Nitrogen Requirements for Maize Cultivars after Different Winter Crops

Nawar, A. I.
Crop Sci. Dept., Faculty of Agriculture, Alexandria University

ABSTRACT

Two field experiments were performed at the Agricultural Experimental Station, Alexandria University, Alexandria, Egypt, to compare the effect of three nitrogen levels (90, 105 and 120 kg/fed) on three maize cultivars (Giza 10, Giza 310 and Giza 2) after three winter crops (faba bean, wheat and flax) during 2000 and 2001 summer seasons. A split-split plot experimental design (three replicates) was used.

Faba bean significantly increased plant height, 100-grain weight, ear grain weight and grain yield of maize in both seasons. Giza 10 was superior to Giza 310 and Giza 2 for ear leaf area, number of grains/ear, grain weight/ear and grain yield/fed during the two seasons.

The high linear response of grain yield to N rates, after the three preceding crops, and the lack of quadratic effect for N rates, indicated that maize might a show positive response to N rates above 120 kg/fed. Increasing N rate by one kg/fed increased grain yield of Giza 10 cultivar by 0.078 ardab/fed (as an average of the two seasons).

Stepwise regression analysis, as represented by R^2 (coefficient of determination) values, indicated that the number of grains per ear, ear grain weight and ear leaf area contributed to about 95% of the variation in grain yield in the first season. In the second season, the same traits, in addition to the number of leaves/plant, explained about 98% of the variation in grain yield.

Keywords: Maize, crop sequence, nitrogen fertilization.

INTRODUCTION

Maize, one of the most important cereals in the world agricultural economy, is used as a food crop for man and a feed for animals. Appropriate crop positioning in crop sequence, a high yielding cultivar and an optimum nitrogen level are important management decisions to reach maximum yield from any crop. Residues amount and quality (C/N ratio) of a previous crop affect the subsequent one. Narrow C/N ratio (below 20:1, as in legumes) increases N mobilization by microbial organisms and the reverse is true with wide C/N ratio (above 20:1), as in flax and wheat (Jones, 1987).

The value of legumes inclusion in a sequential cropping system has been attributed to the contribution they make to the following crop (soil supply with organic matter and available organic N) and reduction of its dependence on chemical N fertilizers (Narwal and Malik, 1989; and Echeverria *et al.*, 1992). Faba bean rational value may lie in soil supplementation with 60-80 kg/ha from residual nitrogen (Summerfield and Roberts, 1985). This crop, as reported by Khalil *et al.*, (1999 and 2000), increased grain yield of the following maize, compared to maize after wheat and other non-legumes. Meanwhile, wheat release chemical compounds that reduce soil N availability, due to

N immobilization for a longer duration by wheat residues, losses of fertilizer N by denitrification and inhibited nitrification with NO_3^-–N. leaching by irrigation water (Rizivi and Rizivi, 1992). Regarding flax, Zenter *et al.* (1987) suggested that lower soil N use coupled with a reduction in allelopathy may have been responsible for improved yield when spring wheat followed flax than after wheat. Several investigators examined the effect of different preceding crops on maize characteristics including plant height (Khalil *et al.*, 1999), number of leaves/plant and ear leaf area (Khalil *et al.*, 2000) and number of grains/ear, 100-grain weight and ear grain weight (Ahlawat *et al.*, 1983; Narwal and Malik, 1989 and Ramibault and Vyn, 1991).

Nitrogen, an essential element for the biochemical driving yield producing processes, plays a vital role in plant life, concerning the development of vegetative and reproductive organs (Sinclair and Horie, 1989). Nevertheless, the practice of N application more than crop requirement may be a reason for the N transformation into NO_3^-–N followed by N, leaching (Hooker *et al.*, 1983). Several studies were conducted to report the effect of N supply on growth aspects of maize. Faisal (1989) and Amer *et al.* (1995) reported that N supply to maize increased plant height, number of leaves/plant and leaf expansion. However, Lemcoff and Loomis (1988); Muchow (1988); McCullough *et al.* (1994) and Uhart and Andrade (1995) attributed the increases in maize grain yield to the increases in number of grains/ear and single grain weight, as influenced by increasing N levels.

Release of cultivars, high in grain yield and responsive to surrounding conditions, is necessary for increasing maize grain yield potential. It was concluded that maize crosses out-yielded open-pollinated cultivars (Ragheb *et al.*, 1993 and Ali *et al.*, 1994). Meanwhile, reports of Tantawy (1994) and Attallah (1996) showed that single cross Giza 10 was superior to the 3-way cross, Giza 310 and the synthetic cultivar, Giza 2, in productivity.

This investigation was conducted to study the response of maize cultivars to nitrogen fertilization rates after different winter crops.

MATERIALS AND METHODS

The present investigation was conducted at the Agricultural Experimental Station, Alexandria University, Alexandria, Egypt, during the two summer seasons of 2000 and 2001 on clay loam soil with a pH value of 8.2 and a 1.8% organic matter content. A split-split plot experimental design, with three replicates, was used, where the main plots were assigned to the preceding crops (faba bean = P1; wheat = P2 and flax = P3). The N rates of 90 (= N1), 105 (=N2) and 120 (=N3) kg/fed were allocated to the sub-plots, whereas, maize cultivars [Giza 10 (= single cross); Giza 310 (= 3-way cross) and Giza 2 (= synthetic)] occupied the sub-sub plots. Sowing date was May 20th and 25th in 2000 and 2001 seasons, respectively. Each experimental unit comprised five ridges, each 5 m long and 0.7 m wide (17.5 m^2 = 5 × 3.5 m). Seeds were sown in hills, spaced at 30 cm with one seed/hill. Nitrogen was added in the form of ammonium nitrate (33.5%) in two equal splits; at the second and third irrigations (after sowing irrigation). All other cultural practices were carried out as recommended for maize production in the region.

At harvest, data were recorded for plant height (cm), number of leaves/plant, ear leaf area (cm^2), number of grains/ear, 100-grain weight (g), weight of grains/ear (g) and grain yield/fed (ardab). Statistical analysis for these characters and estimation of regression response of grain yield to N rates for each of maize cultivars, or following each of the preceding crops, were carried out, according to Gomez and Gomez (1984). Also, grain yield was subjected to stepwise regression analysis (according to Gomez and Gomez, 1984) in relation to plant height, number of leaves/plant, ear leaf area, number of grains/ear and 100-grain weight in both seasons to determine the relative role for each of these characters in explaining the variations in grain yield.

RESULTS AND DISCUSSION

The analysis of variance presented in Table (1) indicated that plant height, 100-grain weight, ear grain weight and grain yield/fed responded significantly to the effect of the preceding crops during the two seasons. Meanwhile, variations were significant among N rates for plant height, ear leaf area, number of grains/ear, ear grain weight and grain yield/fed in both seasons. Furthermore, significant differences were detected among cultivars for ear leaf area, number of grains/ear, ear grain weight and grain yield/fed during 2000 and 2001 seasons. There were significant preceding crops X N levels interactions for number of grains/ear and grain yield/fed in both seasons. However, significant interactions of N levels with cultivars were found for number of grains/ear and grain yield/fed during the two consecutive seasons. In fact, the other two- and three-factor interactions were not significant (Table 1).

Data in Table (2) indicated that maize after faba bean was significantly taller than that in the other cropping sequences. The increases in plant height for P1 plants, compared to that for P2 and P3 plants, might have been attributed to the higher soil organic matter and N content that largely enhanced the maize vegetative growth in terms of plant height (Ahlawat *et al.*, 1983; Narwal and Malik, 1989 and Khalil *et al.*, 1999 and 2000). The short plant height, following wheat, might result from a reduction in soil N content due to N immobilization by wheat residues for a larger period, losses in fertilizer N by leaching of NO^-_3–N and denitrification (Rizvi and Rizvi, 1992).

Responses of 100-grain weight to the preceding crop (Table 2) were found to be significantly greater after faba bean than following either flax or wheat by 0.95 and 1.81 g (as average of the two seasons), respectively. The superiority of 100-grain weight for maize after faba bean might be attributed to increasing soil N (due to faba bean N less uptake) and carry over of N from its residues to the subsequent maize. As a result, there was an increase in photosynthetic rate and photo-assimilates translocation into grains, leading to the increase in 100-grain weight. Furthermore, 100-grain weight for maize, grown after flax was higher than grain weight of maize following wheat. These results might be associated with lower soil N use, coupled with a reduction in allelopathy by flax, compared to wheat (Zenter *et al.*, 1987).

It should be noted that significant variations were found among the different preceding crops for ear-grain weight in both seasons (Table 2). Such weight for maize, following flax and wheat, were almost statistically equal, but was significantly lower than the corresponding values after faba bean in both seasons. On the average of both seasons, increases in weight of grains/ear after faba bean were 4.89 and 11.0g greater than ear grain weights after flax and wheat, respectively. Higher soil N status and improved physical structure after faba bean might have been the reason for increased weight of maize grains/ear as a result of increases in dry matter accumulation into grains (Ahlawat *et al.*, 1983). This also, could be explained by the increases in number of grains/ear (though not significant) and 100-grain weight.

Data presented in Table (2) further showed that variations of the effects among the preceding crops on grain yield/fed were significant in both seasons. Maize after faba bean produced 3.97 and 1.96 ardab in 2000 and 3.47 and 1.55 ardab in 2001 greater than yields after wheat and flax, respectively. Improved soil physical structure and high content of N and organic matter after faba bean were favorably reflected in higher productivity of the succeeding maize grain yield and its components. It was concluded that faba bean, as a preceding crop, was superior to flax and wheat in this respect. This might be attributed to the good residual effect of the legume and enriching the soil with N and organic matter (Summerfield and Roberts, 1985; Narwal and Malik, 1989; Senarante and Hardarson, 1988; Echeverria *et al.*, 1992 and Khalil *et al.*, 1999 and 2000). Also, data indicated a pronounced superiority in maize characters when grown after flax than after maize grown following wheat. This might be, as had also, been reported by Zenter *et al.* (1987), due to the lower soil N use, coupled with a reduction in allelopathy of flax than after wheat.

Mean values in Table (2), also, showed the significant response of plant height of maize to N supply. It was clear that such height proportionally increased to the increase in the rate of N supplied during the two seasons. Maize plants, supplied with 120 kg N/fed were 43.2 and 60.7 cm taller than those of receiving 90 and 105 kg N/fed in 2000 season, and were 42.0 and 55.7 cm taller in the 2001 season, respectively. These results might be attributed to the stimulating effect of N on the internode elongation during the vegetative growth period in maize and were in accordance with data reported by Faisal (1989) and Amer *et al.* (1995).

In addition, data in Table (2) revealed the presence of significant variations in ear leaf area with N supply. Increasing N rate up to 105 kg/fed insignificantly increased the value of that trait, however, further N increment

(120 kg/fed) was associated with significant increase in ear leaf area in both seasons. The increase in nitrogen supply and greater N uptake by maize might increase the length and width dimensions leading to increase in the ear-leaf over all expansion (Gardner *et al.*,1985; Uhart and Andrade, 1995). Ear-leaf area at 120 kg N/fed was greater than ear leaf area of 90 and 105 kg/N rates by 17.34 and 22.89 cm^2 in 2000 and by 9.26 and 12.00 cm^2 in 2001, respectively. These results contradicted with those of McCullough *et al.* (1994), but were in agreement with those of Muchow (1988) and Uhart and Andrade (1995) who reported that a single leaf expansion increased proportionally to the increase in N rate.

Number of grains/ear, ear grain weight and grain yield/fed (Table 2) appeared to show similar trends in their response to N supply over the two seasons. They proportionally increased to the increase of N rate applied in both seasons. The relative values of number of grains/ear, as averages of the two seasons, were 422.45, 447.92 and 482.25 for N1, N2 and N3, respectively. Furthermore, weight of grains/ear in N3 was 11.26 and 8.00g greater than that obtained from N1 and N2, in 2000, and was 12.11 and 6.08g greater in 2001, respectively. Maize grain yield/fed was directly related to the rate of N applied; the maximum of 24.10 ardabs/fed in 2001 and the minimum of 19.02 ardabs/fed responses were observed at 120 and 90 kg N/fed, respectively. It could be concluded that N shortage seriously affected the grain yield/fed because it reduced ear grain weight and its attributes; i.e., ear grain number and single grain weight. Losses in grain number might be a result of failure in spikelets fertilization and/or increases in the abortion of developed grains due to inadequate N. A reduction in N supply, paralled with a decrease in crop growth rate, caused a drop in current assimilates afflux to the spikelets, leading to spikelets competition for assimilates and higher mortality or infertility of pollen grains, hence, fertilization failure and decrease in number of grains/ear, in addition to a decrease in single grain weight and finally, to a reduction in grain yield. This conclusion has been represented by several investigators (Lemcoff and Loomis, 1986; Schussler and Westage, 1991 and Uhart and Andrade, 1995) and Hassan (1995). These results are in agreement with those of Faisal (1989); Sinclair and Horie (1989); Coonor *et al.* (1993) and Ali *et al.* (1994).

As reported, the response of maize grain yield to nitrogen level was linear showing that the effect of higher N doses on increasing such yield needed more investigations to determine the optimum level of N required for maize growth.

Data regarding cultivars (Table 2) indicated that Giza 10 gave the largest ear leaf area 882.9 cm^2) followed by Giza 310 (812.19 cm^2) that was 33.5 cm^2 greater (an average of both seasons) than ear leaf area for Giza 2 cultivar. However, Giza 10 was equal to Giza 310, but greater than Giza 2 in number of grains/ear, ear grain weight and grain yield/fed in both seasons. Decreases in number of grains/ear for Giza 2, compared to Giza 10 and Giza 310, were 55.41 and 51.22 grains, in 2000, and were 57.50 and 55.17 grains in 2001 season, respectively. However, corresponding decreases, related to ear grain weight, were 10.85 and 10.11, in 2000, and 7.69 and 6.93 in 2001, respectively. In addition, grain yield of Giza 10 was equal to that of Giza 310, but was 1.37 ardab greater than that obtained from Giza 2, as an average of both seasons. It could be concluded that increases in ear leaf area might have been associated with increases in photo-assimilates that increased ear grain weight and its attributes (number of grains/ear and a single grain weight), hence, increased grain yield/ fed for Giza 10 and Giza 310, compared to Giza 2 cultivar. These results were in agreement with those published by the Egyptian Ministry of Agriculture (2002) that indicated the superiority of both Giza 10 and Giza 310, as high yielding cultivars, to Giza 2. Also, the present results were in agreement with those reported by Tantaway (1994) and Attalha (1996) who reported that Giza 10 exceeded Giza 310 in grain yield potential.

The preceding crops X N rates interactions (Table 3) indicated that increase in N supply significantly increased the number of grains/ear and grain yield/fed over all the three preceding crops during the two successive seasons. The difference, in relative magnitude of increase in these two characters, was in favour of faba bean, followed by flax, then, wheat in the two seasons. The increase in number of grains/ear from N1 to N3 were about 50, 53 and 50 grains in 2000, and about 83, 70 and 73 grain, in 2001, for faba bean, flax and wheat, respectively. The respective increases in grain yield/fed were 5.36, 4.20 and 3.91 ardabs in 2000, and 4.62, 4.30 and 2.13 ardabs in 2001. The superiority of these characters after faba bean, compared to flax and wheat might be attributed to the favorable effect of the legume on soil characteristics. Increases in N supply, in addition to the increase in soil available N after faba bean, increased N uptake and photo-assimilates translocated into maize silk, thus, reducing both failure of spikelets, fertilization and abortion of grains, leading to an increases in a single grain weight, number of grains/ear and, hence, increasing grain yield.

Furthermore, there were significant N rates X cultivars interactions for number of grains/ear and grain yield/fed in both seasons. Responses were found either between N rates over all the three cultivars, or between cultivars at each N rate. The increase in N1 supply proportionately increased to reach the maximum values of the two traits at 120 kg N/fed applied to Giza 10 and Giza 310 in both seasons.

Describing the change in grain yield for every change in the rate of applied nitrogen, a trend comparison was worked out and summarized in response equations (Table 4). The rate of increase varied after the preceding crops and with cultivars over the whole range of nitrogen. The rate of grain yield increased with the increase in the rate of nitrogen application by kg/fed was 0.161 ardab grain for faba bean (an average of the two seasons), and that was higher than those obtained following flax and wheat by 0.019 and 0.027 ardab grain, respectively. Applying 1.0 kg of nitrogen resulted in an average increase of 0.078 ardab grain yield for Giza 10, compared to 0.065 and 0.054 ardab grain for Giza 310 and Giza 2 cultivars, respectively. Consequently, as reported, nitrogen application contributed mostly to grain yield after faba bean (than flax and wheat) and Giza 10 was the most responsive to N application than Giza 310 and Giza 2 cultivars. Good behaviour response of maize after faba bean to nitrogen might be attributed to remedy of soil chemical properties, leading to the increase in response of maize to N supply (Ahlawat *et al.*, 1983 and Narwal and Malik, 1989). The high linear response of maize grain yield to applied N levels, after the three preceding crops, in addition to the lack of quadratic effect for N levels, indicated that maize might show positive response to N rates above 120 kg N/fed. These results were in agreement with those of Ali *et al.* (1994) who reported that maize linearly responded to N level up to 120 kg N/fed. Superiority of Giza 10 to the other cultivars in its response to N rate might be a result of vigorous growth for plants of this cultivar during the early vegetative growth, leading to the faster and greater response to the applied N (Hassan, 1995). For equations in (Table 4), the maximum (R^2 = 100%) and the minimum (R^2 = 88%) variation in grain yield (as an average of the two seasons) could be attributed to maize response to N application following faba bean and wheat, respectively. Meanwhile, corresponding values were 97.0 and 84.6% for Giza 10 and Giza 2 cultivars, respectively.

The data of stepwise regression analysis (Table 5), as represented by R^2 values, indicated that the number of grains/ear, ear grain weight and ear leaf area contributed to about 95% of the variations in grain yield in the first season. In the second season, the same traits, in addition to number of leaves/plant, explained about 98% of the grain yield of maize. That might emphasize the role of these traits in prediction of grain yield of maize and differentiate between maize genotypes response on quantitative basis in the present investigation.

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Table 1. Mean squares for maize characters in 2000 and 2001 seasons.

S.O.V	d.f.	Plant height (cm)		Number of leaves/plant		Ear-leaf area (cm^2)		Number of grains/ear		100-grain weight (g)		Ear grain weight (g)		Grain yield/fed. (ardab)	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Preceding crops (A)	2	*	*	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	*	*	*	*	*	*
Error (a)	4	19.66	9.49	1.100	1.353	103.35	158.18	116.57	164.79	1.729	1.047	17.55	82.25	0.83	1.38
Nitrogen rates (B)	2	*	*	n.s.	n.s.	*	*	*	*	n.s.	n.s.	*	*	*	*
A × B	4	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	*	*	n.s.	n.s.	n.s.	n.s.	*	*
Error (b)	4	16.91	16.93	3.280	3.445	98.82	62.64	106.41	32.747	1.76	0.89	44.13	19.91	17.07	1.74
Cultivars (C)	2	n.s.	n.s.	n.s.	n.s.	*	*	*	*	n.s.	n.s.	*	*	*	*
A × C	4	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
B × C	4	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	*	*	n.s.	n.s.	n.s.	n.s.	*	*
A × B × C	8	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Error (c)	36	29.12	21.83	0.76	1.36	96.93	85.02	69.30	43.70	1.13	0.88	34.13	6.02	0.125	0.134

* Significant at the 0.05 level of probability. n.s. = Not significant

Table 2. Mean values of maize characters as affected by preceding crops, nitrogen rates and cultivars in 2000 and 2001 seasons.

Treatments	Plant height (cm)		Number of leaves/plant		Ear leaf area (cm^2)		Number of grains/ear		100-grain weight (g)		Ear grain weight (g)		Grain yield/fed. (ardab)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Preceding crops:														
Faba Lean (P1)	257.15	234.67	18.30	17.89	810.50	807.70	455.75	438.07	41.50	39.50	180.30	186.48	23.19	23.64
Wheat (P2)	245.37	224.81	17.90	17.72	809.70	805.90	454.11	438.00	37.74	37.74	168.48	176.28	19.23	20.17
Flax (P3)	205.96	223.93	17.76	16.89	809.40	805.30	453.70	436.48	40.26	38.84	177.70	179.30	21.23	22.09
L.S.D. 0.05	3.45	2.39	---	---	---	---	---	---	0.99	0.77	10.01	6.85	0.69	0.90
Nitrogen rates (kg/fed):														
N1 = 90	223.41	204.59	18.29	17.30	800.41	801.04	429.63	415.26	40.75	39.91	167.37	177.00	19.02	19.75
N2 = 105	240.96	218.48	18.31	17.50	805.96	803.78	457.63	438.21	40.10	39.70	170.63	182.93	21.34	22.05
N3 = 120	284.11	260.30	18.42	17.70	823.30	813.04	478.70	455.89	40.00	39.15	178.63	189.11	23.39	24.10
L.S.D. 0.05	2.43	2.44	---	---	5.90	2.99	3.94	2.65	---	---	3.94	2.65	2.45	1.78
Cultivars:	251.44	230.40	18.76	17.67	834.04	931.74	474.19	457.96	40.47	40.00	176.11	182.76	21.72	22.46
Giza 10	250.56	227.15	18.44	17.78	812.48	811.89	470.00	455.63	40.23	39.77	175.37	182.00	21.63	22.36
Giza 310	244.48	225.85	18.13	17.06	783.15	774.22	418.78	400.46	40.00	39.39	165.26	175.07	20.38	21.07
Giza 2														
L.S.D. 0.05	---	---	---	---	5.40	2.75	4.94	3.64	---	---	3.21	1.35	0.19	0.11

Table 3. Interactions of N rates with each of preceding crops and cultivars in 2000 and 2001 seasons.

Nitrogen rate	Preceding crops						Cultivars					
	Number of grains/ear			Grain yield/fed			Number of grains/ear			Grain yield/fed		
	P1[2]	P2	P3	P1	P2	P3	Giza 10	Giza 310	Giza 2	Giza 10	Giza 310	Giza 2
	2000						2000					
N1 [1]	440.60	431.00	437.25	20.29	17.19	19.22	467.78	429.78	396.67	21.55	20.51	18.27
N2	444.41	440.56	441.33	23.29	19.60	21.05	492.60	454.78	423.89	22.15	22.02	18.91
N3	490.22	484.00	487.22	25.65	21.10	23.42	525.56	462.78	435.78	23.67	23.42	19.86
L.S.D. 0.05		6.82			0.336			7.93			0.34	
	2001						2001					
N1	406.11	402.00	405.33	21.28	18.93	20.02	457.22	402.11	371.44	21.96	21.20	18.97
N2	422.33	418.00	419.00	23.74	20.47	21.93	482.33	417.33	408.50	22.85	22.78	19.64
N3	489.22	472.18	478.79	25.90	21.06	24.32	500.33	451.33	422.69	24.40	24.15	20.62
L.S.D. 0.05		6.30			0.348			6.30			0.348	

(1) N1, N2 and N3 = 90, 105 and 120 kg nitrogen/fed, respectively.

(2) P1, P2 and P3 = Faba bean, wheat and flax, respectively.

Table 4. Response equation for maize grain yield to N rates after preceding crop and with cultivars in 2000 and 2001 seasons.

Factors	2000		2001	
	Equations	R^2	Equations	R^2
Preceding crops:				
Faba bean (P1)	$Y = 5.66 + 0.167\,x$	1.000	$Y = 7.47 + 0.154\,x$	1.000
Wheat (P2)	$Y = 6.50 + 0.140\,x$	0.950	$Y = 6.38 + 0.143\,x$	0.930
Flax (P3)	$Y = 6.80 + 0.130\,x$	0.870	$Y = 5.69 + 0.138\,x$	0.890
Cultivars:				
Giza 10	$Y = 15.27 + 0.077\,x$	0.970	$Y = 15.80 + 0.079\,x$	0.972
Giza 310	$Y = 14.36 + 0.064\,x$	0.639	$Y = 14.80 + 0.065\,x$	0.769
Giza 2	$Y = 13.45 + 0.053\,x$	0.884	$Y = 14.00 + 0.055\,x$	0.808

Table 5. Stepwise regression analysis of grain yield in relation to plant height (X_6), number of leaves/plant (X_5), ear leaf area (X_4), number of grains/ear (X_1), 100-grain weight (X_2) and ear grain weight (X_3) in 2000 and 2001 seasons.

2000 Variable	R^2	2001 Variable	R^2
X_1	0.870	X_1	0.889
X_1 X_4	0.930	X_1 X_4	0.903
X_1 X_3 X_4	0.944	X_1 X_3 X_4	0.935
X_1 X_3 X_5	0.947	X_1 X_3 X_5	0.941
X_1 X_2 X_3 X_5	0.948	X_1 X_2 X_3 X_5	0.960
X_1 X_2 X_3 X_5 X_6	0.949	X_1 X_2 X_3 X_5 X_6	0.981
X_1 X_2 X_3 X_4 X_5 X_6	0.949	X_1 X_2 X_3 X_4 X_5 X_6	0.985

الملخص العربي

الاحتياجات النيتروجينية لأصناف من محصول الذرة الشامية بعد محاصيل شتوية مختلفة

على عيسى نــوار
قسم المحاصـــيل – كلية الزراعة – جامعة الإسكندرية

أجريت تجربتان حقليتان بمحطة التجارب الزراعية لـ [illegible]ـعة الإسكندرية بالإسكندرية (ج٠م٠ع٠) لمقارنة تأثـــير ثـــلاث مستويات من النيتروجين (٩٠ ، ١٠٥ و ١٢٠ كجم نيتروجين/فدان) على ثلاثة أصناف من الذرة الشامية (جيزة ١٠ ، جيزة ٣١٠ و جيزة ٢) عقب ثلاثة محاصيل شتوية (الفول البلدي و القمح و الكتان) خلال الموسمين الصيفيين " ٢٠٠٠ و ٢٠٠١ ". وقد استخدم تصميم القطع المنشقة مرتين (ثلاث مكررات)٠

وقـــد وجـــد انـــه ازداد الفول البلدي معنويا في كل من ارتفاع النبات ووزن المائة حبة ووزن الحبوب بالكوز ومحصول الحبوب للذرة في الموسمين و قد تفوق الصنف "جيزة ١٠" على الصنفين "جيزة ٣١٠ و جيزة ٢" في المساحة الورقية للكوز و وزن الحبوب بالكوز و محصول الحبوب بالفدان في الموسمين.

وقـــد أوضحت الاستجابة الخطية التالية لمحصول الحبوب لمعدلات النيتروجين عقب المحاصيل الثلاثة الســـابقة، وغـــياب الاســـتجابة التربيعـــية لهذه المعدلات ، أن الذرة الشامية قد تظهر استجابة موجبة لمعدلات النيتروجيـــن فـــوق ١٢٠ كجـــم للفدان٠ وقد أدت إضافة كيلوجرام واحد نيتروجين للفدان إلى زيادة محصول الحبوب للصنف " جيزة ١٠ " بمعدل ٠,٠٧٨ أردب للفدان (كمتوسط للموسمين)٠

وقد أظهر تحليل الارتداد والممثل بقيم R^2 (معامل التلازم المضاعف)- أن كلا من عدد الحبوب بالكوز ووزن حـــبوب الكـــوز والمساحة الورقية للكوز قد ساهمت في تباين محصول الحبوب بمعدل ٩٥% في الموسم الاول. وفـــى الموسم الثاني ساهمت نفس هذه الصفات بجانب عدد أوراق النبات – بحوالي ٩٨% في تباين هذا المحصول٠