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YIELD OF MAIZE IN RELATION TO PHOTOSYNTHATE PARTITIONING PARAMETERS

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ABSTRACT : This work was laid out during 2003 and 2004 seasons at administration field at Kafr El-Sheikh Village, Abo-Kapeer Distinct, Sharkia Governorate, Egypt, to study the effect of mineral N and un-mineral other fertilizers, being organic, biological and foliar fertilizers, on growth, photosynthates partitioning parameters and yields/plant of both S.C.10 and T.W.C. 321 maize hybrids. The studied factors were : 1- Two maize hybrids, being S.C.10 and T.W.C. 321, (V). 2- N fertilization levels of zero, 40, 80 and 120 kg N/fad (N). 3- Three other un-mineral fertilizers (F), including organic Compost fertilizer at a rate of 2 ton/fad, Cerealine biofertilizer (400 gm/fad) and Delfan foliar fertilizer (1200 cm^3/fad). Also, 2 untreated plots were used as a general control in this study. The experimental design was split-split plot system of three replicates, with 2 cvs as main plots, the 4 N levels as sub-plots and the three other fertilizers as sub-sub plots. The experimental unit was 13.5 m^2 with dimension of 3.0 x 4.5 m.

The 2 cultivars varied inherently and significantly in all studied traits, since the S.C.10 cv gave greater mean values in both straw and biological yields/plant and the RPP of them. On the other hand, the T.W.C.321 cv was superior in LAI, MC, ear and grain yields/plant and RPP of grain yield/plant.

Also, the 120 kg N level or Compost fertilizer treatments produced marked excesses as for LAI, MC, ear yield/plant as well as straw, grain and biological yields/plant and their RPP.

In addition, all treatment means exceeded the un-treated ones in all examined traits mentioned previously.

The cultivars x N levels or cultivars x other fertilizers detected significant effects on most of the studied traits and the best results for MC and economic ear or grain yields were in favour of T.W.C. 321 cv along with either 120 kg N level or Compost treatment.

Likewise, the 80 kg N level together with Compost fertilizer gave the best record for MC and the yields/plant from ear, grain and biomass if compared with the other treatments studied.

Finally, the T.W.C.321 cv under the different treatments utilized the photosynthetic capacity of canopy structure to the better and this strengthen the relationship between yields/plant and photosynthates partitioning parameters that could reflect a considerable impact on yield capacity of maize plants, especially under the environmental conditions prevailing through conducting such trials.

Key words : Maize, cultivars, fertilization, yield, photosynthetes partitioning

INTRODUCTION

Maize (*Zea mays*, L.) is considered one of the most important cereal crops in Egypt and all over the world, due to its numerous uses for human, animals and industry. The total production, in Egypt, is not sufficient to meet the increased demands of the growing people. So, the major concern of agronomists is to attain the maximum yield of maize by applying the most suitable practices such as using N, organic and foliar fertilizers as well as inoculating maize grains by an effective bacterial inoculant. Such suitable fertilizers could reflect their favourable effect on yield potentiality especially for maize hybrids characterized by their highest values from vegetative growth, yield and its components and photosynthates partitioning towards the final economic yields per plant or per unit land area.

Some workers recorded significant cultivar differences in growth, yield and its related characters, relative photosynthetic potential of straw, grain and biological yields/plant as well as migration coefficient, among them: Atia, (1988), Ahmed (1990), El-Sherbieny *et al.* (1994) and Ahmed and Hassanein (2000).

Also, other workers refering to the importance of using N fertilization in raising growth and yield potentiality of maize, such as

Atia, Zahera (1988), Ghanem (1988), Griesh *et al* (2001) and El-Nagar (2003).

In addition, organic and biofertilizers could improve plant growth, yield and increasing photosynthates partitioned to economic yield, as mentioned by : Atta-Allah (1998), Radwan *et al.* (1999), Rout *et al.* (2001), Ramadan *et al.* (2002) and Adediran *et al.* (2004).

Furthermore, other investigators documented the importance of folair fertilization with different macro or micro-nutrients on growth, photosynthetic activity of leaves (which might account much for high accumulation of metabolites into the storage centres) and yield, being Kargbo (1985), Ghanem (1988) and Abdul-Galil *et al.* (1990).

Finally, this investigation aimed to study the effect of different fertilizers on the relationship between yield and photosynthates partitioning parameters of both S.C.10 and T.W.C. 321 maize hybrids.

MATERIALS AND METHODS

This study was excuted at administration field at Kafr El-Sheikh Village, Abo-Kapeer Distinct, Sharkia Governorate, Egypt under the supevision of Agronomy Department, Faculty of Agriculture, Zagazig University, Egypt during 2003 and 2004 seasons. The aim of this work was to study the effect of mineral N fertilization against other different fertilizers, (being organic, biological and foliar fertilizers) on growth, photosynthates partitioning parameters and the final yields per plant of both S.C.10 and T.W.C. 321 maize hybrids. The soil of the experimental fields were medium black soil, having 18.60, 25.00 and 167.00 ppm available N, P and K as well as 0.65, 0.47 and 1.10 melli-equ/100 gm soil from Ca, Mg and Na, orderly. Likewise, the organic matter value was 1.5% and pH 7.50. The values for such nutrients are classified as low, with some exceptions (average of both seasons).

The Studied Factors

I. Maize hybrids

Two maize cultivar were evaluated in such work as following :

1. Single cross 10 (S.C.10).
2. Three way cross 321 (T.W.C. 321).

II. Nitrogen fertilization levels

1- Check (without N application).

2- 40 kg N/fad.

3- 80 kg N/fad.

4- 120 kg N/fad

III. Other fertilizers

Three different fertilizers were tried, being :

1. Organic fertilizer, Compost. Such fertilizer was added before planting immediately at the rate of 2 ton/fad. It consists of 2.15% total N, 460 ppm ammonium nitrate, 125 ppm nitrate N, 36.1% organic matter, 13% Humic acid, 1.5% total P, 1.26% total K, 1025 ppm Fe, 115 ppm Mn, 180 ppm Cu and 28 ppm Zn.

2. Biological fertilizer "Cerealine" It considered as N fixing bactiera, *Azospirillum brasilense*, L. *and Azotobacter chroococcum*, L. Such fertilizer was used for inoculating maize grains of both cultivars at a rate of 400 gm/12 kg grains/fad before planting irrigation, immediately.

3. Foliar fertilizer "Delfan" which considered as growth stimulant. It was added by a rate of 2 cm^3 Delfan solution/ 1 litre of water/fad. The foliar application treatment was repeated three times, i.e. at 20, 30 and 40 days from planting using 400 cm^2 from Delfan solution in each spray. The total solution of Delfan was 1200 cm^3/fad for the 3 sprayings. The foliar spraying was conducted by a small hand-pump sprayer. The Delfan compound consisted of 10% free amino acids, 18.4% organic matter, 3% total N, 2.39% organic N, 1.4% amine N, 34.0% total amino acids and pH 5.0.

Also, two un-treated plots for both cultivars were found inside the mainplots of each trial and considered as a general control in this study.

The experimental design was split-split plot system of 3 replicates. The main plots were occupied by the 2 maize cultivars, and the 4 N levels were randomly distributed in the sub-plots. Whereas, the sub-sub plots were devoted to the 3 other fertilizers. The sub-sub plot size was 13.5 m^2 and contained five ridges each of 3 meter in length and 90 cm in width.

The preceding crop was Egyptian clover in both seasons. To realize a good nutritional status, the plots were fertilized with calcium super-phosphate (15.5%

P_2O_5) and potassium sulphate (50% K_2O) fertilizers which applied fully prior to planting at a rate of 15.5 or 25.0 kg P_2O_5 and K_2O/fad, respectively. Maize grains at a rate of 12 kg grains/fad were sown on May 18th and 20th in each trial, orderly. The distance within ridges was 20 cm for both cultivars. Thinning was practised before the first irrigation. Other cultural practices were kept as usual. Harvesting date was on 10 and 15 September in the first and second seasons, orderly.

Characters Studied

1. Leaf area index (LAI) : was recorded at 65 days age.
2. Relative photosynthetic potential of straw yield/plant (gm/LAI), RPP_{straw}.
3. Relative photosynthetic potential of grain yield/plant (gm/LAI), RPP_{grain}.
4. Relative photosynthetic potential of biological yield/plant (gm/LAI), $RPP_{boil} = RPP_{straw} + RPP_{grain}$.

The RPP of straw, grain and biological yields/ plant were estimated according to the procedure documented by Vidovic and Pokorny (1973).

5. Migration coefficient (MC).

$$MC = \frac{\text{Ear dry weight/plant at harvest, gm}}{\text{Biological yield/plant at harvest, gm}}$$

Such parameter was estimated as mentioned by McGraw (1977).

At harvesting time, five guarded plants were taken from the second ridge of each experimental unit in the 3 replicates to estimate the following characters :

6. Ear weight (yield) per plant (gm).
7. Straw weight (yield) per plant (gm).
8. Grain weight (yield) per plant (gm)
9. Biological yield/plant (above ground biomass), gm.

Statistical analysis was undertaken for the characters of each trial as well as their combined data as mentioned by Snedecor and Cochran (1967). Duncan's multiple range test was followed for comparison between treatment means (Duncan, 1955). In interaction Tables, capital and small letters were used to compare both row and column averages, respectively.

*, ** and N.S. denote to significant and highly significant differences and not significant, orderly.

RESULTS AND DISCUSSION

1. Cultivar Behaviours

The 2 maize hybrids under study varied significantly as for all maize plant yields and their photosynthate parameters, where the S.C. 10 cv surpassed the T.W.C.321 one in both straw and biological yields/plant and their relative photosynthetic potentials found in Tables 1, 2 and 3, orderly. The reverse hold true respecting : LAI, RPP of grain yield/plant, MC and the final yields/plant from ear and grain, since the T.W.C. 321 hybrid was extreme in this regard. This picture was fairly manifested in both trials and over them. Such cultivar performance may be due to the differences in their genetical potential and their response to the environmental conditions found around the surrounding media. In other meaning T.W.C.321 cv proved to be of more photosynthates partitioned to the final grain yield/plant. Similar cultivar performances as for the final maize yields and their photosynthates partitioning parameters, were found by other workers, of them : Atia, Zahera (1988), Ahmed (1990), El-Sherbieny *et al.* (1994) and Ahmed and Hassanein (2000).

2. Nitrogen Fertilization Effect

Withal, the N fertilization levels exerted marked changes in LAI and final yields/plant as well as in photosynthates partitioning parameters, where the 120 kg N level/fad detected the highest mean values followed by 80, 40 kg N levels and the un-fertilized control. This phenomenon was fairly valid in separate seasons and over them as well Tables 1, 2 and 3, orderly. The favourable effect of N fertilization on such charaters may be due to the activation and excess of photosynthates and other metabolic processes, being responsible for such increment in LAI and the final yields/plant of maize and their photosynthate distribution parameters. Analogous findings were documented by Atia, (1988), Ghanem (1988), Griesh *et al.* (2001) and El-Nagar (2003).

3. Other Fertilizers Effect

Aside from, the three other un-chemical fertilizers reflected significant impacts on the studied characters, being : LAI, RPP of straw, grain and biological yields/plant, MC, ear, straw, grain and biological yields/plant of maize, since the organic fertilizer Compost produced the greatest mean values, followed by the biofertilizer

Table 1 : Leaf area index (LAI) and relative photosynthetic potential of both straw and grain yields/plant, gm/LAI, of maize (RPP_{Straw}, RPP_{Grain}) due to various treatments during 2003 and 2004 seasons

Treatments	LAI			RPP_{Straw}			RPP_{Grain}		
	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.
Cultivars, V :									
S.C. 10	4.85 a	4.87 a	4.86 a	65.07 b	60.67 b	62.87 b	46.80 a	38.52 a	42.66 a
T.W.C. 321	4.93 b	4.99 b	4.96 b	60.79 a	56.43 a	58.61 a	49.84 b	38.92 b	44.38 b
F. test	**	**	**	**	**	**	**	*	**
N levels effect (kg N/fad), N :									
Check	4.58 a	4.46 a	4.52 a	50.75 a	48.67 a	49.71 a	42.65 a	32.51 a	37.58 a
40	4.74 b	4.90 b	4.82 b	60.08 b	57.38 b	58.73 b	49.49 b	36.49 b	47.99 b
80	5.06 c	5.08 c	5.07 c	68.23 c	63.71 c	65.97 c	49.81 c	41.85 c	45.83 c
120	5.18 d	5.28 d	5.23 d	72.66 d	64.44 d	68.55 d	51.33 d	44.03 d	47.68 d
F. test	**	**	**	**	**	**	**	*	**
Fertilizers effect, F :									
Compost (2ton/fad).	5.07 c	5.05 c	5.06 c	63.56 c	61.56 c	62.56 c	48.70 c	39.82 c	43.99 c
Cerealine (400 gm/fad).	4.93 b	4.97 b	4.95 b	58.49 a	55.89 a	57.19 a	47.85 a	39.09 b	43.47 b
Delfan (1200 cm^3/fad).	4.67 a	4.77 a	4.72 a	66.74 b	58.20 b	62.47 b	48.41 b	37.79 a	43.10 a
F. test	**	*	**	**	*	*	*	**	*
Fert. vs. unfert. effect :									
Fertilization, in general.	4.89 b	4.93 b	4.91 b	62.93 b	58.55 b	60.74 b	48.32 b	38.72 b	43.52 b
Without fertilization.	4.27 a	3.51 a	3.89 a	48.58 a	57.92 a	54.25 a	36.42 a	34.66 a	35.54 a
F. test	**	**	**	**	**	**	**	**	**
Interactions :									
V x N	*	**	**	**	*	*	**	*	**
V x F	*	N.S	N.S	*	N.S	N.S	N.S	N.S	N.S
N x F	N.S	*	N.S	N.S	N.S	N.S	*	N.S	N.S

Table 2 : Relative photosynthetic potential of biological yield/plant (RPP_{biol}) gm/LAI, migration coefficient (MC) and ear yield/plant (gm) of maize due to various treatments during 2003 and 2004 seasons

Treatments	RPP_{biol}			Migration coefficient (MC)			Ear yield/plant (gm)		
	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.
CultivarsCultivars, V :									
S.C. 10	111.87 b	99.19 b	105.53 b	0.50 a	0.54 a	0.52 a	275.73 a	265.27 a	270.50 a
T.W.C. 321	110.63 a	95.35 a	102.99 a	0.54 b	0.58 b	0.56 b	298.11 b	277.77 b	287.94 b
F. test	*	**	**	**	**	**	**	**	**
N levels effect (kg N/fad), N :									
Check	93.40 a	81.18 a	87.29 a	0.50 a	0.50 a	0.50 a	229.23 a	198.89 a	214.06 a
40	109.57 b	93.87 b	101.72 b	0.53 c	0.55 b	0.54 b	287.16 b	250.00 b	268.58 b
80	118.04 c	105.56 c	111.80 c	0.52 b	0.58 c	0.55 c	311.05 c	302.19 c	306.62 c
120	123.99 d	108.47 d	116.23 d	0.53 c	0.61 b	0.57 d	320.24 d	335.00 d	327.62 d
F. test	**	**	**	*	**	**	**	**	**
Fertilizers effect, F :									
Compost (2ton/fad).	112.27 c	100.83 c	106.55 c	0.54 b	0.58 c	0.56 b	290.04 b	286.76 c	288.40 c
Cerealine (400 gm/fad).	106.34 a	94.98 a	100.66 a	0.49 a	0.57 b	0.53 a	285.16 a	270.72 b	277.40 c
Delfan (1200 cm^3/fad).	115.15 b	95.99 b	105.57 b	0.53 b	0.53 a	0.53 a	285.56 a	257.08 a	271.32 a
F. test	**	**	**	**	**	**	**	*	**
Fert. vs. unfert. effect :									
Fertilization, in general.	111.25 b	97.27 b	104.26 b	0.52 b	0.56 b	0.54 b	286.92 b	271.52 b	279.22 b
Without fertilization.	85.00 a	92.58 a	88.79 a	0.48 a	0.54 a	0.51 a	186.32 a	181.66 a	183.99 a
F. test	**	**	**	**	*	**	**	**	**
Interactions :									
V x N	**	*	**	*	**	**	**	**	**
V x F	N.S	*	N.S	*	*	*	*	N.S	**
N x F	N.S	N.S	N.S	*	*	*	**	**	**

Table 3 : Straw, grain and biological yields/plant (gm) of maize in response to the different treatments during 2003 and 2004 seasons

Treatments	Straw yield/plant (gm)			Grain yield/plant (gm)			Biological yield/plant (gm)		
	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.	2003 season	2004 season	Comb.
Cultivars, V :									
S.C. 10	266.80 b	217.78 b	242.29 b	227.02 a	187.66 a	207.34 a	542.53	483.05 b	512.79 b
T.W.C. 321	247.36 a	198.06 a	222.71 a	245.76 b	194.16 b	219.96 b	545.47	475.83 a	510.65 a
F. test	**	**	**	**	**	**	N.S	**	**
N levels effect (kg N/fad), N :									
Check	198.33 a	160.03 a	179.18 a	195.34 a	145.00 a	170.17 a	427.56 a	358.92 a	393.24 a
40	232.22 b	210.00 b	221.11 b	234.60 b	176.66 b	205.63 b	519.38 b	460.00 b	489.69 b
80	286.12 c	223.88 c	255.00 c	252.00 c	211.10 c	231.55 c	597.17 c	526.07 c	561.62 c
120	311.65 d	237.77 d	274.71 d	263.62 d	230.88 d	247.25 d	631.89 d	572.77 d	602.33 d
F. test	**	**	**	**	**	**	**	**	**
Fertilizers effect, F :									
Compost (2ton/fad).	279.16 c	221.72 b	250.44 c	246.93 c	198.37 b	222.65 c	569.20 b	508.48 c	538.84 b
Cerealine (400 gm/fad).	239.16 a	201.24 a	220.20 a	236.08 b	194.16 b	215.12 b	524.32 a	471.96 b	498.14 a
Delfan (1200 cm^3/fad).	252.92 b	200.80 a	226.86 b	226.16 a	180.20 a	203.18 a	538.48 a	457.88 a	498.18 a
F. test	**	*	**	*	*	*	*	**	*
Fert. vs. unfert. effect :									
Fertilization, in general.	257.08 b	207.92 b	232.50 b	236.39 b	190.91 b	213.65 b	544.00 b	479.44 b	511.72 b
Without fertilization.	176.66 a	143.32 a	159.99 a	155.50 a	121.66 a	138.58 a	362.98 a	324.98 a	343.98 a
F. test	**	*	**	**	**	**	**	**	**
Interactions :									
V x N	**	**	**	**	**	**	*	**	**
V x F	*	N.S	**	**	N.S	*	*	**	**
N x F	**	**	**	**	**	**	**	**	**

Cerealine and at last foliar Delfan fertilizer. Such inclination was completely true in both trials and in their pooled data as well Tables 1, 2 and 3, successively. The effect of Compost and Cerealine on raising the activity of root system to absorb more necessary nutrients for producing more assimilates is responsible much for in boosting these characters. In addition, the foliar added Delfan gave reasonable influence, compared with the general control, on such tested characters reflecting its importance in raising photosynthetic activity of maize leaves, which might account much for high accumulation of metabolites in maize plant tissues and the sequent yields/plant. Ghanem (1988) and Abdul-Galil *et al.* (1990) documented similar views due to foliar fertilization system.

4. Fertilizer Against Un-fertilizer Treatments Effect

Moreover, the un-treated maize plants of the 2 hybrids possessed lower mean averages of all the tabulated traits of Tables 1, 2 and 3, when compared with those treated with the different treatments examined. Such treatment effects might be due to increasing the vital biochemical processes inside plant tissues which reflected their preferable effects on such tested traits.

5. Interactions Effect

The interaction between maize hybrids and N levels detected marked effects on M.C., ear, straw, grain and biological yields/plant Tables 4 and 5 indicating the superiority of S.C.10 cv on T.W.C. 321 one as for straw and biological yields/plant, in general, at all N levels and the check. However, the latter cv (T.W.C. 321) produced greater mean values of MC and both ear and grain yields/plant under the same N levels used. At the other extreme, the maize plants of both cvs either received N levels or not, possessed a greater mean records of MC and the final yields/plant from ear, straw, grain and biomass per plant when the 120 kg N level was considered (Tables 4 and 5).

In addition, the Vx F interaction gave significant effects on the studied characters found in Tables 6 and 7 showing that under Compost, Cerealine and Delfan fertilizers, the S.C. 10 cv was superior to T.W.C. 321 regarding both straw and biological yields/plant, but the reverse hold

Table 4 : Migration coefficient, ear and straw yields/plant of maize as affected by the V × N interaction recorded from the combined data

Cultivars, V	Migration coefficient (MC)				Ear weight/plant (gm)				Straw yield/plant (gm)			
	Nitrogen fertilization levels (kg N/fad), N											
	Check	40	80	120	Check	40	80	120	Check	40	80	120
S.C.10	A	B	C	C	A	B	C	D	A	B	C	D
	0.50 a	0.52 a	0.54 a	0.54 a	205.88 a	261.38 a	306.02 a	308 72 a	192.77 b	228.33 b	270.84 b	277.22 b
T.W.C. 321	A	B	B	C	A	B	C	D	A	B	C	D
	0.52 b	0.55 b	0.55 a	0.62 b	222.24 b	275.78 b	307.22 b	346.52 b	165.59 a	213.89 a	239.16 a	272.20 a

Table 5 : Grain and biological yields/plant (gm) of maize owing to the V × N interaction documented from the consolidated data

Cultivars, V	Grain yield/plant (gm)				Biological yield/plant (gm)			
	Nitrogen fertilization levels (kg N/fad), N							
	Check	40	80	120	Check	40	80	120
S.C.10	A	B	C	D	A	B	C	D
	161.44 a	200.61 a	228.66 a	238.65 a	398.65 b	489.71 b	576.86 b	585.94 a
T.W.C. 321	A	B	C	D	A	B	C	D
	178.90 b	210.65 b	234.44 b	255.85 b	387.83 a	479.67 a	556.38 a	618.72 b

Table 6 : Migration coefficient (MC) and both ear and straw yields/plant (gm) of maize for the Vx F interaction given from the pooled data

Cultivars, V	Migration coefficient (MC)			Ear weight/plant (gm)			Straw yield/plant (gm)		
	The other tested fertilizers, F								
	Compost	Cerealine	Delfan	Compost	Cerealine	Delfan	Compost	Cerealine	Delfan
S.C.10	C	B	A	C	A	B	C	B	A
	0.57 a	0.51 a	0.48 a	273.80 a	268.62 a	269.08 a	251.66 b	239.79 b	235.42 b
T.W.C. 321	C	A	B	C	B	A	C	A	B
	0.60 b	0.53 b	0.55 b	303.00 b	287.26 b	273.56 b	249.22 a	200.61 a	218.30 a

Table 7 : Grain and biological yields/plant (gm) of maize in response to the V × F interaction (pooled data)

Cultivars, V	Grain yield/plant (gm)			Biological yield/plant (gm)		
	The other tested fertilizers, F					
	Compost	Cerealine	Delfan	Compost	Cerealine	Delfan
S.C.10	C	B	A	C	B	A
	210.19 a	206.29 a	205.54 a	525.46 a	508.41 b	504.50 b
T.W.C. 321	C	B	A	C	B	A
	235.11 b	223.95 b	200.82 b	552.22 b	497.87 a	481.86 a

true as for T.W.C. 321, since it was pioneer under the studied fertilizer, being MC and ear as well as grain yields/plant. On other words, the plants of both hybrids had considerable mean averages of MC, ear, straw, grain and biomass/plant due to Compost fertilizer application if compared with Cerealine and Delfan ones.

Moreover, the NxF interactions exhibited significant effects on the studied traits listed in Tables 8 and 9 revealing that the Compost maize plants received 80 kg N level/fad attained the greatest mean averages from MC, ear, straw, grain and biological yields/plant indicating the efficiency of such organic fertilizer in reducing the mineral N level to about 30% from the recommended N dose. On that score, the lowest records from such traits, being M.C, ear, straw, grain yields/plant beside biomass/plant were documented at the no-N treatment when Compost fertilizer (in grain yield/plant) or Cerealine biofertilizer (regarding ear and straw yields and their biomass/plant) or Delfan foliar fertilizer (as for MC) were in the picture. Other values produced from the discussed treatments found in Tables (8 and 9) came in between.

Ultimately, it could be concluded from the findings of this work that, growing maize plants of both hybrids (S.C.10 and T.W.C. 321) under 120 kg N/fad and by using 2 ton/fad organic fertilizer (Compost), especially in low fertility soil like used herein, was considered worthwhile. But, the more pronounced results were in favour of T.W.C. 321 hybrid of a higher canopy structure and can produce excessive growth habit, greater assimilates partitioned to the economic yield and outstanding yields/plant. Likewise, the effective action of N fertilization that can reduces the agricultural costs and environmental pollution could be improved by a combination of 80 kg N level/fad associated with 2 ton/fad from organic fertilizer "Compost" for raising the photosynthetic capacity of maize plant organs that was reflected positively on enhancing the migration of more assimilates into the storage centres ending with maximizing the yield potentiality of maize crop.

Table 8 : Migration coefficient (MC) and both ear and straw yields/plant (gm) of maize as affected by the N × F interaction (combined data)

Fertilizers, F	Migration coefficient (MC)				Ear weight/plant (gm)				Straw yield/plant (gm)			
	Nitrogen fertilization levels (kg N/fad), N											
	Check	40	80	120	Check	40	80	120	Check	40	80	120
Compost (2ton/fad)	A	B	C	B	A	B	D	C	A	B	D	C
	0.51 b	0.55 b	0.63 c	0.55 a	220.32 b	272.25 c	334.57 c	326.46 a	176.94 b	221.94 b	306 12 c	296.77 c
Cerealine (400 gm/fad)	A	C	B	D	A	B	C	D	A	B	C	D
	0.50 ab	0.54 ab	0.52 b	0.56 a	199.25 a	262.29 a	321.81 b	328.41 a	162.51 a	217.50 a	243.33 b	257.46 a
Delfan (1200 cm^3/fad)	A	B	A	C	A	B	C	D	A	C	B	D
	0.49 a	0.53 a	0.50 a	0.60 b	225.61 c	262.20 b	266.48 a	330.99 b	198.10 c	223.89 c	215.55 a	269.90 b

Table 9 : Grain and biological yields/plant (gm) of maize resulting from the N x F interaction effect (pooled data)

Fertilizers, F	Grain yield/plant (gm)				Biological yield/plant (gm)			
	Nitrogen fertilization levels (kg N/fad), N							
	Check	40	80	120	Check	40	80	120
Compost (2ton/fad)	A	B	D	C	A	B	D	C
	158.66 a	229.23 c	261.13 c	241.58 b	397.25 b	494.19 b	640.69 c	623.23 c
Cerealine (400 gm/fad)	A	B	D	C	A	B	D	C
	172.91 b	205.75 b	246.32 b	235.50 a	361.76 a	499.79 c	545.14 b	585.87 a
Delfan (1200 cm^3/fad)	A	B	C	D	A	B	C	D
	178.94 c	181.91 a	187.20 a	264.67 c	420.71 c	475.09 a	499.03 a	597.89 b

REFERENCES

Abdul-Galil, A.A., S.A. Ghanem, O.A. Zeiton and M.M. Moselhy 1990. Effect of planting density and foliar N fertilization on yield of maize. Prof. 4th conf. Agron., Cairo, 1 : 405-417.

Adediran, J.A., L.B. Taiwo, M.O. Akande, R.A Soulo and O.J. Idowu 2004. Application of organic and inorganic fertilizer for sustainable maize and cowpea yields in Nigeria. J. of plant nutrition, 27(7) : 1163-1181.

Ahmed, M.A. 1990. Partition and migration of dry matter in newly cultivated maize cultivars in Egypt. Egypt J. Agron.. 15(1-2): 61-73.

Ahmed, M.A. and M.S. El-Hassanein 2000. Partition of photosynthates in yellow maize hybrids. Egypt. J. Agron., 22 : 39-63.

Atia, Zahera, M.M. 1988. Effect of some agronomic practices on yield of maize. Ph.D. Thesis, Fac. of Agric., Zagaizg Univ., Egypt.

Atta-Alla, S.A.A. 1998. Response of maize to nitrogen and biofertilizer. Assiut J. of Agric. Sci., 29(1) : 59-73.

Duncan, D.B.C. 1955. Multiple range and multiple F.test. Biometrics, 11 : 1 : 42.

El-Nagar, G.R. 2003. Integrating of mineral and bio-fixed nitrogen fertilization in maize production under different irrigation regimes. Assiut J. of Agric. Sci., 34(5) : 53-75.

El-Sherbieny, H.Y., S.E.Sadek, A.A. Abdel-Aziz and H. El.M. Gado 1994. Correlation and path coefficient analysis in fourteen white maize hybrid charaters. J. Agric. Sci., Mansoura Univ., 19(12) : 4133.

Ghanem, S.A.I. 1988. Response of maize to foliar P application under different soil N fertilization. Zagazig J. Agric. Res., 15(2) : 361-385.

Griesh, M.H., G.M. Yakout, W.J. Horst, M.K. Schenk, A. Burkert, N. Claassen, H. Flessa, W.B. Frommer, H. Goldbach, H.W. Olfs and V. Romheld 2001. Effect of plant population density and nitrogen fertilization on yield and yield components of some white and yellow maize hybrids under drip irrigation system in sandy soil. Plant nutrition food security and sustainability of agroecosystems through basic and applied

research fourteenth international plant nutrition colloquium., 810-811.

Kargbo, C.S. 1985. Effect of plant reproductive stage and rates of foliar fertilizer sprays on corn yield and yield components. Zeitschrift für Acker und pflanzenbau, 155(4) : 268-273.

McGraw, R.L. 1977. Yield dynamics of florunner peanut (*Arachis hypogae* L.) M.Sc. Thesis. Florida Univ., U.S.A.

Radwan, S.M.A., M. Saber, D. Anac and P.P. Martin 1999. Response of corn to bio- and organic fertilizers in a newly reclaimed sandy soil. Improved crop quality by nutrient management, 253-257.

Ramadan, H.M., E.A. Koreish, H.M. Gaber, and M.E. El-Fayoumy 2002. Assessment and comparison of bio-and mineral fertilization on farm profitability in different newly-reclaimed soils. Alex. J. Agric. Res., 47(1): 133-146.

Rout, D., M.R. Satapathy and B.K. Mohapatra 2001. Effect of biofertilizers on nitrogen economy in maize. Madras Agric. J., 88(7-9) : 530-532.

Snedecor, G.W. and W.G. Cochran 1967. Statistifal methods. 6th ed. Iowa State Univ., Press, Ames, Iowa, U.S.A.

Vidovic, J. and V. Pokorny 1973. The effect of different sowing densities and nutrient levels in LAI, production and distribution of dry matter in maize. Gologia planta, 15, 374.

المحصول فى الذرة الشامية وعلاقته بمقاييس ناتجات التمثيل الضوئى

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أجريت هذه الدراسة بحقل إرشادى بقرية كفر الشيخ - مركز أبو كبير ، محافظة الشرقية، خلال الموسمين ٢٠٠٣ ، ٢٠٠٤ ، بهدف دراسة تأثير التسميد النيتروجينى (صفر ، ٤٠ ، ٨٠ ، ١٢٠ كجم ن / فدان) ، والأسمدة الأخرى غير المعدنية (السماد العضوى كومبوست بمعدل ٢ طن / فدان ، السماد الحيوى سيريالين بمعدل ٤٠٠ جم/فدان والسماد الورقى دلفان بمعدل ١٢٠٠ سم^{٣}/فدان) على محصول صنفين من الذرة الشامية (هجين فردى ١٠ ، وهجين ثلاثى ٣٢١) وعلاقته بمقاييس ناتجات التمثيل الضوئى. كان التصميم المستخدم هو نظام القطع المنشقة من الدرجة الثانية - حيث تم توزيع الصنفين فى القطع الرئيسية ، بينما كانت مستويات السماد النيتروجينى الأربع فى القطع الشقية من الدرجة الأولى وأخيراً احتوت القطع الشقية من الدرجة الثانية على الأسمدة الثلاث الأخرى - وزعت المعاملات التجريبية فى ثلاث مكررات - وفى كل قطعة رئيسية وجدت قطعة تجريبية واحدة بدون أى معاملة - وبذلك يكون عدد القطع التجريبية ٢ للصنفين × ٤ لمستويات السماد النيتروجينى × ٣ للأسمدة الأخرى × ٣ مكررات = ٧٢ قطعة تجريبية + ٢ قطعة بدون أى معاملة فى كل مكررة. احتوت كل قطعة تجريبية على ٥ خطوط وكان عرض الخط ٩٠ سم وطوله ٣ م. وبذلك تكون مساحة القطعة التجريبية ٤,٥ × ٣ = ١٣,٥ م^{٢}.

أظهرت النتائج وجود اختلافات معنوية بين الصنفين تحت الدراسة ، حيث تفوق الصنف هجين فردى ١٠ فى محصول القش والمحصول البيولوجى للنبات وأيضاً الإمكانية التمثيلية النسبية لهاتين الصفتين. وعلى العكس من ذلك ، فقد تفوق الهجين الثلاثى ٣٢١ فى كل من : دليل مساحة الأوراق ، معامل الهجرة ، محصولى الكيزان والحبوب/ نبات وأخيراً فى الإمكانية التمثيلية النسبية لمحصول الحبوب للنبات.

أيضاً ، كشفت النتائج وجود اختلافات معنوية بين مستويات السماد النيتروجينى والأسمدة الأخرى للصفات تحت الدراسة ، حيث نتج عن المستوى ١٢٠ كجم ن/ فدان وأيضاً معاملة السماد العضوى Compost زيادة معنوية فى كل من : دليل مساحة الأوراق ، معامل الهجرة، محصول الكيزان/نبات وأيضاً محصولى القش والحبوب والمحصول البيولوجى/نبات وأخيراً الإمكانية التمثيلية النسبية لمحصول القش ، محصول الحبوب

والمحصول البيولوجى/ نبات ، بالمقارنة بالمستويين ٤٠ ، ٨٠ كجم ن/فدان ومعاملة الكنترول أو السماد الحيوى (سيريالين) والسماد الورقى (دلفان).

بالمثل ، أوضحت النتائج وجود تداخل فعل موجب ومعنوى بين الصنفين إما مع مستويات السماد النيتروجينى أو مع الأسمدة الأخرى وكانت أفضل النتائج لمعامل الهجرة ومحصول الحبوب الاقتصادى فى صالح الصنف هجين ثلاثى ٣٢١ إما مع المستوى ١٢٠ كجم ن/فدان أو مع السماد العضوى (Compost).

وفوق ذلك ، بينت النتائج أيضاً ، وجود تداخل فعل معنوى بين مستويات السماد النيتروجينى والأسمدة الأخرى على معامل الهجرة ، محصول الكيزان/نبات ، محصولى القش والحبوب/ نبات وأخيراً المحصول البيولوجى/ نبات وكان ذلك فى صالح المستوى ٨٠ كجم ن/فدان مع السماد العضوى كومبوست ، وذلك بالمقارنة بالمستويات الأخرى تحت الدراسة ، أى أنه نتج عن السماد العضوى مع التسميد النيتروجينى نقص فى معدل التسميد النيتروجينى بحوالى ٤٠ كجم ن/فدان ، وهذا يقلل من التكاليف الزراعية ومن مخاطر التلوث البيئى الناتج من زيادة السماد النيتروجينى المعدنى.

أخيراً ، يمكن الاستنتاج من هذه الدراسة أن الصنف T.W.C.321 كان أكثر كفاءة فى توظيف وهجرة المادة الجافة (ناتجات التمثيل الضوئى) إلى المحصول النهائى/نبات ويمكن استخدامه فى تقوية العلاقة بين المحصول فى الذرة الشامية ومقاييس ناتجات التمثيل الضوئى تحت ظروف إقامة هذا البحث بمحافظة الشرقية – جمهورية مصر العربية.