THE RELATIVE CONTRIBUTION OF YIELD COMPONENTS TO GRAIN YIELD OF SOME WHEAT CULTIVARS GROWN UNDER DIFFERENT NITROGEN FERTILIZER LEVELS

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Abstract

A two-year field experiment was conducted at the Agricultural Research Station of Giza, Agricultural Research Center, during the two growing seasons of 2006/2007 and 2007/2008. The experiment was carried out to study the effect of four levels of N fertilizers *i.e* 0, 40, 80 and 120 N kg/fed on yield and some of its components of some wheat cultivars namely: Sakha 94, Gemeiza 9 and Giza 168. Also, to investigate the relationship between grain yield and its components using some multivariate procedures *i.e* correlation, path-coefficient and stepwise multiple linear regression.

The results cleared that Gemeiza 9 cultivar surpassed each of Sakha 94 and Giza 168 cultivars in number of spikes/m^2, number of spikelets/spike, weight of 1000 grains, biological and grain yields in both seasons of the study. Increasing N fertilizer to 40, 80, 120 Kg N/fed significantly increased wheat yield and its components. The highest values of yield and its components were obtained by applying 120 Kg N/fed. The interaction of wheat cultivars and N fertilization significantly affected spike length, biological and grain yields only in the first season.

The results of multivariate analysis procedures revealed that number of spikes/m^2, number of grains/spike and weight of 1000 grains were the most important contributing characters in the total variability of grain yield. These characters have to be ranked the first in any breeding program to improve wheat grain yield.

INTRODUCTION

Wheat is the most important cereal crop in Egypt as well as all over the world. It is a staple food for more than one third of the world population. In Egypt, the local production of wheat dose not cover the total consumption. Consequently, increasing wheat production is a national target to fulfill the food security for the people. This target can be achieved by means of raising the productivity through growing high yielding varieties and the application of improved agro-techniques.

Several investigators reported that wheat cultivars significantly differed in grain yield and most of the studied characters. Hassanein *et al* (1997) and El-Karamity

(1998) found that Sids cultivars 6, 7 and 8 outyielded Giza 163, Giza 164 and Sakha 69 cultivars concerning yield components, grain and straw yields. Salem (1999) reported that wheat cultivar Sids 6 gave the highest grain yield compared with Sids 4 and Sids 5 cultivars. Ashmawy and Abo-Warda .(2002) found that Giza 168 cultivar surpassed Sids 1 and Gemeiza 9 cultivars in all studied characters.

Nitrogen fertilization is among the most important factors having profound effects on yield of wheat. Several researchers reported a beneficial effect for nitrogen application to wheat. They found that number of spikes/m^2 , number of grains/spike and grain yield of wheat increased by increasing nitrogen fertilization level (Mosalem *et al*, 1999, Ashmawy and Abo-Warda, 2002 and Mohamed, 2003).

Yield is a very complex attribute. It is a final product of a number of components. Thus, it is essential to detect the variables having the greatest effect on the yield and their relative contribution to the total variability of the yield.

Correlation is not only an important statistical procedure used to facilitate breeding programs for yield, but it is also used to examine the direct and indirect contribution of yield components. Path-coefficient analysis could be used in this respect. It divides correlation coefficient into direct and indirect effects through alternate path ways. Nasr (1998) used correlation analysis and reported that number of spikes/m^2, spike weight, number of plants/m^2 and plant weight had the greatest influence on grain yield. Also, results of path analysis indicated that the mentioned characters exerted the greatest influence both directly and indirectly upon grain yield. Stepwise multiple linear regression aims to construct a regression equation that includes the variables accounting for the majority of the total yield variation. Nasr (1998) using stepwise regression, reported that number of spikes/m^2 and number of grains/spike were included in the stepwise model as the most important contributing characters to wheat yield variation. Mohamed *et al* (2005) found that number of spikes/m^2, spike length and weight of 1000 grains were from the characters significantly contributed to the total variation of plant grain yield of wheat.

The present study was performed to find out the yielding ability of local wheat cultivars as affected by nitrogen fertilization levels. Also, to determine the most important variables and their relative contribution to the total variability of wheat grain yield using different statistical techniques.

MATERIALS AND METHODS

A two year field experiment was conducted at the Agricultural Research Station of Giza, Agricultural Research Center, during the two growing seasons of 2006/2007 and 2007/2008. The experiment was carried out to study the effect of four levels of N fertilizers *i.e* 0, 40, 80 and 120 kg N/fed on yield and yield components of some wheat cultivars namely: Sakha 94, Gemeiza 9 and Giza 168. Also, to investigate the relationship between grain yield and its components using some multivariate procedures *i.e* correlation, path-coefficient and stepwise multiple linear regression.

The experimental treatments were arrangend in four replications in a strip-plot design. Wheat cultivars were assigned in the vartical strips while N fertilizer levels were occupied the horizontal strips. Seeds were sown in rows of 3.5 m long with 20 cm apart. Plot area was 10.5 m^2 and consisted of 15 rows. Mechanical and chemical analysis of the soil of the experiment is presented in Table 1. The preceding crop was maize in both seasons. Nitrogen fertilization was applied as urea (46.5 % N). Sowing was done on November 25^{th} in both seasons and the harvest was done at the end of May.

Table 1. Mechanical and chemical analysis of the soil of the experiment. (Average of both seasons of 2006/2007 and 2007/2008).

Mechanical analysis (%)	Average	Chemical analysis	Average
Coarse sand	7.0	Organic matter(%)	2.0
Fine Sand	27.2	pH	7.6
Silt	19.5	$CaCo_3$ (%)	3.1
Clay	46.4	Nutrients (ppm)	
Soil	Clay soil	Total N	61.2
		P	8.6
		K	295.7

Studied characters

1- Number of spikes/m^2: estimated by counting the number of spikes in a randomly selected square meter area in each Sub-plot.

At harvest, a sample of ten plants was randomly chosen from the inner rows in each sub-plot to esimate the following characters:

2- Spike length in cm. 3- Number of spikelets/spike.

4- Number of grains/spike. 5-Weight of 1000-grains.

6- Biological yield (ton/fed): was estimated on whole sub-plot basis.

7- Grain yield (kg/fed): was determined by threshing the harvested sub-plot and weighing the resulting grains.

Statistical analysis

1- Analysis of variance

The obtained data were subjected to the proper analysis of variance for strip-plot design as outlined by Gomez and Gomez (1984). The differences between treatment means were detected using least significant difference test (L.S.D).

2- Multivariate procedures

2-1- Simple correlation: It was computed for various characters as described by Gomez and Gomez (1984).

2-2 Path coefficient analysis: Was performed as applied by Dewy and Lu (1959). A path-coefficient is simply a standarized partial regression coefficient as it measures the direct effect of one variable upon another and permits the separation of the correlation coefficient into components of direct and indirect effects.

2-3 Stepwise multiple linear regression

This approach was used to determine the effective yield components, as independent variables, which significantly contribute to the total variability in grain yield, as dependent variable. This method develops a sequence of multiple regression equations in a stepwise manner. One variable is added to the regression model at each step. The added variable is the one that causes the greatest reduction in the error sum of squares. It is also the variable which has the highest partial correlation with the dependent variable for fixed values of those variables already added, and is the variable that has the highest F value in regression analysis of variance. Stepwise regression analysis was carried out according to the method reported by Draper and Smith (1981).

To detect precence of multicolinearity, value of variance inflation factor (VIF) among all independent variables is often used (Neter *et al,* 1990). A maximum VIF value in excess of 10 is often taken as an indicator of the precence of multicolinearity.

The above mentioned multivariate procedures were applied to the data over both seasons of the exepriment including plant characteristics namely: number of spikes/m^2 **(x_1)**, spike length **(x_2)**, number of spikelets/spike **(x_3)**, number of grains/spike **(x_4)**, weight of 1000 grains **(x_5)** and grain yield/fed **(Y)**.

RESULTS AND DISCUSSION

Effect of wheat cultivars

Mean values of wheat yield and its components as affected by cultivars in the 2006/2007 and 2007/2008 seasons are shown in Table 2. Wheat cultivars significantly differed in number of spikes/m^2, number of grains/spike and grain yield/fed in both seasons of the study. The tested cultivars significantly differed in weight of 1000 grains and biological yield in the first season and spike length in the second season.

Table 2. Effect of wheat cultivars on yield and its components during 2006/2007 and 2007/2008 seasons.

Characters	Cultivars			L.S.D (0.05)
	Sakha 94	Giza 168	Gemeiza 9	
2006/2007 season				
Number of spikes/m^2	507.13	494.06	508.19	12.31
Spike length (cm)	10.39	11.70	10.88	NS
Number of spikelets/spike	20.19	20.86	21.41	NS
Number of grains/spike	51.70	60.24	57.97	5.19
Weight of 1000 grains (gm)	40.58	40.41	42.02	0.61
Biological yield (ton/fed)	8.69	8.48	8.74	0.06
Grain yield (kg/fed)	2716.94	2827.80	2935.43	63.42
2007/2008 season				
Number of spikes/m^2	531.88	525.94	541.56	9.46
Spike length (cm)	11.94	11.76	12.43	0.52
Number of spikelets/spike	21.51	21.31	21.78	NS
Number of grains/spike	57.82	56.76	59.31	1.89
Weight of 1000 grains (gm)	42.26	41.47	43.01	NS
Biological yield (ton/fed)	8.81	8.77	9.02	NS
Grain yield (kg/fed)	2953.75	2900.00	3023.75	61.72.

The results in Table 2 clearly showed that Gemeiza 9 cultivar gave the highest number of spikes/m^2 followed by Sakha 94 and Giza 168 cultivars in both seasons. The tested wheat cultivars significantly differed in both seasons for number of grains/spike. Giza 168 cultivar gave the highest number of grains/spike in the first season followed by Gemeiza 9 without significant differences and Sakha 94 came in the thrid order. In the second season, Gemeiza 9 cultivar had the highest number of grains/spike followed by Sakha 94 and Giza 168 which were not significantly different. The results in Table 2 show that the tested cultivars significantly affected grain yield/fed in the two seasons. Gemeiza 9 cultivar gave the highest yield of grains in both seasons. Giza 168 cultviar significantly outyielded Sakha 94 in the first season and vise versa in the second one but without significant differences. The tested wheat cultivars significantly differed only in the 2007/2008 season for spike length. Gemeiza 9 cultivar gave the longest spikes followed by Sakha 94 without significant difference. Giza 168 gave the shortest spikes which significantly differed with those of Sakha 94 and Gemeiza 9 cultivars. Weight of 1000 grains was significantly affected by the tested cultivars only in the first season. The heaviest weight of 1000 grains was obtained by Gemeiza 9 cultivar followed by Sakha 94 and Giza 168, respectively. The same trend was observed in the second season but without significant differences between the tested cultivars. Biological yield (ton/fed) was significantly affected by tested wheat cultivars only in the frist season. Gemeiza 9 cultivar gave the highest biological yield followed by Sakha 94 and Giza 168. The same results were recorded in the second season but without significant differences between the tested cultivars.

The previous results may be due to the genetic variability among the tested cultivars and response of each to the environmental conditions during the growing seasons. These results are similar to those obtained by Salem (1999), Ashmawy and Abo-Warda (2002) and Mohamed *et al* (2005).

Effect of N fertilization levels

Results of wheat yield and its components as affected by nitrogen fertilization levels during both seasons of 2006/2007 and 2007/2008 are presented in Table 3. The results clearly indicated that the application of N fertilization significantly increased all the studied characters in both seasons.

Number of spikes/m^2 was significantly increased by 11.00 %, 30.44 % and 34.70 % over the check treatment by the application of 40, 80 and 120 kg N/fed, respectively in the first season. The corresponding increases in the second season were 9.82 %, 27.37 % and 32.78 %, respectively. Adding 40, 80 and 120 kg N/fed to the wheat plants significantly increased spike length by 4.65 %, 12.57 % and 18.02 %, respectively in the first season corresponding to 9.06, 18.30 % and 22.50 % in the second season. Number of spikelets/spike was positively affected by N fertilization. This trait increased significantly by 2.85 %, 12.07 % and 16.42 % as a result of increasing N levels to 40, 80 and 120 kg N/fed, respectively, in the first season. The increase was 6.77 %, 11.50 % and 18.13 % in the second season for the corresponding N levels, respectively. Concerning number of grains/spike, results in Table 3 showed that the effect of N fertilizer on this triat was significant, since raising N fertilization levels to 40, 80 and 120 kg N/fed markedly increased number of grains/spike by 7.41 %, 19.22 % and 29.82 % over the control, respectively, in the first season, corresponding to 3.46 %, 14.42 % and 20.75 % in the second season.

Table 3. Means of yield of wheat and its components as affected by nitrogen fertilization levels during seasons of 2006/2007 and 2007/2008.

Characters	Nitrogen fertilizer levels (Kg N/fed)				L.S.D 0.05
	0	40	80	120	
2006/2007 season					
Number of spikes/m^2	422.67	469.17	551.33	569.33	22.94
Spike length (cm)	10.10	10.57	11.37	11.92	0.36
Number of spikelets/spike	19.31	19.86	21.64	22.48	1.03
Number of grains/spike	49.63	53.31	59.17	64.43	2.34
Weight of 1000 grains (gm)	37.24	39.42	43.14	44.22	0.39
Biological yield (ton/fed)	6.37	7.55	9.78	9.82	0.17
Grain yield (kg/fed)	2248.48	2543.82	3155.52	3359.07	81.46
2007/2008 season					
Number of spikes/m^2	453.75	498.33	577.92	602.50	15.78
Spike length (cm)	10.71	11.68	12.67	13.12	0.34
Number of spikelets/spike	19.91	20.49	22.20	23.52	0.43
Number of grains/spike	52.86	54.69	60.48	63.83	1.81
Weight of 1000 grains (gm)	38.77	40.42	43.98	45.81	1.14
Biological yield (ton/fed)	6.75	8.04	9.77	10.91	0.17
7- Grain yield (kg/fed)	2553.33	2785.00	3123.33	3375.00	72.30

Nitrogen levels induced a significant positive effect on weight of 1000 grains. Applying 40, 80 and 120 kg N/fed increased this character by 5.85 %, 15.84 % and 18.74 % , respectively, compared with the check treatment in 2006/2007 season. The corresponding increase in 2007/2008 season was 4.26 %, 13.44 % and 18.16 % for the respective N levels. Regarding the effect of N on biological yield, the results presented in Table 3 showed that applying N at 40, 80 and 120 kg/fed significantly increased biological yield by 18.52 %, 53.53 % and 54.16 %, respectively, over the check treatment in the first season. The increase in the second season was 19.11 %, 44.07 % and 61.63 % for the same N fertilizer levels, respectively. Grain yield/fed significantly increased as N levels increased to 40, 80 and 120 kg N/fed. Grain yield increased by 13.14 %, 40.34 % and 49.43 %, respectively, over the control in the 2006/2007 season, corresponding to 9.07 % , 22.32 % and 32.18 % in the 2007/2008 season for the same respective N levels. The increase in grain yield is mainly due to the beneficial effect of N on yield components characters. Also, a good supply of N may be increased the vegetative growth and grain filling periods which, in turn, positively affected grain yield. Similar results were reported by El-Sawi (2001), Ashmawy and Abo-Warda (2002) and El-Nady (2003) .

It is observed that there was a significant increase in grain yield obtained by adding 120 Kg N/fed compared with that obtianed by adding 80 Kg N/fed in both seasons. From the economic point of view, this increase was not economic where the return of this increase were £ E 86 and £ E 148 in the first and second seasons, respectively. The price of kg urea was £ E 3.7 and the price of kg wheat grains was £ E 1.15 according to the Agricultural Credit and Development Bank, in Cairo (2008).

Effect of the interaction

Results of the interaction between the tested wheat cultivars and nitrogen fertilizer levels during 2006/2007 and 2007/2008 seasons are shown in Table 4. The results indicated that spike length, biological and grain yields were significantly affected by the interaction between cultivars and N levels only in 2006/2007 season. The three mentioned characters were gradually increased by increasing N levels for all tested cultivars. The longest spikes being 12.94 cm were obtained by planting Giza 168 cultivar supplied with 120 kg N/fed. Highest biological yield was given by planting Sakha 94 and applying 120 kg N/fed whereas Gemeiza 9 cultivar supplied with 120 kg N/fed recorded the highest grain yield being 3448.75 kg. However, the response of Gemeiza 9 cultivar to the increase in N level was relatively different compared to the other two cultivars. For example, concening grain yield, it increased nearly by 52 %, 53 %and 44 % for Sakha 94, Giza 168 and Gemeiza 9, respectivel, in the first seaseon. On the other hand, the lowest values of spikes length, biological and grain yields were 9.65 cm, 6.05 ton/fed and 2131.80 kg/fed and obtained by planting Sakha 94 under N untreated plots.

The results in Table 4 show that number of spikes/m^2, number of spikelets/spike, number of grains/spike and weight of 1000 grains were not significantly affected by the interaction of cultivars and N fertilizer levels in both seasons of the study as well as spike length, biological and grain yields/fed in the second season.

Table 4. Effect of the interaction between wheat cultivars and N levels on yield and its components during 2006/2007 and 2007/2008 seasons

Interaction	Number of spikes/m^2		Spike length (cm)		Number of spikelets/spike		Number of grains/spike		Weight of 1000 grains (gm)		Biological yield (ton/fed)		Grain yield (kg/fed)	
	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08
Sakha 94														
Without N	431.75	452.50	9.65	10.63	18.73	19.80	43.80	52.35	37.14	38.65	6.05	6.73	2131.80	2545.00
40 kg N/fed	462.50	495.00	10.18	11.68	19.43	20.15	47.28	55.08	38.83	40.63	7.95	8.09	2487.50	2775.00
80 kg N/fed	547.50	577.50	10.69	12.58	20.95	22.15	54.20	60.28	42.69	44.20	9.89	9.50	3011.40	3145.00
120kgN/fed	586.75	602.5	11.04	12.88	21.68	23.53	61.53	63.58	43.68	45.55	10.87	10.91	3237.05	3350.00
Giza 168														
Without N	403.75	447.50	10.63	10.33	19.53	19.73	52.98	50.78	36.11	38.05	6.32	6.67	2218.70	2500.00
40 kg N/fed	457.50	493.75	11.18	11.50	19.80	20.25	57.25	52.45	38.72	39.70	7.58	7.81	2608.10	2695.00
80 kg N/fed	555.00	571.25	12.08	12.33	21.65	21.93	63.33	59.83	42.93	43.13	9.68	9.74	3093.00	3080.00
120kgN/fed	560.00	591.25	12.94	12.90	22.48	23.33	67.40	62.75	43.91	45.00	10.32	10.87	3391.40	3325.00
Gemeiza 9														
Without N	432.50	461.25	10.04	11.18	19.68	20.20	52.13	54.20	38.48	39.60	6.75	6.85	2394.95	2615.00
40 kg N/fed	487.50	506.25	10.36	11.88	20.35	20.68	55.40	56.55	40.72	40.93	7.85	8.23	2535.85	2885.00
80 kg N/fed	551.50	585.00	11.35	13.10	22.33	22.53	59.98	61.33	43.82	44.63	9.77	10.07	3362.15	3145.00
120kgN/fed	561.25	613.75	11.78	12.58	23.28	23.70	64.48	65.15	45.07	46.63	10.61	10.94	3448.75	3450.00
L.S.D(0.05)	NS	NS	0.31	NS	NS	NS	NS	NS	NS	NS	0.19	NS	131.64	NS

Correlation analysis

Simple correlation coefficients among grain yield/fed and its components in wheat are presented in Table 5 . The results showed clearly that the relationship between all possible pairs of the studied characters were highly significant in all cases. Grain yield showed highly significant and positive correlation with each of number of spikes/m^2 (r = 0.923**) spike length (r = 0.733**), number of spikelets/spike (r = 0.875**), number of grains/spike (r = 0.827**) and weight of 1000 grains (r = 0.920**). These findings are similar to those found by Salama *et al* (2000) and Mohamed *et al* (2005).

Table 5. Simple correlation coefficients among grain yield/fed and its components in wheat. (Combined over both seasons of 2006/2007 and 2007/2008).

Characters	X_1	X_2	X_3	X_4	X_5
Number of spikes/m^2 (X_1)					
Spike length (X_2)	0.738**				
Number of spikelets/spike (X_3)	0.844**	0.826**			
Number of grains/spike (X_4)	0.760**	0.775**	0.833**		
Weight of 1000 grains (X_5)	0.918**	0.715**	0.861**	0.777**	
Grain yield/fed (Y)	0.923**	0.733**	0.875**	0.827**	0.920**

Stepwise regression

Data were subjected to stepwise regerssion analysis to determine the significant variables contributing to the variation of grain yield and estimate their relative contributions. Accepted variables and their relative contributions are shown in Table 6. The results revealed that the most contributing characters in the total variability of grain yield of wheat were number of spikes/m^2, number of grains/spike and weight of 1000 grains. These characters contributed at 90.7 % in grain yield variation. It is observed from the results in Table 6 that number of spikes/m^2 was the most important character followed by number of grains/spike and weight of 1000 grains. The relative contributions in the total variation of grain yield were 85.3 %, 3.7 % and 1.7 % for the above mentioned characters, respectively. The best prediction equation was formulated as follows :

$$\hat{Y} = -1302.212 + 2.742\ x_1 + 15.007\ x_4 + 46.051\ x_5$$

Table 6. Characters explaining grain yield of wheat using stepwise multiple linear regression analysis over seasons of 2006/2007 and 2007/2008.

Characters	Reg. coeff	Std error	Prob.	Partial R^2 %	Commu. R^2 %	Variance Inflation Factor
Number of spikes/m^2 X_1	2.742	0.517	0.000	85.3	85.3	6.636
Number of grains/spike X_4	15.007	3.334	0.000	3.7	89.0	2.663
Weight of 1000 kernels X_5	46.051	11.302	0.000	1.7	90.7	6.940

Intercept = -1302.212
R^2 of studied characters = 91.1 %
R^2 of accepted characters = 90.7 %
R^2 adjusted = 90.4 %
Standard error of estimate = 126.6

spike length and number of spikelets were eliminated from the model due their non-significant contributions. These results are similar to those obtained by Nasr (1998) who found that number of spikes/m^2 and number of grains/spike were the most improtant contributing variables in the total variability of wheat yield. Also, Mohamed *et al* (2005) reported that number of spikes/m^2 , spike length and weight of 1000 grains significantly contributed in the total variance of grain yield of wheat.

Path-Coefficient analysis

Coefficients of simple correlation among grain yield and its components were individually partitioned into their components of direct and indirect effects. The results of direct and indirect effects of yield components and their relative importance to the total grain yield variation are shown in Table 7.

The results clearly indicated that number of spikes/m^2, weight of 1000 grains, number of grains/spike and number of spikelets/spike exhibited the highest direct effects towards grain yield. The relative importance of these characters to the total yield variability was 14.04 %, 6.36 %, 3.47 %, and 2.20 %, respectively.

Table 7. Direct and indirect effects of yield components and their relative importance in grain yield of wheat over seasons of 2006/2007 and 2007/2008.

Characters	Effects	CD*	RI**
Direct			
Number of spikes/m² X_1	0.4224	0.1785	14.0442
Spike length X_2	-0.0829	0.0069	0.5413
Number of spikelets/spike X_3	0.1672	0.0208	2.1998
Number of grains/spike X_4	0.2010	0.0441	3.4697
Weight of 1000 grains X_5	0.2844	0.0809	6.3654
Indirect			
X_1 vs X_2	-0.0612	-0.0517	4.0694
X_1 vs X_3	0.1411	0.1192	9.3823
X_1 vs X_4	0.1596	0.1348	10.6106
X_1 vs X_5	0.2611	0.2206	17.3594
X_2 vs X_3	0.1381	-0.0229	1.8026
X_2 vs X_4	0.1627	-0.0270	2.1241
X_2 vs X_5	0.2033	-0.0337	2.6543
X_3 vs X_4	0.1749	0.0585	4.6027
X_3 vs X_5	0.2449	0.0819	6.4437
X_4 vs X_5	0.2210	0.0928	7.3032
Residual		0.0893	7.3032

Multiple coefficient of determination = 92.70 %

* CD = Coefficient of determination.

** RI = Relative importance.

Number of spikes/m² contributed at 17.36 % to the grain yield variation through 1000-grain weight, 10.61 % through number of grains/spike, 9.38 % through number of spikelets/spike and 4.07 % through spike length. Number of grains/spike possesed indirect effect of 7.30 % through weight of 1000 grains which accounted for 6.44 % through number of spikelets/spike that contributed at 4.60 % indirectly through number of grains/spike. Spike length had indirect effect of 1.80 %, 2.12 % and 2.64 through number of spikelets/spike, number of grains/spike and weight of 1000 grains, respectively.

The results in Table 6 showed clearly that the total relative contribution of the studied characters to the grain yield variation referred to R^2 was 92.70 and the residual effect of the other yield components, that were probably not included into this model, was 7.30 %.

From the previous results of multivariate analysis, it could be concluded that number of spikes/m², number of grains/spike and weight of 1000 grains were the most important contributing characters to the total variability of wheat grain yield. Therefore, these characters should be ranked first in any breeding program for improving grain yield of wheat.

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المساهمة النسبية لمكونات المحصول فى محصول الحبوب لبعض أصناف القمح المنزرعة تحت مستويات مختلفة من السماد الآزوتى

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١. *المعمل المركزى لبحوث التصميم و التحليل الاحصائى – مركز البحوث الزراعية.*
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أقيمت تجربة حقلية فى محطة الجيزة للبحوث الزراعية– بمركز البحوث الزراعية خلال موسمى النمو ٢٠٠٦/٢٠٠٧ ، ٢٠٠٧/٢٠٠٨ . وذلك لدراسة تأثير أربعة مستويات من السماد الآزوتى (صفر، ٤٠ ، ٨٠ ، ١٢٠ كجم أزوت/ف) على بعض مكونات المحصول لثلاثة أصناف من القمح هى سخا ٩٤ و جيزة ١٦٨ و جميزة ٩ . وايضا لدراسة العلاقة بين المحصول و مكوناته باستعمال بعض طرق تحليل المتغيرات المتعددة مثل الارتباط البسيط و معامل المرور و الانحدار المتعدد المرحلى.

أوضحت النتائج ان الصنف جميزة ٩ تفوق على كل من الصنفين سخا ٩٤ و جيزة ١٦٨ فى عدد السنابل/م٢ ، وعدد سنيبلات السنبلة ووزن ١٠٠٠ حبة والمحصول البيولوجى ومحصول الحبوب فى موسمى الدراسة .

أدى التسميد بمعدلات ٤٠ ، ٨٠ ، ١٢٠ كجم أزوت /ف إلى زيادة معنوية فى المحصول ومكوناته. حيث أدى التسميد بمعدل١٢٠ كجم أزوت / ف إلى الحصول على أعلى القيم للمحصول ومكوناته. أثر التفاعل بين الاصناف ومعدلات السماد الأزوتى معنويا على كل من طول السنبلة والمحصول البيولوجى ومحصول الحبوب فى الموسم الأول فقط .

أوضحت نتائج تحليل المتغيرات المتعددة أن عدد السنابل/م٢ وعدد حبوب السنبلة ووزن ١٠٠٠ حبة كانت اهم الصفات و أعلاها أسهاما فى تباين محصول الحبوب مما يوضح انه يجب أن تحتل هذه الصفات المرتبة الأولى لأى برنامج تربية لتحسين محصول حبوب القمح.