MEAN PERFORMANCE, CORRELATION AND PATH COEFFICIENT ANALYSIS FOR GRAIN YIELD AND ITS COMPONENTS OF FOUR BREAD WHEAT CULTIVARS GROWN UNDER FOUR NITROGEN LEVELS

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Abstract

To study mean performance, phenotypic, genotypic and environmental associations as well as path coefficient analysis for yield and yield components of bread wheat *(Triticum aestivum, L.)*, under various nitrogen levels two field experiments were conducted during 2003/2004 and 2004/2005 winter seasons at Kafr El-Hamam Agricultural Research Station, Zagazig, Sharkia Governorate, Agricultural Research Center (ARC). The response of four wheat cultivars i.e., Gemmeiza 9, Sakha 69, Sakha 93 and Giza 168 to four nitrogen fertilization rates e.g., 25, 50, 75 and 100 kg N/fad were investigated. Spilt-plot design with three replications was used where, wheat cultivars were randomly distributed in main plots, meanwhile, nitrogen fertilizer levels were allotted in sub plots.

The obtained results showed highly significant differences among the studied wheat cultivars in both seasons for days to maturity, spike length, number of spikes/m^2, 1000-grain weight, biological yield (ton/fad) and grain yield (ardb/fad), meanwhile plant height (2nd season) and number of grains/spike (1st season) were only significant. Also, significant differences among nitrogen fertilization levels were observed for all studied characters, in both seasons, except plant height (1st season). Sakha 93 had the shortest plants and the longest ears and was, earliest in days to maturity. The highest number of spikes/m^2 was recorded for Sakha 69 and the highest number of grains for Giza 168. Gemmeiza 9 possessed the heaviest 1000-grain weight. Sakha 93 had the highest grain yield (ardb/fad). Meanwhile, the highest biological yield was recorded for Gemmeiza 9. Significant variations were recorded for nitrogen levels for all studied characters. Mean values of characters under nitrogen levels varied from character to character. It could be noted that, generally, the interaction effect between cultivars × nitrogen levels was insignificant.

Path coefficient analysis showed that the highest contributions for grain yield (ardb/fad) was the number of grains/spike followed by 1000-grain weight.

Characters association showed that the grain yield was associated positively and significantly with number of grains/spike at both phenotypic and genotypic levels on both seasons. Also, spike length was associated significantly with grain yield (ardb/fad) in 2nd season only.

These results are of great interest for wheat producer and agronomist as well as plant breeder to give valuable information for wheat production and breeding for high yielding.

INTRODUCTION

Wheat either bread *(Triticum aestivum,* L.*)* or durum *(Triticum turigidum* var *durum)* are of great importance for human being, since it contains carbohydrate that gives energy, protein which has many important functions, vitamens and nutrient minerals. Egypt suffers from a wide gap between production and consumption. So, Egypt imports about 50% of its needs from different foreign sources. To overcome this gap, releasing high yielding genotypes of wheat along withier optimum cultural practices should be made available to the producers.

Many investigators tested a great number of wheat genotypes for their response to nitrogen fertilization to obtain higher grain yield. Applying nitrogen fertilizer up to 150 kg N/fad caused significant increases in wheat for plant height, spike length, 100-grain weight, number of grains/spike, days to maturity and grain yield. This view was reported by Shehab El-Din and Eissa (1992), Allam (1996), El-Nagar (1997), Oritz-Monasterio *et al.,* (1997), Seif El-Nasr and Zahran (1998), Tammam *et al.,* (2000), Ismail (2001), Saleh (2001, 2002 and 2003), Mahfouz and Ghabour (2003), Zeidan, (2003) and El-Wakil and Abd-Alla (2004).

Interrelationships among yield and its components at phenotypic, genotypic and environmental levels were investigated by many research workers and indicated positive and significant correlation coefficients among grain yield, number of spikes/m^2, 1000-grain weight and number of seeds/plant (Mahfouz and Ghabour, 2003).

Grain yield/fad was correlated positively and significantly with plant height (0.886**) number of grains/spike (0.874**), 100-grain weight (0.624**) and number of spikes/m^2 (0.816**), (El-Wakil and Abd-Alla, 2004). Tammam *et al.* (2000) detected negative and significant association at phenotypic level among grain yield and days to heading and 100-grain weight. Also, at genotypic level positive and significant association were found among grain yield on one hand and days to heading, number of spikes/plant, number of grains/spike and 100-grain weight, on the other hand. El-Nagar (1997), reported positive and highly significant correlations between grain yield and each of 100-grain weight, spike length and number of spikes/m^2.

Path coefficient analysis could be successfully used to identify appropriate selection criteria for improving grain yield. The findings of many investigators showed that grain yield was affected directly by, number of kernels/spike, 1000-kernel weight and number of spikes/plant in both phenotypic and genotypic correlation coefficients levels. Also, It was affected indirectly by biological yield via effects in number of spikes/plant, number of kernels/spike, 1000-grain weight and days to heading (Tammam *et al.,* 2000, Ismail, 2001 and El-Wakil and Abd-Alla, 2004).

The main targets of this research work are to test four wheat cultivars of Egyptian origin for their response to four levels of nitrogen fertilizer at Kafr El-Hammam Agricultural Research Station, Zagazig, Sharkia Governorate and the effect on yield and yield components. Studying the interrelationships among the studied characters at phenotypic, genotypic and environmental levels of associations. Testing the contribution of yield components on grain yield using path coefficient analysis.

MATERIALS AND METHODS

This investigation was conducted at Kafr El-Hamam Agricultural, Reseach Station, Zagazig, Sharkia Governorate, Agriculture Research Center (ARC) during two successive seasons 2003/2004 and 2004/2005. Four wheat cultivars i.e., Gemmeiza9, Sakha 69, Sakha 93 and Giza 168 were studied under four levels of nitrogen e.g, 25, 50, 75 and 100 kg N/fad.

The treatments were arranged in split-plot design with 3 replications according to Steel and Torrie (1980). The four wheat cultivars were randomly distributed in main plots, meanwhile, the four nitrogen levels were allotted in sub-plots. The area of sub-plot was 6 m^2 including 10 rows, 3m length and 20cm apart .

Soil samples were mechanically and chemically analyzed before sowing (Table, 1). Nitrogen fertilizer (in form of urea 46.5%N) was applied in two equal doses before 1^{st} and 2^{nd} irrigation .

All recommended agricultural practices for wheat production other than nitrogen fertilization were applied at proper time .

Seeds of wheat cultivars were hand sown in rows using the recommended seeding rate at 14^{th} and 16^{th} November in 1^{st} and 2^{nd} growing seasons .

Table 1. Mechanical and chemical analysis of the experimental site during 2003/2004 and 2004/2005 seasons.

Mechanical analysis				*Chemical analysis*				
Sand %	*Silt %*	*Clay %*	*Texture*	*N ppm*	*P ppm*	*K ppm*	*pH*	*Ee*
26.90	30.50	40.91	Clay	145	41	625	8.6	0.56

Collected data :

The following characters were recorded at the proper time :

1. Earliness characters :

a. Number of days to 50% maturity (days).

2. Yield and yield attributes:

a. Plant height (cm).

b. Number of grains/spike: average of 10 spikes .

c. 1000-grain weight (g) : average mean of two samples and the difference between them did not exceed 3% .

d. spike length (cm) : estimated as the average mean of 10 mains/spikes .

e. Number of spikes/m^2: were estimated using woody frame of ½m × ½m and then multiplied by 4.

f. Grain yield (ardb/fad): was estimated from the whole plot area.

g. Biological yield (ton/fad).

Statistical analysis:

The obtained data were subjected to statistical analysis of the split-plot design. Phenotypic, genotypic and environmental correlation coefficients were calculated for each season according to procedures outlined by Gomez and Gomez (1984). To test the differences among means least significant differences (L.S.D.) were used. The method of path coefficient analysis outlined by Dewy and Lu (1959) was applied for calculating the contribution of yield components i.e., number of spikes/m^2, number of grains/spike and 1000-grain weight to grain yield of various wheat cultivars under various nitrogen levels.

RESULTS AND DISCUSSION

Mean performance:

Data in Table (2) showed mean values of days to maturity, plant height and spike length for 4 wheat genotypes, Gemmeiza 9, Sakha 69, Sakha 93 and Giza 168 under four levels of nitrogen e.g., 25, 50, 75 and 100 Kg N/fad during two wheat growing seasons .

Statistical analysis showed highly significant differences among the studied wheat cultivars. This was true in both growing seasons for days to maturity. The earliest cultivar was Sakha 93 in both seasons, while, the latest cultivar was Gemmeiza 9.

Plant height for Sakha 93 (99.58cm) had the shortest plants, while, Gemmeiza 9 gave the tallest plants of 113.75cm. This was true in 2nd season only. Insignificant variation was recorded for plant height in 1st season. These results indicated that this character is more affected by environmental changes. These results are in accordance to El-Nagar, (1997), Seif El-Nasr and Zahran (1998) and Zeidan (2003).

For nitrogen fertilization, the obtained results showed that increasing nitrogen by Tammam *et al.,* (2000), Ismail, (2002), Saleh, (2001), Shehab El-Din and Eissa (1992).

The shortest plants were observed under 25Kg N/fad (109.58cm), however, the tallest plants were recorded under 75kg N/fad (117.92cm).

As for spike length, significant differences among the studied cultivars were observed in 2nd season only. Significant differences were noted among Gemmeiza 9 and the other three cultivars. The results indicated that this character was affected by environmental rather than genetic variance. The tallest spikes were observed for Sakha 93 and Sakha 69.

Nitrogen fertilizer showed significant differences among the studied levels and indicated in 2nd season that increasing nitrogen level increased spike length up to 75 Kg N/fad. This was true in both seasons. Spike length ranged from 12.33cm at 25 Kg N/fad to 14.00 cm in 1st season, Meanwhile it ranged from 12.50 (25 Kg N/fad) to 13.00 cm for 75 Kg N/fad in the 2nd season. These results are confirmed by the findings of **El-**Nagar (1997), Seif El-Nasr and Zahran (1998), Tammam *et al.,* (2000) and Ismail, (2001).

Interaction effect between wheat cultivars and nitrogen levels presented in Table (2) showed insignificant variations for the three studied characters except for days to maturity in the 1st season These results indicated that every factor of study acted independently.

Table 2. Mean performance of 4 wheat cultivars under four nitrogen levels for days to maturity, plant height (cm.) and spike length during two winter seasons 2003/2004 and 2004/2005 .

Characters / Seasons	Days to maturity		Plant height (cm.)		Spike length (cm.)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Cultivars (C) :						
Gemmeiza 9	152.67	148.33	115.83	113.75	12.42	12.50
Sakha 69	147.67	146.75	117.92	101.66	12.50	13.58
Sakha 93	146.58	145.58	115.42	99.58	12.17	13.67
Giza 168	149.50	148.00	110.00	100.00	12.83	13.42
L.S.D.	0.863	0.860	N.S	4.742	N.S	0.836
Nitrogen levels (N):						
25 KgN/fad	147.42	144.33	109.58	99.58	12.50	12.33
50 KgN/fad	148.83	147.67	115.83	105.08	12.75	13.83
75 KgN/fad	149.75	148.08	117.92	105.83	13.00	14.00
100 KgN/fad	150.75	148.58	115.83	104.58	11.67	13.00
L.S.D.	0.863	0.860	3.748	N.S	0.756	0.700
Interaction :						
C × N	*	N.S	N.S	N.S	N.S	N.S

N.S = not significant

** = significant at 5% level of probability

Results of yield components i.e., number of spikes/m^2 number of grains/spike and 1000-grain weight are shown in Table (3). Statistical analysis showed significant differences among all the studied components in both seasons, except for number of grains/spike in the 2nd season.

Table 3. Mean performance of 4 wheat cultivars under four nitrogen levels for number of spikes / m^2, number of grains / spike and 1000-grain weight (g.) during two winter seasons 2003/2004 and 2004/2005 .

Characters / Seasons	Number of spikes / m^2		Number of grains / spike		1000-grain weight (g.)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Cultivars (C) :						
Gemmeiza 9	355.17	336.92	65.85	63.78	52.24	50.09
Sakha 69	462.83	404.67	62.35	61.30	48.61	49.55
Sakha 93	387.25	345.83	60.50	61.11	45.46	47.36
Giza 168	362.67	364.00	67.52	63.45	44.76	45.30
L.S.D.	18.206	24.868	4.956	N.S	2.519	1.949
Nitrogen levels (N):						
25 KgN/fad	378.33	338.92	64.13	59.89	50.47	50.44
50 KgN/fad	388.00	369.50	66.77	63.03	49.29	48.85
75 KgN/fad	404.75	382.50	66.38	65.24	46.75	47.68
100 KgN/fad	396.83	360.50	58.93	61.38	44.55	45.35
L.S.D.	16.273	25.426	4.061	2.655	2.517	1.949
Interaction : C × N	*	N.S	*	*	N.S	N.S

N.S = not significant

** = significant at 5% level of probability

The studied yield components varied from character to character in both seasons. Sakha 69 and Sakha 93 for number of spikes/m^2 and Gemmeiza 9 and Giza 168 for number of grains/spike and 1000-grain weight (g.) for Gemmeiza 9 and Sakha 69. The obtained results indicated that Gemmeiza 9 surpassed the other wheat genotypes for two out of the three yield components.

It could be noted that Giza 168 had the highest yield component in the 2nd season for number of spikes/m^2 and 1st and 2nd seasons for number of grains/spikes. Sakha 69 ranked 3rd order of the heaviest 1000-grain weight in both seasons. These results are supported by the findings of El-Nagar (1997), Ismail (2001), Saleh (2003), Zeidan (2003) and Mahfouz and Ghabour (2003).

Applying 75 Kg N/fad gave the highest number of spikes /m^2 and number of grains/spikes during the two growing seasons, meanwhile, the heaviest 1000-grain weight was recorded when applying 25 Kg N/fad. in both growing seasons. However applying (50 Kg N/fad) revealed the followed values as combined to the values obtained through the application of 25 kg N/fad for the three yield components.

These results indicated that the favorable nitrogen level for increasing yield components was 75 Kg N/fad. These results are confirmed by Seif El-Nasr and Zahran (1998), Oritz Monasterio *et al.* (1997) Tammam *et al.,* (2000), Saleh (2002) and El-Wakil and Abd-Alla (2004).

Interaction effects for cultivar × nitrogen level were significant in the 1st season for number of spikes/m^2 and in the 1st and 2nd seasons for number of grains/spike. The remaining characters were insignificant in both seasons, (1000-grain weight) and number of spikes/m^2 (2nd season), revealing that each factor acted independently.

Data of grain yield (ardb/fad) and biological yield (ton/fad) during two winter growing seasons are presented in Table (4).

Table 4. Mean performance of 4 wheat cultivars under four nitrogen levels for grain yield (ardb/fad) and biological yield (ton/fad) during two winter growing seasons 2003/2004 and 2004/2005.

Characters / Seasons	Biological yield (ton/fad)		Grain yield (ardb/fad)	
	I	II	I	II
Cultivars (C) :				
Gemmeiza 9	9.084	9.161	18.316	19.635
Sakha 69	8.250	7.176	19.918	20.941
Sakha 93	7.324	6.940	20.766	21.676
Giza 168	8.295	7.149	20.206	21.770
L.S.D.	0.560	0.438	2.042	1.879
Nitrogen levels (N):				
25 KgN/fad	7.168	6.288	18.795	21.256
50 KgN/fad	8.745	8.455	23.286	24.558
75 KgN/fad	8.781	7.866	20.953	21.455
100 KgN/fad	8.258	7.816	16.170	16.753
L.S.D.	0.371	0.497	1.447	1.870
Interaction :				
C × N	**	N.S	N.S	N.S

N.S = not significant
** = significant at 5% level of probability

Statistical analysis of grain and biological yield for wheat cultivars and nitrogen fertilization levels showed highly significant variations. This was true in both growing seasons.

As for wheat cultivars, the highest grain yield was obtained for Sakha 93 followed by Giza 168 in both seasons. Sakha 93 gave 20.766 and 21.676 ardb/fad., for the 1st and 2nd seasons, respectively. Giza 168 recorded 20.206 and 21.770 ardb/fad for 1st and 2nd season, respectively. Gemmeiza 9 produced the lowest grain yield (ardb/fad) in both seasons. These results are in accordance with those obtained by El-Wakil and Abd Alla (2004).

The obtained results of nitrogen fertilization levels indicated that the highest grain yield was recorded for 2nd level (50 kg N/fad) followed by the 3rd dose of nitrogen level (75 kg N/fad). This was true in both growing seasons. These results are in agreerat with the findings of Tammam *et al.,* (2000), (Saleh (2003) and El-Wakil and Abd Alla (2004) .

The lowest grain yield (ardb/fad) was recorded when applying 100 kg N/fad. This was true in both seasons.

The interaction effect between wheat cultivars and nitrogen fertilization revealed insignificant variation, indicating that each factor acted independently.

Concerning biological yield, the highest biological yield was obtained by Gemmiza 9 (9.084 and 9.161 ton/fad for 1st and 2nd seasons), respectively followed by Giza 168 (8.295 and 7.149 for 1st and 2nd seasons, respectively. The lowest biological yield was recorded for Sakha 93 (7.324 and 7.149 ton/fad) for 1st and 2nd seasons, respectively). These results are in agreement with those obtained by Shehab El-Din and Eissa (1992) and Allam (1996) and Saleh (2003).

The trend was observed for nitrogen fertilization levels in grain yield giving evidence for the positive association between grain yield (ardb/fad) and biological yield (ton/fad). These results are in harmony with those obtained by Ismail (2001), Mahfouz and Ghabour (2003) and Zeidan (2003).

The interaction effect between wheat cultivars and nitrogen fertilization showed significant effect in 1st season, and insignificant effect was noticed in the 2nd one.

Character associations :

The phenotypic, genotypic and environmental correlations among the various characters in the two growing seasons (2003/2004 and 2004/2005) are presented in Table (5). In most cases there was a close agreement between phenotypic and genotypic correlation, while in other cases, the differences were high in both seasons, signifying the importance of the environmental effects in estimating these parameters.

As for grain yield, significant and positive association was found with number of grains/spike, at phenotypic and genotypic level, in 1st and 2nd season, respectively. In 2nd season, significant and positive relationship was found between grain yield and spike length at both phenotypic and genotypic association of 0.914^{**} and 0.716^{**}, respectively.

Also, grain yield was associated positively and significantly with plant height at environmental level in 2nd season, positive and significant association at phenotypic level was observed with days to maturity.

In 1^{st} season, plant height was related positively and significantly, at phenotypic and genotypic levels, with number of spikes/m^2 (0.952^{**} and 0.892^{**}) and biological yield (0.765^{**} and 0.526^{*}). Also, negative and significant association was detected with number of grains/spike at environmental level. In 2^{nd} season, also, positive and significant association was recorded among plant height and days to maturity, number of grains/spike and biological yield at phenotypic and genotypic levels, respectively. These results are in close agreement with those of El-Nagar (1997).

Table 5. Phenotypic (r_p), genotypic (r_g) and environmental (r_c) correlation coefficients during 2003/2004 (upper diagonal) and 2004/2005 (lower diagonal) winter growing seasons for 8 characters of 4 wheat cultivars under 4 nitrogen levels.

		(1) Grain yield ardb /fad	(2) Plant height (cm.)	(3) Spike length (cm.)	(4) Days to mat-urity	(5) Number of spikes /m₂	(6) Number of grains /spike	(7) 1000-grain weight (g.)	(8) Bio-logical yield (ton/fad)
	rp		0.071	0.491	0.562*	0.009	0.933**	0.218	0.026
1	rg		0.067	0.100	0.475	0.011	0.617*	0.192	0.053
	re		0.082	0.155	0.285	0.024	0.058	0.139	0.203
	rp	0.030		0.498	0.018	0.952**	0.489	0.086	0.765**
2	rg	0.141		0.259	0.194	0.892**	0.284	0.001	0.520*
	re	0.574*		-0.015	0.111	-0.165	-0.868**	-0.205	-0.236
	rp	0.914**	-0.087		-0.428	-0.210	0.869**	0.742**	0.975**
3	rg	0.716**	-0.131		-0.171	-0.107	0.977**	0.768**	0.454
	re	0.146	-0.219		0.070	-0.054	0.210	0.020	0.092
	rp	0.130	0.890**	0.230		-0.445	0.337	0.153	0.706**
4	rg	0.135	0.710**	0.184		-0.402	0.268	0.173	0.666**
	re	0.400	-0.009	0.044		-0.246	0.040	0.396	0.073
	rp	0.434	-0.129	0.209	0.443		-0.332	-0.161	-0.034
5	rg	0.333	-0.136	0.729**	0.342		-0.247	-0.127	-0.031
	re	0.068	-0.151	0.299	0.070		0.041	0.095	-0.038
	rp	0.692**	0.997**	0.315	0.809**	0.140		0.408	0.570
6	rg	0.572**	0.704*	0.444	0.584*	0.092		0.379	0.451
	re	0.359	0.057	0.155	0.304	0.043		0.324	0.086
	rp	0.174	0.567**	-0.881**	-0.692**	-0.192	0.090		0.179
7	rg	0.145	0.405	-0.456	-0.524*	-0.107	0.057		0.182
	re	0.035	0.007	0.447*	0.298	0.058	0.015		0.230
	rp	0.067	0.980**	-0.003	0.776**	-0.019	0.557*	0.137	
8	rg	0.061	0.976**	0.004	0.732**	-0.043	0.390	0.364	
	re	0.044	-0.025	0.039	0.201	-0.178	0.159	0.696**	

At phenotypic and genotypic levels, spike length was related positively and significantly to number of grains/spike and 1000-grain weight and at phenotypic level only with biological yield. This was true in 1^{st} season. Also, days to maturity was associated positively and significantly with biological yield.

In 2^{nd} season, spike length was correlated positively and significantly, at genotypic level, with number of spiks/m^2. But, negative and significant, at phenotypic level, accused with 1000-grain while, positive and significant at environmental level. At phenotypic and genotypic levels, positive and significant associations were recorded among days to maturity on one hand and both of number of grains/spike and biological yield on the other hand. Negative association was observed, also, at phenotypic and genotypic levels with 1000-grain weight.

At phenotypic level, positive and significant relationship was recorded between, biological yield and number of grains/spike. Biological yield was associated positively and significantly with 1000-grain weight.

Path coefficient analysis :

Direct and indirect effects of yield components under various nitrogen levels for 4 wheat cultivars (combined data in both seasons) are given in Table (6). The results showed that the highest contribution for grain yield of wheat cultivars was recorded for number of grains/spike. 1000-grain weight followed by number of grains/spike in contribution for grain yield. The lowest contribution was obtained for number of spikes/m^2. This may be due to the environmental effects on number of spikes/m^2.

The indirect effects was the highest for spikes m^2 × grains/spikes. Meanwhile, negative and indirect effects were obtained for spikes/m^2 × 1000-grain weight and grains / spike × 1000-grains weight. This may be due to the prevalence of decreasing alleles controlling these interactions.

These findings are in accordance to those obtained by Tammam *et al.* (2000) Ismail (2001) and El-Wakil and Abd-Alla (2004).

These results are of great interest for agronomist and plant breeder to release high yielding wheat genotypes to raise grain yield of new genotypes of wheat and increase self sufficiency in wheat production to face the demand for Egyptian people.

Table 6. Direct and indirect effects of yield components to grain yield under various levels of nitrogen for 4 wheat cultivars (combined data) .

Items	Coefficient of determination C.D.	Percentage
Direct effects		
1. Number of spikes/m^2 P_1^2	0.03882	3.882
2. Number of grains/spike P_2^2	1.14806	114.806
3. 1000-grain weight P_3^2	0.09345	9.345
Indirect effects		
Spikes/m^2×grains/spike $2P_1P_2\,r_{12}$	0.40913	40.913
Spikes/m^2×1000-grains weight $2P_1P_3\,r_{13}$	-0.11771	-11.771
Grains/spike×1000-grains weight $2P_2P_3\,r_{23}$	-0.61651	-61.651
R^2	0.955239	95.523
P^2E	0.044761	4.477
Total	1.000	100.00

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متوسط السلوك والارتباط وتحليل معامل المرور لمحصول الحبوب ومكوناته لأربعة أصناف من قمح الخبز نامية تحت أربعة مستويات من التسميد النيتروجيني

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قسم بحوث القمح ، معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية ، جيزة

لدراسة متوسط السلوك والارتباط المظهري والوراثي والبيئي بالإضافة لمعامل المرور للمحصول ومكوناته تحت مستويات مختلفة من التسميد النيتروجيني تم إجراء تجربتين حقليتين خلال موسمي ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ في محطة بحوث كفر الحمام الزراعية ، الزقازيق ، محافظة الشرقية ، مركز البحوث الزراعية .

ولقد تم دراسة استجابة ٤ أصناف من قمح الخبز هي جميزة ٩ ، سخا ٦٩ ، سخا ٩٣ ، جيزة ١٦٨ لأربعة مستويات من التسميد الأزوتي ٢٥ ، ٥٠ ، ٧٥ ، ١٠٠ كجم نتروجين/للفدان . ولقد تم استخدام تصميم القطع المنشقة في ثلاث مكررات حيث تم توزيع أصناف القمح في القطع الرئيسية عشوائياً . بينما وضعت مستويات التسميد في القطع الشقية.

ولقد أوضحت النتائج المتحصل عليها وجود اختلافات معنوية عالية بين أصناف القمح تحت الدراسة لصفات عدد الأيام حتى النضج ، طول السنبلة ، عدد السنابل / م٢ ، وزن الألف حبة ، المحصول البيولوجي (طن / فدان) ، محصول الحبوب (أردب/فدان) بينما كان ارتفاع النبات (الموسم الثاني) وعدد حبوب السنبلة (الموسم الأول) معنوية فقط . ولقد تم أيضاً مشاهدة اختلافات معنوية بين مستويات التسميد النيتروجيني لكل الصفات تحت الدراسة . وكان ذلك حقيقياً في الموسمين ما عدا ارتفاع النبات (الموسم الأول) ، ولقد كان الصنف سخا ٩٣ أقصر في طول النبات وأطول في طول السنبلة ومبكراً في ميعاد النضج . ولقد تم تسجيل أعلى عدد للسنابل / م٢ للصنف سخا ٦٩ وأعلى عدد من الحبوب للصنف جيزة ١٦٨ ، ولقد سجل الصنف جميزة ٩ أعلى وزن للألف حبة . كما أعطى الصنف سخا ٩٣ أعلى محصول حبوب (أردب/فدان) . بينما تم تسجيل أعلى محصول بيولوجي بواسطة الصنف جميزة ٩ ..

ولقد لوحظ اختلافات معنوية لمستويات النتروجين . واختلفت قيم الصفات المختلفة تحت مستويات النتروجين من صفة إلى أخرى كما كان التفاعل بين الأصناف ومستويات النتروجين كان غير معنوي .

ولقد أوضح الارتباط بين الصفات أن محصول الحبوب ارتبط معنوياً وموجباً مع عدد حبوب السنبلة على مستوى الارتباط المظهري والوراثي في كلا الموسمين . وأيضاً ارتبط طول السنبلة موجباً ومعنوياً مع محصول الحبوب (أردب/فدان) في الموسم الثاني .

ولقد أظهر تحليل معامل المرور أن أعلى مساهمة في محصول الحبوب كان راجعاً لعدد حبوب السنبلة ، يتبعه وزن الألف حبة .

وهذه النتائج ذات أهمية لمنتج القمح والباحث في إنتاج المحاصيل بالإضافة لمربى النبات ليعطي معلومات مفيدة لإنتاج القمح وكذلك تربية تراكيب وراثية عالية الإنتاجية للمساهمة في رفع نسبة الاكتفاء الذاتي من القمح في مصر .