للألف حبة في حين أن الأصناف جميزة ٣ وسخا ٩٢ وسخا ٦٩ غلت أعلي محصول من الحبوب للنبات الفردي.

٢-دلت النتائج وجود ارتباط موجب عالي المعنوية بين محصول حبوب السنبلة الرئيسية وكل من طول ورقة العلم، عرض ورقة العلم، مساحة ورقة العلم، طول السنبلة، عدد حبوب السنبلة الرئيسية، محصول السنبلة الرئيسية، عدد حبوب النبات الفردي، وزن الألف حبة و محصول النبات الفردي. وكذلك وجود ارتباط عالي ومعنوي بين محصول النبات الفردي وجميع الصفات المدروسة ماعدا طول النبات، طول حامل السنبلة، وعدد السنيبلات وعدد حبوب السنبلة الرئيسية.

٣-أوضحت نتائج تحليل الانحدار الكلي أن معامل التحديد ر٢ تقع مابين ٩٣%-٩٦% بينما تحليل الانحدار المرحلي تقع ما بين ٨٠%- ٩٤% بالنسبة لمحصول السنبلة.

٤-وكذلك نتائج تحليل الانحدار الكلي أن معامل التحديد ر٢ تقع مابين ٩٨% -٩٩% بينما تحليل الانحدار المرحلي تقع مابين ٨١% - ٩٦% بالنسبة للنبات الفردي.

٥-وقد أتضح أن أهم العوامل المناخية الكبرى المؤثرة علي محصول السنبلة هي طول السنبلة، وعدد حبوب السنبلة الرئيسية وزن الألف حبة، متوسط درجة حرارة التربة عند عمق ٢٠ سم في مرحلة الطرد و الرطوبة النسبية في مرحلة امتلأ الحبوب.

٦-وكذلك أتضح أن أهم العوامل المناخية الكبرى المؤثرة علي محصول النبات الفردي هي عدد السنابل وزن الألف حبة وطول السنبلة والحرارة المتجمعة للنمو في مرحلة تكوين الحبوب.

٧-أظهرت نتائج تحليل المكون أن الصفات المدروسة بالنسبة لمحصول السنبلة تقع في مكونا واحدا يضم طول السنبلة، وزن الألف حبة ، عدد حبوب السنبلة، عرض ورقة العلم، مساحة ورقة العلم، محصول السنبلة وطول ورقة العلم حيث أنها تفسر ١٠٠% من التباين الكلي.

٨-كما أظهرت نتائج تحليل المكون أن الصفات المدروسة بالنسبة لمحصول النبات الفردي تقع في مكونين يضم الأول محصول النبات، عدد حبوب النبات، عدد السنابل، عدد الأفرع، طول ورقة العلم، مساحة ورقة العلم بينما المكون الثاني صفات طول السنبلة، عرض ورقة العلم، عدد السنيبلات ووزن الألف حبة وهذه الصفات المدروسة كانت كافية حيث تفسر ٩٩% من التباين الكلي.