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THE YIELD AND YIELD COMPONENTS OF MAIZE AS INFLUENCED BY NITROGEN, ZINC AND BORON FERTILIZATION

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ABSTRACT

Two field experiments were carried out at Gemmeiza Agricultural Research Station farm during 2000 and 2001 seasons to evaluate the effect of nitrogen zinc and boron on chlorophyll content grain yield and its components as well as stover yield of maize plant (*Zea mays*, L.) C.v. Sc 10 . The most important results can be summarized as follows :-

1- Chlorophyll a,b , total chlorophyll content, yield components , (i . e , ear length , ear weight , ear grains weight, number of grains and row , 100 – grain weight , number , of ears / fed, ear yield ton / fed ., grain yield ton / fed . and stover yield ton / fed.) were l significantly increased by increasing rate of N - fertilizer up to 120 kg N / fed .

2- Increasing nitrogen fertilizer rates up to 120 kg N / fed . significantly increased nitrogen concentration and its uptake as well as protein content .

3- Phosphorus and Potassium concentrations and its uptake were significantly increased by applying 120 kg N / fed .

4- Zinc application at 20 kg zinc sulphate / fed . showed significant increase in values of ear weight , ear grains weight , number of grains / row , number of ears / fed . ear yield ton / fed ., chlorophyll a,b, Phosphorus and Potassium concentration and its uptake.

Application of 10 kg zinc sulphate / fed increased nitrogen concentration and its uptake as well as protein content .

5- The effect of foliar boron application was not significant with the studied characters except number of ears / fed .stover , yield in the first season and number of ears / fed ., in the second one , as well as N .P . k concentration and its uptake.

From the aforementioned results it can be concluded that ,for high yield production of maize nitrogen fertilizer and zinc sulphate must be applied at 120kg N and 20kg zinc sulphate/fed.

INTRODUCTION

Raising the demand for food production and need for improvement the agricultural products during the last decade of the 20 th century needs an unprecedented spate of technological changes such as plant breeding , fertilizer , irrigation .....etc . So , increasing crop productivity of the unit of caltivated area has become the main goal of all workes in this field , especially under Egyptian conditions where the caltivated area is limited and it decreases annually due to housing .

Nitrogen is a major nutrient – element and it is needed in large amount to increase gowth and yield of maize .

Increasing maize growth characteristics due to nitrogen application was reported by Kandil *et al.* (1984) , Gouda *et al* , (1993) , Esmail and El – Sheikh (1994) , Hassan (1995) and Abu – Grab *et al* . (1997) . They found

that nitrogen fertilization had significant positive effect on number of green leaves / plant , leaf area / plant . leaf area index , plant height , dry matter yield and chlorophyll a , b and total chlorophyll

Also increasing nitrogen fertilizer rates significantly increased yield and its attributes (Esmail , and El – Sheikh (1994) Soliman *et al* (1995) . Younis *et al* (1995.,) :- Faisal *et al* . (1996) Badawi and El – Moursy (1997) Atta – Allah (1998) and Salem , (2000) . Abdel Aziz *et al* (1986) . reported that increasing nitrogen fertilizer levels led to increase N – uptake by corn plant in both grain and stover . Phosphorus uptake was also increased as the rate of nitrogen was increased (Hegab, 1990) . As for potassium, Kandil , *et al* ., (1984) showed that K , content in both blades and stems of corn plants was significantly increased by increasing N – levels , while K percentage in grains was not affected .

Zinc functions in plants are largely associated with activity . It plays an important role in protein synthesis from amino acids . (Vallee and Wacker , 1970) Dibrova (1978) found that application of 20 kg Zn / ha before ploughing and 5 kg Zn / ha at sowing increased plant height , dry weight , leaf area, number of ears by 6.6 – 16 .1 % and grain yield by 10 . 4 – 21.7 % . Yagshiev (1974) Stiborova *et al* (1987) , and Kvyatkovskii (1988) reported that application of Zn increased chlorophyll content .

El – Koumey (1998) , reported that application of Zn or B increased dry matter yield and Zn or B content of plant or grains .

The aim of present investigation is to study the fertilization effects of nitrogen, Zinc, boron and their interaction on yield and yield attributes of maize crop .

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of Gemmeize Agricultural Research Station (Middle Delta , Egypt) . during the two successive seasons 2000 and 2001 to study the effect of different rates of nitrogen , zinc and boron and their combinations on yield and yield attributes of maize (cv sc 10) . The soil of the experimental site was clay loam in texture and its chemical properties were determined according to the standard methods reported by Hesse (1971) .

Table (1): Chemical analysis of experimental site .

Analysis	2000	2001
PH (in 1:2.5 soil suspention	8.000	8.000
E . C. mmhos /cm	2.140	1.880
Organic matter (%)	2.000	2.050
$Caco_3$ (%)	3.800	3.500
Available N (ppm)	33.500	30.000
Available P (ppm)	8.800	8.000
Available K (ppm)	440	450
Available Zinc (ppm)	0.800	0.79
Available Boron (ppm)	0.10	0.12

The experiments were laid out in split – split – plot design with four replications where .

N – level (main – plots) as urea 46.5 % N .

1- O kg N / fed .
2- 60 kg N / fed .
3- 120 kg N / fed .

Zinc – level (sup – plots) as Zinc salphate .

1- O kg / fed .
2- 10 kg / fed .
3- 20 kg / fed .

Boron level (sup – sup plots) as boric acid .

1- O ppm B .
2- 350 ppm . B Foliar application .

Grains of maize were sown in hills 30 cm apart within 70 cm between ridges, the plot area was $21m^2$ i. e. 6 ridges x 5 m length . Sowing dates were 21 st June in both seasons. The amount of each N treatment was divided into two equel doses and added befor the first and second irrigation , respectively .

The amount of each Zn treatment was added to the soil befor the first irrigation

After 21 and 35 days from sowing plants were sprayed with boron in the from of boric acid at concentration of 350 ppm B .

The other different field practices were done on the usual manner for maize production .

After 75 days of planting a representative sample of ear leaf was taken from each experimental plot for chlorophyll determination using the method described by Moran (1982).

Harvesting took place after 120 days form swing in both seasons .Ear length, ear weight, ear grains weight number of row / ear , number of grains / row , 100 – grain weight , number of ears / fed and ear yield ton / fed.

Total grain per plot was transformed to ton / fed. and adjusted to 15.5% moisture content . Stover yield (air dried) was recorded as ton / fed . Samples of grains were over dried at 70 c^{o} then milled and kept for chemical analysis .

Nitrogen was determined using the micro – kjeldhl method as described by Chapman and Pratt (1961) . So protein % was computed by multiplying N % by the factor 5.7 . Potassium was determined using a flam photometer method . Phosphorus was determined calorimeterically according to Hesse (1971) . Available zn was determined according to method of Lindsay and Norvell (1969) .

All collective data were statistically analysed according to the procedure described by Snedecor and Cochran (1967).

RESULTS AND DISSCUSION

Chlorophyll content :

Data presented in Table 2 reveal significant increase in chlorophyll a,b and total chlorophyll in maize leaves parallel due to the increase in nitrogen applied rate from 0 to 120 kg N / fed . in both seasons. In agreement with those obtained by Stocking and Ongun (1982.,) who reported that as much as 90 % of total leaf nitrogen may be concentrated in chloroplast . The obtained results agree with those obtained by Abu– Grab *et.al* (1997) and El – Kabbany ,and Darwish (2002)

Zinc application increased chlorophyll a,b, and total chlorophyll in both seasons as shown in Table (2). The relative increases in chlorophyll a were 4.829 % and 11.02 % for 10 and 20 kg Zinc sulphate / fed. respectively, as compared to control . The relative increases in total chl . were 6.518 % and 6.952 % , respectively , The relative increases in total chlorophyll were 5.221 % and 10.09 respectively as compared to control over the first season .The corresponding relative increase in chlorophyll a , b and total chlorophyll were 3.220 % and 8.241 % , 14.762 % and 13 % , and 5.839 % and 9.317 %, respectively as compared to control , over the second season . Similar results were found by Stiborova *et al* (1987). who reported that application of Zn increased leaf chlorophyll content of maize plants . Also Kvyatkovskii (1988) indicated that application of Zn showed positive action in the physiological processes at the formation of chlorophyll .

Data in Table 2 show that the spraying of boron increased chlorophyll a, b and total chlorophyll. But these increases were not significant.

Table 2: Effect of nitrogen zinc and boron on Chlorophyll contents (mg/dm^2) of maize plants .

Treatments	first season			Second season		
	Chl . A	Chl. B	Chl. A+B	Chl. A	Chl. B	Chl. A+B
N. level						
Okg N.fed	3.225	0.930	4.155	3.206	1.008	4.214
60kgN. Fed	4.895	1.476	6.371	4.896	1.462	6.358
120kg N.fed	5.091	1.472	6.563	5.130	1.460	6.590
L . S . D 5%	0.890	0.263	0.993	1.322	0.148	1.50
Zinc . level						
O kg . fed	4.183	1.237	5.420	4.247	1.199	5.446
10kg . fed	4.385	1.318	5.703	4.388	1.376	5.764
20kg . fed	4.644	1.323	5.967	4.597	1.355	5.952
L . S . D 5%	0.458	N.S	N.S	N.S	N.S	N.S
Boron – level						
Zero	4.279	1.257	5.536	4.278	1.255	5.533
350 ppm B	4.529	1.328	5.857	4.544	1.401	5.945
F – test	N.S	N.S	N.S	N.S	N.S	N.S

Effect of nitrogen zinc and boron on yield and yield components of maize :

Yield and yield components of maize plants as affected by N , Zn . and B . treatments are shown in Table 3.

The results demonstrate clearly that the yield components of maize i. e., ear length , ear weight, ear grains weight and 100 – grain weight were significantly increased with application of nitrogen up to 60 kg / fed . in both seasons whereas number of ears/ fed., ear yield ton / fed , grain yield ton / fed .,as well as stover yield ton / fed . were markedly increased with the highest rate of nitrogen applied i.e., 120 kg N / fed . in both seasons. This increases in grain yield could be due to the increase in amount of metabolites synthesized by plants. The relative increases in grain yield were 54.7 % and 78.3 % for 60 and 120 kg N / fed ., respectively, as compared to control , over the first season, and 30.8 % and 42.0 %, respectively , as compared to control over the second seasons. Similar trends were obtained by Younis *et al* (1995) Esmail and El –Sheikh (1994) , they reported that increasing nitrogen fertilizer rates significantly increases grain and stover yields . Moreover . Abu – Grab *et al* (1997), and Salem (2000) reported that moderate nitrogen rate 100 kg N/fed. produced the highest grain yield.

Table 3: Effect of nitrogen, zinc , and boron on yield and yield attributes of maize.

Treatments	Ear Leng-th (cm)	Ear Weig-ht (g)	Grain Ear Weight (g)	No of Row Ear	No of Grain row	100 grain Weight (g)	No of Ear / fed	Ear Yield ton / fed	Grain Yield ton / fed	Stover Yield ton / fed
First season										
N-level kgN. /fed										
Control	17.3	224.5	115.14	12.1	39.8	36.728	12615	2.800	1.357	5.090
60 kg (N./ fed .)	18.5	256.1	125.28	12.1	40.8	38.556	15144	4.247	2.100	7.768
120 kg (N./ fed .)	19.4	272.2	138.72	12.30.	42.00	38.222	17921	4.843	2.420	7.968
L . S . D 5%	1.3	17.5	21.7	N .S	N.S	0.995	540	1.866	0.407	0.790
Z- level										
Control	18.1	247.9	121.7	12.1	43.1	38.00	15040	3.864	3.200	6.667
10 kg	18.5	251.5	126.2	12.1	40.1	38.02	15337	3.998	3.261	7.020
20 kg	18.8	253.3	131.3	12.30	40.3	38.49	15304	4.028	3.327	7.183
L . S . D 5%	N.S	N.S	6.900	N.S	2.230	N.S	N.S	N.S	N.S	N.S
Boron – level										
Control	18.5	251.3	124.8	12.2	41.3	37.819	14699	3.890	3.197	6.792
350 PPm B	18.4	250.6	127.9	12.1	41.0	38.519	15487	4.056	3.329	7.092
F – Test	N.S	N.S	N.S	N.S	N.S	N.S	*	N.S	N.S	*
Second season										
N-level										
Control	17.6	231.5	111.24	12.2	41.8	37.9	13705	2.960	1.518	6.197
60 kg (N. / fed)	19.1	2523	124.98	12.7	43.7	40.2	15927	3.652	1.985	7.328
120 kg (N. / fed)	19.7	271.9	131.22	12.7	47.1	40.2	16669	3.976	2.156	7.584
L . S . D 5 %	1.14	39.5	8.1	N.S	1.200	1.200	441	0.014	0.279	0.165
Z-level										
Control	18.7	236.2	116.0	12.6	42.5	39.5	14962	3.277	1.765	6.856
10 kg	18.8	256.7	125.94	12.6	45.7	39.00	15488	3.800	1.989	7.167
20 kg	19.7	262.8	125.46	12.3	44.4	39.800	15853	3.510	1.906	7.087
L . S . D 5%	N.S	20.4	8.04	N.S	1.6	N.S	425	0.031	0.269	N.S
Boron – level										
Control	19.00	249.2	121.86	12.4	43.9	39.2	15285	3.516	1.870	7.088
350 PPm B	18.8	254.6	123.06	12.6	44.6	39.7	15583	3.542	1.867	6.984
F – Test	N. S	N.S	N.S	N.S	N.S	N.S	*	N.S	N.S	N.S

Nitrogen application up to 120 kg N / fed . causced a significant increase in number of grains / row for second season while the increase was insignificant for first season . These results are in harmony with those obtained by Atta – Allah (1998) and Salem (2000) .

Date reveal that no significant effect were obtained for increasing the rate of nitrogen applied on number of rows /ear. Similar trends were obtained by Hassanein *et al* (1997) Eisa (1998) and salem (2000) .

Zinc sulphate up to 10 kg / fed. causced a significant increase in ear weight, grains weigh/ear number of grains / row number of ear / fed . ear yield ton/fed. and grains yield ton/fed ., for second seasons but not with the first season. These results are in accordance with those obtained by latif *et al.* (1983) and Gyulakhmedov *et al.* (1984) .

No significant effect was obtained for increasing the rate of applied boron on yield and its components of maize plant except number of ears / fed ., stover yield in the first season and number of ears / fed . in the second season. These results are in agreement with this obtained by El – Koamy (1998).

Data of the interaction effects on the studied parameters were not significant so discussion of such data were excluded

Table 4: Effect of nitrogen, zinc and boron on NPK and protein content of maize plant.

Treatments	First season						
	N			P		K	
	%	N.Up-take kg/ fed	Protein Conc %	%	P.uptake kg /fed	%	K.up. take kg / fed
N-level							
Control	1.690	30.853	9.633	0.400	7.191	0.524	9.538
60 kg	1.810	52.152	10.317	0.402	11.522	0.532	15.355
120 kg	1.89	66.191	10.773	0.383	12.979	0.514	16.986
L . S . D 5 %	–	3.261	0.573	–	0.536	–	0.691
Z-level							
Control	1.823	48.139	10.391	0.398	10.424	0.513	13.144
10 kg	1.814	52.270	10.340	0.380	10.062	0.524	14.290
20 kg	1.758	48.842	10.021	0.404	11.206	0.527	14.446
L . S . D 5%		3.180	N.S	–	0.570	–	0.437
Boron – level							
Control	1.834	48.792	10.454	0.385	10.197	0.522	370.01
350 PPm B	1.764	47.155	10.055	0.403	10.931	0.524	383.813
F – Test	–	N.S	*	–	*	–	*
Second season							
N-level							
Control	1.746	36.291	9.633	0.410	8.190	0.522	10.554
60 kg	1.803	49.339	10.279	0.407	11.060	0.539	14.733
120 kg	1.908	57.858	10.876	0.383	11.546	0.550	15.808
L . S . D 5 %	–	2.988	0.235	-	0.678	–	0.766
Z-level							
Control	1.880	44.894	10.403	0.403	9.763	0.534	12.941
10 kg	1.815	51.853	10.334	0.386	10.505	0. 516	14.034
20 kg	1.761	46.741	10.040	0.427	10.535	0.532	14.065
L . S . D 5%	–	2.240	N.S	–	0.677	–	0.933
Boron – level							
Control	1.842	48.802	10.500	0.393	10.302	0.522	13.793
350 PPm B	1.795	46.856	10.025	0.400	10.323	0.533	13.640
F – Test	–	*	*	–	N.S	–	N.S

Effect of N, Zn and B on nitrogen , phosphorus , potassium and protein content .

Nitrogen phosphorus and potassium uptake and protein content for maize grains in both seasons gradually increased as the rate of nitrogen added increased up to 120 kg N / fed . (Table 4) .

An increase in nitrogen uptake due to increasing the added nitrogen was reported by Hegab (1990), also , increasing nitrogen rate led to increase phosphorus uptake by maize plants (Hageb 1990).Kandil , *et al* , (1984) who reported that increasing nitrogen significantly increased K – content in blads and stems of maize plants .

No significant effect was obtained for increasing the rate of applied zinc on nitrogen content in maize plants . However , application of 10 kg $ZnSO_4$ increased N content . It might be due to the effect of Zn in the formation and / or the activity of the enzymes responsible for protein synthesis . Orabi and Abdel–Aziz (1982) and Hulagur and Dangarwola (1983). found that zn application increased total N in corn plants . Abou Hussien and Faiyed (1996)found that application of Zn up to 16 ppm increased N, Z and concentration and total amount uptake .

Data presented in Table (4) reveal that the content of phosphorus and potassium in maize plant was increased significantly by increasing the rate of zn up to 20 kg $ZnSO_4$ / fed. these results are in agreement with those obtained by Orabi and Abdel -Aziz (1982).

Folior application of B increased N . P and K uptake while, it caused slightly decrease or had no clear effect on NPK concentration.

These results are in agreement with the results of El- Koumey (1998).

The interaction influence of nitrogen fertilizer rate and zinc level on N.P.K and uptake in grain was generally significant in both seasons. Table 5, In this regard 120 kg N/fed and 20 kg zinc sulphate resulted in the highest value of N.P and K in second season . But in first season 120 kg N / fed and 10 kg zinc sulphate produced the highest value of N.P and K – uptake

As for interaction between nitrogen fertilizer rates and boron, data on Table 5 show that 120 kg N / fed and O boron significantly recorded the highest N.P and K . up take in grain in both seasons .

Data in Table 6 also show the influence of the interaction between zinc level and boron level on N, P and K uptake by maize plants. In this respect, 10 kg zinc sulphate and O boron significantly achieved the highest N,P and K uptake in grains .

From the aforementioned results it can be concluded that , for high yield production of maize nitrogen fertilizer and zinc sulphate must be applied at 120 kg N and 20 kg zinc sulphate / fed .

Table (5): The interaction effect of zinc and boron with different level of nitrogen fertilization on NPK and protein content of maize plant.

Treatments		First season							Second season						
		N			P_2O_5		K_2O		N			P_2O_5		K_2O	
		%	N. uptake kg/fed.	Protein conc. %	%	N. uptake kg /fed.	%	N. uptake kg /fed	%	N. uptake kg /fed.	Protein conc. %	%	N. uptake kg /fed.	%	N. uptake kg /fed.
N x zinc															
	0	1.773	33.351	10.107	0.413	7.725	0.517	8.016	1.773	32.068	10.108	0.405	7.240	0.547	9.671
0	10	1.665	26.238	9.491	0.406	6.347	0.566	10.721	1.665	43.422	9.491	0.413	9.505	0.518	11.736
	20	1.628	32.970	9.281	0.372	7.502	0.486	9.829	1.631	33.383	9.300	0.383	7.844	0.500	10.255
	0	1.743	45.914	9.937	0.423	11.523	0.540	14.930	1.742	44.134	9.928	0.432	10.990	0.532	13.537
60	10	1.878	59.096	10.706	0.362	11.096	0.488	15.051	1.873	56.496	10.678	0.368	11.119	0.523	15.765
	20	1.805	51.447	10.289	0.422	11.945	0.568	16.085	1.795	47.385	10.232	0.420	11.072	0.565	14.900
	0	1.953	65.153	11.134	0.360	12.023	0.483	16.437	1.960	58.481	11.172	0.373	11.058	0.525	15.614
120	10	1.898	71.478	10.820	0.372	12.742	0.517	17.100	1.907	55.839	10.868	0.376	10.891	0.507	14.602
	20	1.840	62.107	10.488	0.418	14.172	0.527	17.422	1.857	59.455	10.588	0.478	12.690	0.532	17.040
L . S . D 5%			5.517	N.S		0.988		0.757		3.880	0.727		1.574		1.539
N x boron															
0	0	1.732	32.043	9.874	0.380	7.050	0.500	9.293	1.736	36.450	9.893	0.389	8.145	0.503	10.383
	350	1.650	29.043	9.405	0.414	7.332	0.548	9.763	1.756	36.142	9.373	0.412	8.247	0.540	10.527
60	0	1.782	49.634	10.159	0.400	11.056	0.548	15.175	1.781	48.149	10.152	0.406	10.878	0.537	14.439
	350	1.836	54.671	10.463	0.404	11.987	0.517	15.535	1.826	50.527	10.406	0.407	11.241	0.542	15.024
120	0	1.989	70.121	11.330	0.377	12.484	0.518	16.644	2.009	61.818	11.454	0.383	11.882	0.527	16.334
	350	1.807	62.370	10.298	0.390	13.474	0.500	17.328	1.807	53.897	10.298	0.380	11.209	0.516	15.169
L . S . D 5%			4.505	N.S		0.806		0.618		3.168	0.593		1.283		1.319

Table (6): The interaction effect of zinc and boron on NPK and protein content of maize plant.

Treatments	First season							Second season						
	N			P_2O_5		K_2O		N			P_2O_5		K_2O	
Zinc x boron	%	N. up-take kg/ fed.	Protein conc. %	%	N. up-take kg /fed.	%	N. up-take kg /fed	%	N. up-take kg /fed.	Protein conc. %	%	N. up-take kg /fed.	%	N. up-take kg /fed.
0 0	1.801	45.529	10.266	0.361	9.552	0.510	12.731	1.736	42.698	10.272	0.388	9.136	0.508	11.905
0 350	1.846	50.750	10.520	0.417	11.295	0.573	15.949	1.756	47.089	10.532	0.419	10.390	0.536	13.975
10 0	1.911	57.491	10.893	0.379	10.313	0.506	13.394	1.781	55.806	10.950	0.383	11.068	0.509	14.682
10 350	1.717	47.050	9.785	0.381	9.810	0.487	12.590	1.856	47.900	9.741	0.389	9.941	0.570	13.386
20 0	1.790	48.778	10.203	0.397	10.723	0.550	14.987	2.000	47.903	10.276	0.407	10.702	0 550	14.569
20 350	1.726	48.905	9.836	0.411	11.689	0.504	14.109	1.806	45.579	9.803	0.448	10.368	0.492	13.601
L . S . D 5%		4.505	0.263		0.806		0.618		3.168	0.593		1.285		1.319

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تأثير اضافة الأزوت و الزنك و البورن علي المحصول و مكوناتــه لنبــات الــذرة الشامية

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أجريت تجربتين حقليتين بالمزرعة البحثية لمحطة البحوث الزراعية بالجميزة –محافظــة الغربية خلال الموسمين الزراعين ٢٠٠٠ / ٢٠٠١ لدراسة تأثير معدلات السماد الأزوتي (صفــر ، ٦٠ و ١٢٠ كيلو جرام) أزوت للفدان علي صورة يوريا ٤٦,٥ % و ثلاثة معدلات زنك (صفر ، ١٠ و ٢٠ كيلو جرام كبريتات زنك للفدان) و معدلين من البورن (صفر و ٣٥٠ جــزء فــي المليون بورن علي صورة حامض البوريك) رشا علي النباتات و التفاعل بينهما علي المحصــول و مكوناتة و محتوي الاوراق من الكلورفيل و كذلك محتوي الحبوب من اليــتروجين و الفوســفور والبوتاسيوم لنبات الذرة الشامية صنف هجين فردي ١٠ .

و تتلخص أهم النتائج المتحصل عليها في الأتي :-

١- أوضحت النتائج أن محتوي الأوراق من الكلورفيل و مكونات المحصول (طــول الكــوز – وزن الكوز – وزن حبوب الكوز – عدد حبوب السطر – وزن ١٠٠ حبة – عدد الكــيزان للفدان – محصول الحبوب للفدان – وكذلك وزن القش) ازدادت زيادة معنوية بزيادة معــدل السماد الأزتي من صفر الي ١٢٠ كم نيتروجين للفدان . و كذلك أدت زيــادة الأزوت الــي زيادة في محتوي الحبوب من النيتروجين و الفوسفور و البوتاسيوم وكذلك البروتين .

٢- أدت اضافة ٢٠ كيلو جرام كبريتات زنك للفدان الي زيادة معنوية فــي وزن الكــوز – وزن حبوب الكوز – عدد حبوب السطر – عدد الكيزان في الفدان – محصول الكيزان للفــدان و كذالك محتوي الأوراق من الكلورفيل و كذلك زيادة تركيز الفوسفور و البوتاسيوم في الحبوب كما أوضحت النتائج أن اضافة ١٠ كيلو جرام كبريتات زنك للفدان أدت الي زيادة معنويــة في محتوي الحبوب من النتروجين و البروتين .

٣- أدي اضافة البورن الي زيادة غير معنوية في جميع الصفات المدروسة ما عدا عدد الكــيزان في الفدان – وزن القش وكذلك تركيز النتروجين و الفوسفور و البوتاسيوم في الحبوب .

٤- وعلي هذا يمكن استخلاص أن اضافة النتروجين بمعدل ١٢٠ كجم وكذلك اضافــة الزنــك بمعدل ٢٠ كجم كبريتات زنك للفدان للحصول علي أعلي محصول من الذرة الشامية صنــف هجين فردي ١٠ تحت ظروف منطقة وسط الدلتا بالجميزة.