EFFECT OF SPLITTING DIFFERENT NITROGEN FERTILIZER LEVELS ON PRODUCTIVITY OF MAIZE

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ABSTRACT: The present investigation was conducted for two seasons (2002 and 2003) at the Experimental Farm ,Faculty of Agric., Zagazig Univ.,to study the effect of four nitrogen levels (0 ,40 ,80 and 120 kg /fad) and three times of application (T1: 1/2 at 20 day after sowing + ½ at 35 day after sowing, T2 : 1/3 at 20 day after sowing +1/3 at 35 day after sowing +1/3 at 50 day after sowing and T3: 1/4 at 20 day after sowing +1/4 at 35 day after sowing +1/4 at 50 day after sowing +1/4 at 65 day after sowing) on yield and its components of the maize hybird S.C .10 .

The obtained results indicated that the increase of N level up to 120 kg N/fad significantly increased plant height, ear height, stalk diameter, ear diameter, ear length rows/ear, grains/row, grains /ear, grain ear weight, shelling % and grain yield /fad .

Regarding the time of application, addition of nitrogen in two equal doses significantly increased yield and all of its attributes under study.

The results clearly reveal that the ear grain weight, number of grains/ear and the interaction between number of grains /ear and ear grain weight are considered the main sources of grain yield variation, having the relative contribution of 65.05 ,3.79 and 17.26%, consecutively. However, the contribution of 100-grain weight and number of grains /ear with 100 –grain weight had low contribution to final grain yield /fad, viz: 0.28 and 1.36 consecutively.

Keywords: Maize, nitrogen levels, nitrogen splitting, hybrid, yield components.

INTRODUCTION

Maize is one of the most important cereal crop grown principally during the summer season in Egypt. Maize grain is used for both human consumption and animal poultry feed .The local production of the crop is not sufficient to meet the continuous increase of consumption. Therefore, attempts to increase maize production are of most importance .Such attempts could be achieved through horizontal and vertical expansions.

Nitrogen fertilizer is an important factor in increasing yield of maize. Many investigators reported that increasing nitrogen levels up to 120 kgN/fad led to a significant increase in grain yield and its components (Bedeer *et.al.,* (1992), El–Hefnawy and El–Ashmoony (1992), Younis *et.al.,* (1994), Mokadem and Salem (1994), Abdel Gawad and El–Batal (1996), Samia Amer *et.al.,* (1995) , Selim and El-Sergany (1995), Samira Hussein *et.al.,* .(1998) , Farghly (2001) and El–Hassanin *et.al.,* (2002)).

Time of N application is considered to be among the important agricultural practices used to increase maize productivity. Several reports indicated that time of N-fertilizer application had a marked effect on grain yield and its components. Grouve *et.al.,*(1980) reported that the splitting of nitrogen fertilizer into a seedbed dressing and side – dressing after 7 weeks secured a significant increase of 10% in grain yield. Gouda (1989) demonstrated that adding N-fertilizer in three equal portions (1/3 at planting + 1/3 at 1 st irrigation + 1/3 at 2nd irrigation) increased grain yield /fad .Shlaby *et.al.,* (1990)showed that applying N-fertilizer either as single dress (at 2nd irrigation)or as double dresses (in two equal doses, before 1st and 2nd irrigation) gave maximum grain yield. Basha (1994) found that application of nitrogen fertilizer in two equal doses (at sowing and before 1st irrigation) gave the best results for plant and ear height. While splitting nitrogen into three equal doses (at sowing, before 1st irrigation and before 2nd irrigation) significantly increased each of shelling %, grain yield/fad and its components. El –Bana and Gomaa (1994) reported that the splitting nitrogen into 4 equal doses (at sowing, 25, 40 and 55 days after sowing) increased significantly plant height, ear length, ear diameter ,number of grains /row, grain weight /ear and grain yield /fad. However Mahgoub *et.al.*, (1994) reported that plant height, ear position ,number of ears /fed and grain yield were not affected by time of nitrogen application. Therefore, the aim of this investigation was to study the effect of nitrogen fertilizer levels and time of its application on productivity of maize .

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm, Faculty of Agriculture, Zagazig University during the two successive seasons 2002 and 2003 .Wheat was the preceding crop in both seasons. The soil was clay in texture with pH of 7.7, 1.5 % organic matter and 20, 4.8 and 200ppm available N, P and K, respectively.

Single cross 10 (S.C10) maize cv was sown in both seasons in the 2[nd] week of the June. The experimental treatments included four nitrogen fertilizer levels (0,40,80,and 120 kg N/faddan) in the form of urea (46.5%N) and three N splitting treatments as follows :

1- Two equal splits ,½ at 20 day after sowing +1/2 at 35 day after sowing (T1)
2- Three equal splits ,1/3 at 20 day after sowing +1/3 at 35 day after sowing+ 1/3 at 50 day after sowing 35 day (T2)
3- Four equal splits ,¼ at 20 day after sowing +1/4 at 35 day after sowing+ ¼ at 50 day after sowing +1/4 at 65 day after sowing(T3)

The experimental plot (10.5 m^2) consists of five rows (3 m long and 0.7 m apart), with two outer rows as borders, the second row for the single plants sample and the two middle rows for evaluating yield and yield attributes at harvest. The grains were sown in hills 25 cm apart .After 20 days from sowing, thinning to one plant/hill was done, giving a planting density of 24,000 plant/fad. The experimental design was a split plot with 3 replications where nitrogen fertilizer levels were distributed in the main plot and time of application treatments allocated in sub plots. All plots were fertilized with 31 kg P_2O_5/fad in the form of superphosphate (15.5%P_2O_5) and 50 kg K_2O/fad in the form of potassium sulphate (48%K_2O). All the other normal cultural practices for growing maize were practiced.

At maturity, the two center rows were harvested from each plot to determine grain yield and its attributes. Data on ear characters were taken from 5–ear samples.

The following data were recorded :

1- Plant height (cm)
2- Ear height (cm)
3- Stem(stalk) diameter (cm)
4- Ear diameter (cm)
5- Ear length (cm)
6- Number of rows /ear
7- Number of grains/row
8- Number of grains /ear
9- Hundred grain weight (gm)
10- Grain weight /ear (gm)
11- Shelling %
12- Grain yield in ardab per fad

(one ardab =140kg) adjusted to 15.5% moisture content. Analysis of variance was done according to Steel and Torri (1980) .All possible simple correlation coefficients among the yield and its attributes studied were calculated. Also the path coefficient analysis was performed for partitioning the contribution of yield components ,i.e. number of grains /ear ,ear grain weight and 100 –grain weight overall the nitrogen levels and the time of nitrogen application to grain yield / fad. The response equation of grain yield to the increase of N level was calculated according to Snedecor and Cochran (1967).

RESULTES AND DISCUSSION

The results recorded in Tables 1, 2, 3, and 4 reveal that check N versus all other treatments showed highly significant differences where the plots receiving any nitrogen level surpassed plots of the control .This was true in grain yield and yield attributes except plant height (first season and combine), stalk diameter (first season), 100-grain weight and shelling % (second season) where the differences between control and other treatments did not reach the level of significance.

1-Plant height ,ear height and stalk diameter:

1-a-Nitrogen level effect :

The results in Table (1) show that increasing level of nitrogen fertilizer from 40 to 120 kg N per faddan increased plant height ,ear height and stalk diameter in both seasons and combined analysis ,plots receiving 120 kg N/ fad produced the tallest plants , best ear height (46.92 % ear position) with the thickest stalk diameter compared with the other N-levels. The superiority of plant and ear heights and stalk diameter may be due to the role of nitrogen in stimulating the build up of amino acids and growth hormones. This in turn acts positively in cell division and enlargement.

Many researchers obtained positive responses of grain yield of maize and its attributes to varying levels of nitrogen fertilization, such as, Bedeer *et.al.*, 1992, El-Hefnawy and El-Ashmoony (1992) and Farghly (2001) .

1-b- Nitrogen splitting effect:

Data in Table (1) demonstrate the effect of splitting nitrogen on plant and ear heights and stalk diameter. It is clear from the results that these traits were significantly affected by varying times of nitrogen application in both seasons and the combined analysis. The results show that splitting nitrogen into two equal doses (T1) gave the highest values for plant height and ear height while, stalk diameter showed highly significant response for splitting in three equal doses as in T2 and also T1 (two equal doses) compared with the other treatment T3 which gave the shortest plants lowest ear height and the thinnest stalks.

These results are rather expected as giving N in two equals doses improved plant growth as the whole N dose was given early in the season where the second N split was given by about one month from planting (35 day). The results further indicate that the soil N fertility level from available N (20 ppm) was not enough to satisfy the high N requirements of maize plants early in the season. The obtained results are in a good connection with those reported by Shalaby *et.al.,* (1990) and Basha (1994).

1-c- Interaction effect :

The interaction between nitrogen levels and N splitting treatments did not affect significantly either the plant height or stalk diameter except ear height in second season. Meanwhile, it is evident from (Table 1-a) that ear height was not significantly increased unless the N level was increased to 120 Kg N/fad when N was given as two splits. However, when N was given in three or four splits, the first N increment was enough to increase ear height significantly. In other words, the increase of N level from 80 to 120 Kg N/ fad failed to increase ear height significantly when was given in 3 or 4 splits. These results refer to a higher magnitude of response by ear height to the increase of N level when given as two splits. This response was also non-dimishing, but dimishing when given in three or four splits

2-Ear diameter, ear length and number of rows /ear:

2-a-Nitrogen level effect :

Results in Table (2) show that addition of N was effective to increase ear diameter and length and hence the number of rows/ear. The increase of level of N application was more effective on ear diameter than on ear length. The former responded to the increase of N level up to 120 Kg N/ fad whereas the latter responded to the increase up to 80 Kg N/ fad only according to the combined analysis. Therefore, the number of rows/ear was not significantly increased unless the N level was increased from 40 to 120 Kg N/ fad.

These results clearly indicate that the gained improvements in plant height and stem diameter were reflected in similar improvements in ear diameter and length and hence the number of rows/ ear. Similar results were regarded by (Farghly, 2001) and El-Hassanine *et.al.*, (2002) .

2-b- Nitrogen splitting effect :

Likewise, with regard to splitting of N fertilizer, data in Table (2) indicate that there were highly significant differences in ear diameter, ear length and number of rows/ear. This was true in both seasons and combined analysis, where the application of N-fertilizer in two equal doses treatment (T1) recorded higher averages for these characteristics than T2 or T3. The differences between treatments T2 and T3 did not reach the level of significance in ear length and number of rows/ear. These results are in agreement with those obtained by Basha (1994).

2-c-Interaction effect :

The interaction between nitrogen levels and N splitting treatments did not affect significantly either the ear length or number of rows /ear but ear diameter in first season and the combined. Data in Table (2-a) show the significant effect of the interaction between nitrogen levels and time of application treatments on ear diameter in the combined .The highest value of ear diameter (4.683cm) resulted from addition of 120 kg N/fad and splitting nitrogen into two equal doses (T1). But, the lowest value of ear diameter (3.757cm) was obtained from addition of 40 kg N/fad and splitting nitrogen application into three equal doses (T3 treatment).

3-Number of grains per row and per ear and 100-grain weight:

3-a- Nitrogen level effect:

It is quite clear from Table (3) that the different nitrogen levels had significant effects on each of number of grains /row and per ear and 100–grain weight, but differences did not reach the significant level in first season for 100 –grain weight.

It is clear from Table (3) that the highest N level of 120 kg N/fad possessed the highest average in such traits followed by the 80 kg N/ fad level. But, the lowest N level (40 kg N/fad) gave the lowest average. These results clearly indicate that improvements gained in ear diameter and length and as well in the number of rows / ear (table 2) were reflected in the significant increase observed in the number of grains per ear due to the increase in the number of grains/row. The results further indicate that the increase in the number of grains / ear was not on the expense of single grain weight as expressed herein in the increase of 100 – grain weight due to the increase of N level. These results are in agreement with those reported by Younis *et.al.,* (1994), Samia Amer *et.al.,* (1995), Farghly (2001) and El-Hassanin *et.al.,*(2002).

3-b- Nitrogen splitting effect:

The results documented in Table (3) clearly show significant differences in both number of grains and weight due to splitting nitrogen. It was obvious that the highest mean values were in favour of treatment T1 (where N was given in two equal doses at first and second irrigations). The lowest mean values were recorded for treatment T3 (where N was given in four equal doses). Similar effects were observed in ear diameter and length as well as in the number of rows / ear (Table 2). Similar findings were reported by Basha (1994).

3-c- Interaction effect:

The combined data revealed insignificant interaction between nitrogen levels and nitrogen splitting treatments concerning the number of grains per row and per ear and 100-grain weight (Table 3).

4-Grain ear weight, shelling percentage and grain yield/fad :

4-a-Nitrogen level effect:

As shown in Table 4 the results showed significant differences among the nitrogen levels regarding ear grain weight, shelling percentage (in combined analysis only) and grain yield /fad.

In general, the nitrogen level of 120 kg N/fad was superior in these traits in combined analysis as compared with other nitrogen levels while, 40 kg N/fad was the lowest in these respects. Such results could be attributed to the promotion effect of nitrogen on vegetative growth which in turn favored metabolic processes and increased plant height, stalk diameter (Table 1), ear diameter (Table 2) and subsequently increased the all yield attributes as mentioned before. The obtained results are in a good line with those reported by El- Hefnawy and El-Ashmoony (1992) and Selim and Sergany (1995).

4-b- Nitrogen splitting effect:

Data in Table 4 demonstrated that there were highly significant differences in ear grain weight, shelling percentage and grain yield/fad. This was true in both seasons and the combined analysis. From these results, it could be conclude that, splitting nitrogen application into two equal doses recorded highly mean values for these traits. Results in Tables (1), (2), (3) and (4) it can be explained that, splitting nitrogen application into two or three equal doses is necessary to stimulate early plant growth to meet the rapidly growing stalks, tassels and ears. Similar results were obtained by Beeder *et.al.,* (1992).

4-c- Interaction effects:

The interaction between nitrogen levels and nitrogen splitting treatments did not affect significantly either the ear grain weight or shelling percentage and grain yield /fad.

In brief, the obtained results indicate that nitrogen fertilizer was badly needed for improving growth and productivity of the unit and area from maize , and the best level of nitrogen fertilizer which achieved the highest grain yield (24.76 ardab/fad) and its components was 120 kg N/fad. However, 80 kg N /fad level recorded high mean values with no significant differences with 120kg N/fad concerning No. of rows /ear, No. of grains /row and ear, grain weight /ear and grain yield /fad during the first season but was not confirmed by the combined analysis. Since the interaction between N application levels and N splitting treatments for grain yield / fad was not significant, the following general response equation could be detected from the combined analysis:

$$\hat{Y} = 20.59 + 3.40\,X - 0.66\,X^2$$

This response equation clearly indicates that the increase of grain yield / fad due to the increase of N level, was diminishing. It is evident that each N increment (40 Kg N / fad) produced a linear increase of 3.40 ardab / fad and a quadratic increase of 0.66 ardab /fad. Therefore, the maximum predicted yield which could be obtained amounted to 24.97 ardab / fad instead of 24.76 ardab / fad which is the actual predicted maximum obtained under the present study. This maximum yield could be obtained if level of N addition was increased to 143 Kg N / fad.

According to these results, the maximum N level used under the present study i.e. 120 Kg N / fad was quite enough to maximize the grain yield.

Respecting, time of nitrogen application the results showed that splitting nitrogen fertilizer into two equal doses given before the 1st irrigation and the 2nd irrigation gave the best growth and productivity. Addition of N in three equal doses achieved similar results in grain yield / fad and in some yield attributes. Then, according the results of this investigation, it could be concluded that adding 120 kg N/fad as two or three equal doses improve productivity of maize under similar experimental conditions.

5- Correlation study:

The interrelationships between grain yield on one hand and the studied yield attributes i.e. plant height ,ear height ,stalk diameter , ear diameter , ear length ,No. of rows/ear ,No. of grains /row and ear, 100-grain weight, ear grain weight ,and shelling percentage on the other hand as well as among yield attributes measured as simple correlation are shown in Table (5)

It is clear from the results that grain yield was positively and highly significantly correlated with each of: plant height, ear height, stalk diameter, ear diameter, ear length, No. of rows/ear, No. of grains/row, and ear, 100-grian weight and shelling percentage.

Also, plant height was positively and highly significantly correlated with each of ear height, ear diameter, ear length, No. of rows /ear, No. of grains /row, 100-grain weight and ear grain weight. Weak relations were seen between plant height on one hand and stalk diameter, No. of grains /ear and shelling percentage on the other.

In addition, there were positive and close relations between stalk diameter and the following variables: ear diameter, ear length, No. of rows /ear, No. of grains /row and ear, 100-grain weight and ear grain weight ,while that correlation with shelling percentage was positive and significant only.

Ear diameter showed positive highly significant correlation coefficient with each of ear length, No. of rows /ear, No. of grains /row and ear,100 –grain weight ,grain ear weight and shelling percentage. These results are in agreement with those reported by Basha (1994).

Ear length appeared positive and highly significant correlation coefficients with each of No. of rows /ear, No. of grains /row and ear, 100-grain weight, while that correlation with shelling percentage was positive and significant only.

Furthermore, number of rows/ear appeared to be more correlated strongly with each of No. of grains/row and ear, 100–grain weight and shelling percentage.

There to, number of grains/row gave close interrelationships with each of No. of grains/ear, 100 – grain weight, ear grain weight and shelling percentage.

Besides, number of grains/ear appeared to be more correlated strongly with each of 100 –grain weight, ear grain weight and shelling percentage.

Also, positive and highly significant correlation coefficients were found between 100 –grain weight and each of ear grain weight and shelling percentage .

Moreover, ear grain weight gave strong pertinence with shelling percentage.

6-Path analysis study:

The path coefficient procedure is utilized, in general to analyze the final grain yield /fad components to explore the relative importance of such components to the final grain yield per unit area of the land.

The partitioning of simple correlation coefficients between grain yield /fad and its components, being number of grains per ear, ear grain weight and 100-grain weight is listed in Table (6).

The results cleared that the ear grain weight followed by number of grains per ear reflected the highest direct effects on maize grain yield /fad (0.8066 and 0.1946). But, the direct effect of 100-grain weight on that yield was of low record (0.0529). Furthermore, the indirect impact of ear grain weight through number of grains per ear and 100-grain weight via ear grain weight reflected considerable mean values in this regard, i.e. 0.4436 and 0.4339 orderly,

The relative importance in contributing to the final grain yield /fad found as percentage of variation for number of grains /ear, ear grain weight, 100-grain weight and their interactions are shown in Table (7).

In addition, the residual effect of the other grain yield attributes, not discussed herein, was7.68 %of the total yield diversity. It means that the main contributors to final grain yield /fad variation were actually chosen in this study.

Table 1: Plant height, ear height and stalk diameter as affected by nitrogen levels and splitting in the two seasons and their combined.

Treatments	Plant height (cm)			Ear height (cm)			Stalk diameter (cm)		
	2002	2003	Comb.	2002	2003	Comb.	2002	2003	Comb.
Nitrogen levels(N)									
Control vs. others	208.6	195.7	202.2	99.8 7	59.53	79.7 0	1.527	1.160	1.344
Other N treatments	222.4	184.5	203.4	112.15	76.37	94.26	1.661	1.697	1.679
F. test	**	NS	NS	**	**	**	NS	**	*
40 kgN/fad(N1)	2162 b	1762 b	196.1 c	10939	68.67 b	89.03 b	1.601b	1.558 c	1.579 c
80 kg N/fad (N2)	2235 a	1859 a	204.7 b	11204	7891 a	95.47 a	1.676a	1.711 b	1.693 b
120 kgN/fad(N3)	227.6 a	1913 a	209.5 a	115.02	81.54 a	9828 a	1.707a	1.821 a	1.764 a
F. test	**	**	**	NS	**	**	*	**	**
Number of splits *									
T1: Two	229.6 a	190.7 a	210.1 a	118.43 a	8220 a	10032a	1.760 a	1.736 a	1.748 a
T2: Three	221.4 b	187.2 a	2043 b	11238 b	7657 b	94.47 b	1.667 b	1.843 a	1.755 a
T3: Four	2162 c	175.6 b	195.9 c	105.64 c	7036 c	88.00 c	1.557 c	1.511 b	1.534 b
F. test	**	**	**	**	**	**	**	**	**
Interaction:									
N×T	NS	NS	NS	NS	**	NS	NS	NS	NS

*T1= Two equal doses at 20 and 35 day after sowing.
T2= Three equal doses at 20 ,35 and 50 day after sowing.
T3=Four equal doses at 20,35,50 and 65 day after sowing.

Table 2: Ear diameter (cm), ear length/cm and number of rows/ear as affected by nitrogen levels and splitting in the two seasons and their combined.

Treatments	Ear diameter (cm)			Ear length (cm)			Number of rows/ear		
	2002	2003	Comb.	2002	2003	Comb.	2002	2003	Comb.
Nitrogen levels(N)									
Control vs. others	3.953	3.367	3.66	15.10	14.70	14.90	11.80	11.00	11.40
Other N treatments	4.200	3.978	4.089	20.37	16.47	18.42	12.46	12.27	12.36
F. test	*	**	*	**	*	**	NS	**	*
40 kg N/fad (N1)	4.076 b	3.687 c	3.881 c	19.70	15.61	17.66 b	12.18 b	11.87	12.02 b
80 kg N/fad (N2)	4.174 b	3.984 b	4.079 b	20.51	16.71	18.61 a	12.40ab	12.38	12.39 ab
120 kg N/fad (N3)	4.350 a	4.263 a	4.307 a	20.89	17.10	18.99 a	12.80 a	12.56	12.68 a
F. test	**	**	**	NS	NS	**	*	NS	**
Number of splits *									
T1: Two	4.331 a	4.327 a	4.329 a	21.49 a	17.81 a	19.65 a	13.08 a	12.62 a	12.85 a
T2: Three	4.199 b	3.851 b	4.025 b	19.89 b	15.90 b	17.89 b	12.37 b	12.16ab	12.26 b
T3: Four	4.070 c	3.757 b	3.913 c	19.72 b	15.71 b	17.72 b	11.93 c	12.02 b	11.98 b
F. test	**	**	**	**	**	**	**	*	**
Interaction:									
N×T	*	NS	**	NS	NS	NS	NS	NS	NS

*T1= Two equal doses at 20 and 35 day after sowing.
T2= Three equal doses at 20 ,35 and 50 day after sowing.
T3=Four equal doses at 20,35,50 and 65 day after sowing.

Table 1-a: Ear height (cm) as affected by the interaction between nitrogen levels and N splitting treatments (second season).

Nitrogen levels	Number of N splits		
	Two	Three	Four
40 kg N/fad	A 78.60 b	B 68.60 b	C 58.80 b
80 kg N/fad	A 81.73 b	AB 79.53 a	B 75.47 a
120 kg N/fad	A 86.27 a	B 81.57 a	C 76.80 a
Regression coefficient (cm)	+1.94	+15.38	+24.34

Table 2-a: Ear diameter as affected by the interaction between nitrogen levels and N splitting treatment (combined).

Nitrogen levels	Number of N splits		
	Two	Three	Four
40 kgN/fad	A 4.02 c	B 3.86 b	B 3.76 c
80 kgN/fad	A 4.28 b	B 4.05 a	B 3.91 b
120 kgN/fad	A 4.68 a	B 4.16 a	B 4.07 a

Table 3: Number of grains /row, no .of grains /ear and 100 –gain weight (gm) as affected by nitrogen levels and splitting in the two seasons and their combined analysis.

Treatments	No. of grains /row			No. of grains/ear			100-grain weight		
	2002	2003	Comb.	2002	2003	Comb.	2002	2003	Comb.
Nitrogen levels(N)									
Control vs. others	37.56	37.20	37.38	443.46	409.2	426.3	25.38	29.24	27.31
Other N treatments	44.21	42.61	43.41	516.64	523.8	520.2	31.86	31.69	31.78
F. test	**	**	**	**	**	**	**	Ns	*
40 kg N / fad (N1)	41.71 b	41.44 b	41.58 b	494.9 b	492.8 c	493.8 c	31.42	29.33 c	30.33 c
80 kg N/fad (N2)	45.01 a	42.57 b	43.79 a	521.2 a	527.5 b	524.3 b	31.80	31.87 b	31.83 b
120 kg N / fad (N3)	45.90 a	43.82 a	44.86 a	533.8 a	551.1 a	542.5 a	32.46	33.85 a	33.15 a
F. test	**	**	**	**	**	**	Ns	**	**
Number of splits *									
T1: Two	47.32 a	45.31 a	46.32 a	526.6 a	573.3 a	549.9 a	33.69 a	33.37 a	33.53 a
T2: Three	43.96 b	40.83 b	42.40 b	520.1 a	496.2 b	508.1 b	31.53 b	31.87 a	31.70 b
T3: Four	41.33 c	4169 b	41.51 b	503.3 b	501.8 b	502.5 b	30.36 c	29.81 b	30.09 c
F. test	**	**	**	**	**	**	**	**	**
Interaction:									
N×T	NS	NS	NS	NS	NS	NS	**	NS	NS

*T1= Two equal doses at 20 and 35 day after sowing.
T2= Three equal doses at 20 ,35 and 50 day after sowing.
T3=Four equal doses at 20,35,50 and 65 day after sowing.

Table 4: Grain weight /ear (gm), shelling % and grain yield /fad as affected by nitrogen levels and splitting in the two seasons and their combined.

Treatments	Grain weight/ear (gm)			Shelling percentage (%)			Grain yield /fad (ardab)**		
	2002	2003	Comb.	2002	2003	Comb.	2002	2003	Comb.
Nitrogen levels(N)									
Control vs. others	111.4	76.00	93.70	78.09	82.96	80.53	16.09	12.97	14.53
Other N treatments	164.9	116.8	140.8	84.56	84.75	84.66	25.60	20.19	22.89
F. test	**	**	**	**	NS	*	**	**	**
40kgN/fad(N1)	155.7 b	101.8c	128.7c	83.29	82.44	82.87b	23.48b	17.70c	20.59c
80 kg N/fad (N2)	165.7ab	117.9b	141.8b	84.43	83.84	84.14b	26.33a	20.33b	23.33b
120kgN/fad(N3)	173.4 a	130.9a	152.2a	85.95	87.96	86.96a	26.99a	22.53a	24.76a
F. test	*	**	**	NS	NS	*	**	**	**
Number of splits *									
T1: Two	177.9 a	136.2a	157.1a	87.48a	86.18a	86.83a	26.77a	23.42a	25.09a
T2: Three	164.0 b	104.7b	134.4b	84.92ab	82.18b	83.55b	25.65ab	18.65b	22.15b
T3: Four	152.8 c	109.7b	131.3b	81.27b	85.89a	83.58b	24.39b	18.50b	21.44b
F. test	**	**	**	*	*	**	**	**	**
Interaction:									
N×T	NS	NS	NS	NS	NS	NS	NS	NS	NS

*T1= Two equal doses at 20 and 35 day after sowing.
T2= Three equal doses at 20 ,35 and 50 day after sowing.
T3=Four equal doses at 20,35,50 and 65 day after sowing.

** Ardab =140 kg

Table 5: Correlation coefficients between grain yield /fad and yield attributes of maize (combined of the two seasons).

	1	2	3	4	5	6	7	8	9	10	11
y-grain yield /fad	0.708**	0.715**	0.511**	0.770**	0.882**	0.615**	0.708**	0.673**	0.615**	0.942**	0.386**
1-plant height		0.863**	0.215	0.534**	0.819**	0.373**	0.421**	0.170	0.261**	0.813**	0.118
2-ear height			0.232**	0.516**	0.812**	0.395**	0.454**	0.201	0.175	0.835**	0.071
3-stalk diameter				0.531**	0.339**	0.577**	0.472**	0.573**	0.634**	0.399**	0.239*
4-ear diameter					0.666**	0.712**	0.630**	0.720**	0.607**	0.753**	0.397**
5-ear length						0.582**	0.631**	0.464**	0.517**	0.914**	0.272*
6-No. of rows/ear							0.753**	0.712**	0.661**	0.615**	0.392**
7-No .of grains/row								0.788**	0.636**	0.684**	0.476**
8-No .of grains/ear									0.659**	0.550**	0.441**
9-100 –grain weight										0.538**	0.572**
10-grain weight/ear											0.410**
11-shelling %											--

Table 6: partitioning of simple correlation coefficients between grain yield (ardab)/fad and its components of maize from the combined analysis.

Sources	Values
Number of grains per ear	
Direct effect	0.1946
Indirect effect via ear grains weight	0 .4436
Indirect effect via 100- grain weight	0.0348
Total(ry1)	0.6730
Ear grain weight :	
Direct effect	0.8066
Indirect effect via number of grains per ear	0.1070
Indirect effect via 100- grain weight	0.0284
Total (ry2)	0.9420
100 -grain weight :	
Direct effect	0.0529
Indirect effect via number of grains per ear	0.1282
Indirect effect via ear grain weight	0.4339
Total (ry3)	0.6150

Table 7: Direct and joint effects of grain yield components presented as a percentage of variation of maize (combined of both seasons).

Sources	C.D.	%
Number of grains /ear	0.0379	3.79
Ear grain weight	0.6505	65.05
100-grain weight	0.0028	0.28
Number of grains /ear x Ear grain weight	0.1726	17.26
Number of grains /ear x100 –grain weight	0.0136	1.36
Ear grain weight x100-grain weight	0.0459	4.59
R^2	0.9232	92.32
Residual	0.0768	7.68
Total	1.0000	100.00
C.D.=Coefficient of determination % =percentage contributed		

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تأثير تجزيء مستويات مختلفة من السماد النيتروجيني على إنتاجية الذرة الشامية

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أقيمت تجربتان حقليتان بالمزرعة التجريبية بكلية الزراعة - جامعة الزقازيق – خلال الموسمين الصيفيين ٢٠٠٢ – ٢٠٠٣ بهدف دراسة تأثير أربع مستويات من السماد النيتروجينى (صفر، ٤٠، ٨٠ و ١٢٠ كجم/فدان) وثلاث معاملات تجزيء وهى :

T1 - نصف عند ٢٠ يوم من الزراعة ونصف عند ٣٥ يوم من الزراعة

T2 - ثلث عند ٢٠ يوم من الزراعة و ثلث عند ٣٥ يوم من الزراعة و ثلث عند ٥٠ يوم من الزراعة

T3 - ربع عند ٢٠ يوم من الزراعة وربع عند ٣٥ يوم من الزراعة و ربع عند ٥٠ يوم من الزراعة وربع عند ٦٥ يوم من الزراعة.على صفات المحصول ومكوناته للصنف هجين فردى ١٠- صممت التجربة فى قطع منشقة فى ثلاث مكررات حيث وضعت مستويات التسميد فى القطع الرئيسية ومعاملات التجزيء فى القطع الشقية.

ويمكن تلخيص أهم النتائج المتحصل عليها على النحو التالى :

١- أظهرت النتائج وجود اختلافات معنوية بين معاملة الكنترول (عدم إضافة سماد نيتروجينى) ومستويات النتروجين فى جميع الصفات تحت الدراسة مؤكدة أهمية إضافة السماد النيتروجينى لتحسين إنتاجية الذرة الشامية .

٢- أدت زيادة مستويات النتروجين من ٤٠ إلى ١٢٠ كجم ن/فدان إلى زيادة معنوية فى كل من ارتفاع النبات ،ارتفاع الكوز ،قطر الساق ،قطر الكوز ،طول الكوز ،عدد صفوف الكوز ، عدد حبوب السطر ،عدد حبوب الكوز ،وزن ١٠٠ حبة ،وزن حبوب الكوز ،نسبة التفريط و محصول الحبوب للفدان بالإردب. كما أعطى المستوى ٨٠ كجم ن /فدان نتيجة مماثلة بالنسبة لصفات طول الكوز و عدد حبوب السطر .

٣- أظهرت معاملة الإضافة (T1) أى إضافة النيتروجين على دفعتين متساويتين أفضل القيم بالنسبة لا رتفاع النبات ،ارتفاع الكوز ،قطر الكوز ،طول الكوز ،،عدد صفوف الكوز ، عدد حبوب السطر ،عدد حبوب الكوز ،وزن ١٠٠ حبة ،وزن حبوب الكوز ،نسبة التفريط و محصول الحبوب للفدان بالإردب، فى حين أنه لم يكن هناك فرق معنوى بين معاملتى الإضافة T1, T2(ثلاث دفعات متساوية) فى محصول الحبوب/فدان و بعض مكونات المحصول.

٤- أظهرت نتائج الارتباط وجود علاقة موجبة وعالية المعنوية بين محصول الحبوب /فدان مع كل من ارتفاع النبات،ارتفاع الكوز ،قطر الساق، قطر الكوز ،طول الكوز، عدد سطور الكوز، عدد حبوب السطر، عدد حبوب الكوز، وزن الـ ١٠٠ حبة، وزن حبوب الكوز و نسبة التفريط .

٥- وأشارت نتائج تحليل معامل المرور أن وزن حبوب الكوز وتداخلها مع عدد حبوب الكوز ، وزن الـ ١٠٠ حبه لها الدور الأكبر فى تباين محصول الحبوب للفدان (٦٥,٠٥ و ١٧,٢٦ و ٤,٥٩ % على التوالى) .

بما يؤكد أهمية هذه المؤشرات فى تكوين محصول الحبوب للذرة الشامية تحت ظروف مزرعة كلية الزراعة بالزقازيق والصنف هجين فردى ١٠. حيث تظهر نتائج التجربة أهمية إضافة المعدلات العالية من السماد النيتروجينى (١٢٠ كجم نتروجين /فدان) وكذلك الإضافة على دفعتين أو ثلاث فى تحسن إنتاجية الذرة الشامية تحت ظروف منطقة الزقازيق وكذلك المناطق الأخرى المشابهة لظروف هذه التجربة .