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PRODUCTIVITY OF MAIZE AS AFFECTED BY ORGANIC, FOLIAR AND NITROGEN FERTILIZATION LEVELS

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Abstract- Maize is well known for its high demand for nutrients and other production inputs. Thereby, two field experiments were carried out at El-Orman Village, El-Sinbelaween Station, Dakahlia Governorate, Egypt, during 2010 and 2011 seasons to determine the effect of organic fertilization (without, farmyard manure and compost) and foliar fertilization (without, spraying with water, Crystal Nasr and Melagrow) under nitrogen fertilizer levels (50, 75 and 100 kg N/fed) on productivity of maize hybrid TWC 324. All studied growth characters were exerted significant effect as a result of applying organic fertilization treatments in both seasons. The treatment from organic fertilization which gave the highest values of these characters was applying the compost as compared with other treatments in both seasons. Foliar application with Melagrow as a natural growth promoter significantly recorded the highest values of studied growth, yield and its attributes in both seasons. Whilst, application of Crystal Nasr came in the second rank in this respect in the two seasons. While, lowest values of all growth, yield and its attributes characters were resulted from the control treatment (without foliar application) in both seasons. Application nitrogen fertilization at the level of 100 kg N/fed significantly exceeded other levels (50 and 75 kg N/fed) of studied growth, yield and its attributes parameters in both seasons. The preferable productivity of maize hybrid TWC 324 can be achieved through organic fertilizing with compost, foliar application with Melagrow and mineral fertilizing with 100 kg N/fed under the environmental conditions of El-Sinbelaween Center, Dakahlia Governorate, Egypt.

Keywords- Maize, Organic fertilization, FYM, Compost, Foliar fertilization, Foliar fertilizers, N-levels

Introduction

Maize is considered as one of the main cereal crops, comes the third after wheat and rice. Maize is very essential either for the human food or animal feeding and a common ingredient for industrial products. It plays a vital source of daily human food because their flour mixed with wheat flour by 20% for bread making in Egypt. Also, maize is used as a feed for livestock whether fresh, silage or grains. The grains also have many industrial uses, such as transformation to plastics and fabrics. Therefore, a great attention should be paid to raise maize productivity by maximizing yield per unit area in order to reduce the gab between its production and consumption. Among factors that enhance maize productivity such as organic (farmyard and compost) and foliar fertilization as well as nitrogen fertilizer levels.

Modern agriculture is not possible without fertilizer application, which not only maintains, but even gradually increases field crop yield. Modern fertilization systems are not just an isolated element of plant production, but are indispensable link in the practice. Organic and mineral fertilization provides plants with nutrients at appropriate proportions and quantities which enable maximum yield increase of crops with high biological and technological quality. Organic manure increases soil fertility. In the short-term manure stimulates microbial activity that improves soil structure and in the long-term supplies NO_3 and NH_4 to aid crop production [1].

Among the organic manures, farmyard manure (FYM) is the most important as it contains all the nutrients needed for crop growth including trace elements, albeit in small quantities. Khanday *et al.* [2] found that farmyard manure (FYM) application up to 20 t/ha increased number of grains/cob and grain yield/ha of maize plant. Heluf [3] reported that an increment of 0.47 t/ha in grain yield due to application of FYM during the first year over no FYM. Ladha *et al.* [4] decided that the use of different organic manures such as manure (farmyard manure or green manure), compost, and crop residues (particularly rice straw) are commonly recommended to offset the decrease in soil organic carbon. Sheng, Mao *et al.* [5] showed that farmyard manure supplies adequate amounts of nutrients such as N and K which tended to balance crop requirements and resulted in improving grain yield of maize. El-Hamdi *et al.* [6] revealed that the highest values of ear diameter (4.25 and 4.46 in.), 100 - grain weight (29.93 and 30.32 g) and grain yield (24.04 and 25.26 ardab/fed) were obtained from fertilization with 10 m^3 of chicken manure/fed in the first and second seasons, respectively.

Compost is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. The compost has beneficial effects on the land in many ways, such as a soil conditioner, fertilizer, supplement of vital humus or humic acids, and as a natural pesticide for soil. Lampkin [7] stated that compost is known to improve the properties of the soil (physical, chemical and biological). He also added that use of organic manure over several seasons increased maize yields by 40-60%, but when used in combination with inorganic fertilizers the yields increased by 80-95%. Radwan *et al.* [8] found that 100-grain weight increased from 16.89 with the usual rate of NPK fertilizer to 18.9 and 20.4 with either 20 or 40 m^3/fed composted sawdust, respectively. Pattanashetti *et al.* [9] showed that higher cob length, number of rows/cob, grains number/row, grains weight/ear and 100-grain weight were recorded with the organic manure application compared to the control. FYM application gave higher yield attributes mentioned before if compared with the control and Vermi-compost fertilizer and was par with poultry manure. They, also added that grain and stover yields/ha were higher with FYM application than the control and Vermi-Compost and was at par with poultry manure. Ali *et al.* [10] recorded that organic manure (bio-compost or compost) improved the physical properties of the soil and increased the supplying of available nutrients to plants. Nofal, Fatma *et al.* [11] noticed that applying 10 m^3/fed of chicken manure or rice straw compost increased maize grain yield as compared with the control treatment (without organic manure). This increment may be attributed to organic manure contains of microorganisms which fix and release phytohormones, which stimulate plant growth. Mohamed [12] showed that un-mineral fertilizers detected significant changes in all characters, being plant height, ear diameter, ear length, ear weight, rows number/ear, grains number/row, the yields per plant and per fed from ear, straw and biomass and shelling %. The highest values of these characters were resulted from application organic fertilizer (compost) at a rate of 2 t/fed. Gil *et al.* [13] concluded that compost would be a good substitute for the mineral fertilizers generally used for basal dressing in maize growing. Adejumo *et al.* [14] observed that compost application significantly increased the vegetative and yield parameters of maize and performed better than inorganic fertilizer ($P<0.05$).

Foliar fertilization is a widely used practice to correct nutritional deficiencies in plants caused by improper supply of nutrients to roots. The main benefits of foliar spraying are that it can have up to a 90% efficiency rate of uptake as opposed to 10% efficiency from soil applications. Also, foliar fertilization becomes directly available in the plant because they are 100% water soluble. This lead to foliar fertilization is perfect way for correcting nutrient deficiencies. The other great thing is that foliar spraying stimulates the plants to create exudates in the roots which excite microbes to work harder and thus increases nutrient uptake from the soil. In addition, foliar sprays enhance flavors, sweetness, mineral density and yield of crops. Ling and Silberbush [15] concluded that foliar fertilization may partially compensate for insufficient uptake by plant roots, but requires adequate leaf area to become effective. Mohamed [12] indicated that Dlefan fertilizers gave considerable increases in ear diameter, length and weight, number of grains/row, the final yields either/plant or /fed from ear, straw, grain and biomass and shelling % when compared with the general check. Radulov *et al.* [16] indicated that grain yield increased when nitrogen fertilizer added. Raw protein content of maize grain was ranged between 7.0% and 10.0%. Higher nitrogen application rates alter the amino acid balance thereby reducing the nutritional value. Shahzad *et al.* [17] concluded that the boron certain levels was effective as a foliar application to enhance growth characters in maize crop and accelerated growth and assimilation of mineral revealed that the boron as a micronutrient was very effective and can be applied practically and is also extendable to other crops.

Nitrogen is the constituent of protoplasm, proteins, nucleic acids, chlorophyll and plays a vital role both in vegetative and reproductive phase of crop growth. Maize has been recognized as a heavy feeder and uses more of nitrogen than any other nutrient element. Many reports indicated that nitrogen is considered as one among the most affective factors in increasing growth and yield of maize crop [12,18-23]. However, Wopereis *et al.* [24] concluded that nitrogen was the major limiting yield nutrient in this study. In spite of excess application of nitrogen fertilizer could be accumulated in plant tissues in freely manner, this also affects human health and crop quality. However, judicious use of mineral nitrogen fertilizer should be promoted on improvement maize productivity.

Thus, this study was undertaken to determine the effect of organic and foliar fertilization under nitrogen fertilizer levels on yield and its components of maize hybrid TWC 324 under the environmental conditions of El-Sinbelaween district, Dakahlia Governorate, Egypt.

Materials and Methods

Two field experiments were carried out at El-Orman Village, El-Sinbelaween Station, Dakahlia Governorate, Egypt, during the two successive summer seasons of 2010 and 2011. The main objectives of this study were to determine the effect of organic and foliar fertilization under nitrogen fertilizer levels on yield of maize (*Zea mays* L.) hybrid TWC 324 and to minimize the pollution by nitrate in water and soil.

Each organic fertilization treatment was performed in separate experiment. Every experiment of organic fertilization treatment was carried out in split plot design with four replications. The studied organic fertilization treatments were as follows:

1. Without organic fertilization (control treatment).
2. Farmyard manure (FYM) at the rate of 20 m^3/fed.
3. Compost at the rate of 4 t/fed.

Farmyard manure (FYM) was added in the experiment area before soil preparation. Whereas, compost was added after plowing and leveling and before ridging. Chemical analysis of farmyard manure and compost used in both seasons is listed in [Table-1].

Table 1- Chemical analysis of farmyard manure and compost used in both seasons.

Properties	Farmyard manure	Compost
Moisture (%)	12.96	18.8
OM (%)	19.16	34.1
C/N ratio	11-Dec	14-Jan
N (%)	0.65	1.41
P (%)	0.45	0.2
K (%)	1.4	0.65
pH	8.68	6.61
EC m.mohs/cm	8.38	9.33
Fe (ppm)	650	950
Mn (ppm)	780	150.7
Zn (ppm)	312	111

The main plots were occupied with the following four foliar fertilization treatments in each experiment:

1. Without (control treatment).
2. Foliar spraying with water.
3. Foliar spraying with Crystal Nasr at the rate of 1 kg/200 liter water/fed.
4. Foliar spraying with Melagrow at the rate of 50 ppm (10 g Melagrow/200 liter water/fed).

Foliar fertilization treatments were carried out twice at the aforementioned rates after 25 and 45 days from sowing (DFS). The chemical composition of commercial foliar fertilizer Crystal Nasr used in this experiment is presented in [Table-2].

Melagrow is natural growth promoter extracted from pollen of cabbage flowers and has great effectiveness of many field crops.

Melagrow is combined effects of oxen, cytokines, gibberellins, ethylene and hydrogen cyanamid. The chemical composition of Melagrow is 20% phosphorus, 10% potassium, 3% boron and 0.2% brassinolide. Natural brassinolides (0.2%) is natural plant growth promoter for all crops, which promotes growth, increases yield and improves quality.

Table 2- Chemical composition of Crystal Nasr foliar fertilizer.

Chemical Composition	Value
N %	20
P %	20
K %	20
Zn ppm	120
Fe ppm	700
Mn ppm	420
Cu ppm	160
Mo ppm	140
B ppm	220

For each experiment, the sub-plots were assigned to three nitrogen fertilizer levels (50, 75 and 100 kg N/fed). Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) was added at the formerly mentioned levels in two equal parts, one half after thinning (before the first irrigation) and the other half before the second irrigation.

Each experimental basic unit (sub-plot) included five ridges, each of 60cm width and 3.5m length, resulted an area of 10.5m^2 (1/400 fed). The preceding winter crop was Egyptian clover (*Trifolium alexandrinum* L.) in the first and second seasons. The soil of the experimental site was clay loam in texture with an electrical conductivity (EC) of 2.78 dS/m and a pH of 7.85.

The experimental field well prepared through two ploughing, adding organic fertilizers, leveling, compaction, ridging and then divided into the experimental units (10.5m^2). Calcium superphosphate (15.5% P_2O_5) was applied during soil preparation at the rate of 150 kg/fed. Potassium sulphate (48% K_2O) at the rate of 50 kg/fed was applied with the first dose of nitrogen fertilizer.

Maize grains were hand sown in hills 25cm apart at the rate of 2-3 grains/hill using dry sowing method (Afir) on one side of the ridge during the second week of May in 2010 and 2011 seasons. The plants were thinned to one plant per hill before the first irrigation. The first irrigation was applied after 21 days from sowing and the following irrigations were applied at 15 days intervals during the growing seasons. The other agricultural practices were kept the same as normally practiced in maize fields according to the recommendations of Ministry of Agriculture and Land Reclamation, except for the factors under study.

At harvest time (after 120 days from planting) random samples of five guarded plants were taken at random from each sub-plot to determine the following characters:

1. Plant height (cm); it was measured in cm from the soil surface up to the top of tassel.
2. Ear height (cm); it was measured in cm from the soil surface up to the shank of ear.
3. Ear leaf area (cm2); it was calculated by the following formula according to Gardner et al. [25]:
4. Ear leaf area = Ear leaf length X maximum width of ear leaf X 0.75.
5. Number of ears/plant; it was calculated by dividing the mean number of ears of five plants.
6. Ear length (cm); it was measured as the means of length of five ears.
7. Ear diameter (cm); it was measured by using a varnier caliper as the means of random five ears.
8. Ear weight (g); it was obtained by averages weight of five ears in grams.
9. Number of rows/ear; it was counted as the averages of number of rows of random samples of five ears.
10. Number of grains/row; it was counted as the means of number of grains in each row of random samples of five ears.
11. Ear grains weight (g); it was obtained by averages weight of ear grains of the number of five ears in grams.
12. Shelling percentage (%); it was determined by divided the weight of shelled grains of five ears by their weights and multiplied by 100.
13. 100-grain weight (g); it was taken from clear grains and determined as the means weight of four random samples of 100 grains of each plot and adjusted to 15.5% moisture content.
14. Grain yield (ardab/fed); it was determined by the weight of grains per kilograms adjusted to 15.5% moisture content of each plot, then converted to ardab per feddan (ardab = 140 kg).

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split-plot design to each experiment (organic fertilization treatments), then combined analysis was done between organic fertilization treatments as published by Gomez and Gomez [26] by using "MSTAT-C " computer software package. New Least Significant of Difference (NLSD) method was used to test the differences between treatment means at 5% level of probability as described by [27].

Results and Discussion

Effects of Organic Fertilization

Data presented in [Table-3], [Table-4] and [Table-5] illustrate that, the effect of organic fertilization treatments on plant and ear height, ELA, number of ears/plant, ear length (cm), ear diameter (cm), ear weight (g), number of rows/ear, number of grains/row, ear grains weight (g), shelling percentage (%), 100-grain weight (g) and grain yield (ardab/fed) of maize was significant in both seasons of this investigation. There were substantial differences in all studied characters among various studied organic fertilization treatments (without, FYM and compost) in both seasons. Organic fertilizing maize with compost treatment gave the highest values of growth, yield and its attributes under study in both seasons. However, control treatment (without organic fertilization) was accompanied with the least values of growth, yield and its components in the first and second seasons. It was worthy to mention that FYM treatment arranged between aforementioned organic fertilization treatment with respect their effect on of growth, yield and its attributes in both seasons. Such superiority of fertilizing maize by compost in increasing growth characters may be due to the improving action of organic matter on physical, biological and chemical properties of soil. Also, the use of compost improved soil organic matter, nitrogen content, P_2O_5 concentration and exchangeable cations consequently enhanced photosynthesis and the other bio-chemical processes inside maize plants which is responsible much for such increase in plant growth. Similar results were reported by several researchers such as [1,11,12].

Table 3- Plant and ear height, ear leaf area (ELA), number of ears/plant and ear length of maize as affected by organic and foliar fertilization under nitrogen fertilizer levels during 2010 and 2011 seasons.

Characters	Plant Height (cm)		Ear Height (cm)		ELA (cm^2)		Number of ears/plant		Ear length (cm)	
Treatments	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
A- Organic fertilization:										
Control	260.2	262.8	146.8	150.9	477.5	583.6	1.33	1.52	20.84	21.28
FYM	277	273.7	151.3	156.6	574.6	610.5	1.56	1.68	22.33	22.11
Compost	282.3	277.3	159.5	165.4	584.4	660.9	1.72	1.83	23.56	23.01
F. test	*	*	*	*	*	*	*	*	*	*
NLSD 5 %	0.8	1.4	0.4	0.5	3	5.6	0.07	0.08	0.11	0.17
B-Foliar fertilization:										
Control	237.9	230.5	135.8	139.2	395.5	455.5	1.37	1.49	19.79	19.11
Water	264.7	255.9	147.1	148.3	509.7	576.4	1.51	1.55	21.51	21.13
Crystal Nasr	283.8	283	158.7	162.6	595.2	668.2	1.45	1.65	23.22	23.17
Melagrow	306.3	315.6	168.6	180.3	681.5	773.4	1.82	2.02	24.46	25.13
F. test	*	*	*	*	*	*	*	*	*	*
NLSD 5 %	0.9	1.6	0.5	0.6	3.5	6.5	0.09	0.1	0.13	0.2
C- Nitrogen fertilizer levels:										
50 kg N/fed	264.8	262.3	148.9	153.2	511.6	588.2	1.38	1.59	21.69	21.43
75 kg N/fed	273.8	271.3	152.4	157.6	545.9	612.9	1.6	1.68	22.23	22.13
100 kg N/fed	281	280.2	156.3	162.2	578.9	653.9	1.63	1.77	22.82	22.85
F. test	*	*	*	*	*	*	*	*	*	*
NLSD 5 %	0.7	0.6	0.3	0.4	2.3	5.9	0.08	0.11	0.14	0.08

Table 4- Ear diameter and weight, number of rows/ear and number of grains/row of maize as affected by organic and foliar fertilization under nitrogen fertilizer levels during 2010 and 2011 seasons.

Characters	Ear diameter (cm)		Ear weight (g)		Number of rows/ear		Number of grains/row	
Treatments	2010	2011	2010	2011	2010	2011	2010	2011
A- Organic fertilization:								
Control	3.25	4.09	245	256.1	11.73	11.72	40.75	46.83
FYM	3.74	4.1	277.3	263.7	11.9	12.42	42.64	48
Compost	3.87	4.34	281.9	267.2	13.11	13.32	43.98	48.44
F. test	*	*	*	*	*	*	*	*
NLSD 5 %	0.02	0.02	1.3	0.3	0.22	0.2	0.4	0.13
B-Foliar fertilization:								
Control	2.97	3.25	244.9	230.7	10.89	11.33	38.95	43.06
Water	3.25	3.91	255	245	11.64	11.88	41.61	46.74
Crystal Nasr	3.84	4.46	273.6	266.6	12.66	12.59	43.27	49.2
Melagrow	4.42	5.09	298.7	307	13.79	14.14	45.99	52.03
F. test	*	*	*	*	*	*	*	*
NLSD 5 %	0.03	0.02	1.6	0.8	0.26	0.23	0.47	0.15
C- Nitrogen fertilizer levels:								
50 kg N/fed	3.48	3.99	260.9	253.6	11.82	12.09	41.56	46.69
75 kg N/fed	3.6	4.17	266.8	262.3	12.26	12.51	42.48	47.78
100 kg N/fed	3.78	4.38	276.4	271.1	12.66	12.86	43.34	48.8
F. test	*	*	*	*	*	*	*	*
NLSD 5 %	0.02	0.01	1.1	0.5	0.18	0.19	0.46	0.1

Effects of Foliar Fertilization

The effect of foliar fertilization treatments on maize growth, yield and its attributes characteristics *i.e.* plant and ear height, ELA, number of ears/plant, ear length, ear diameter, ear weight, number of rows/ear, number of grains/row, ear grains weight, shelling percentage, 100-grain weight and grain yield/fed was significant in both seasons as shown in [Table-3], [Table-4] and [Table-5]. From obtained results, foliar spraying maize plants with Melagrow significantly increased growth, yield and its components and also produced the highest values of these characters in both seasons under the environmental conditions of this study. On the other wise, plants growing without foliar spraying gave the lowest ones in both seasons. Plants were sprayed with Crystal Nasr came in the second rank after those sprayed with Melagrow in this concern. It can be detected that, spraying maize plants with water, Crystal Nasr and Melagrow significantly enhanced growth, yield and its attributes over the control treatment (without foliar fertilization), and also the differences among them were significant in the first and second seasons of this investigation. The increases in maize growth and yield by foliar application with Melagrow that contains phosphorus, potassium, boron and brassinolide may be due to the role of macro and micronutrients in activating physiological and biochemical processes as well as the role of brassinolides in improvement growth reflecting increases in growth characteristics. Confirming this conclusion by [15,17].

Effects of Nitrogen Fertilizer Levels

The data revealed in [Table-3], [Table-4] and [Table-5] show that the effect of nitrogen fertilizer levels on all studied characters was significant in the two growing seasons. It can be stated that all studied characters significantly increased as a result of increasing nitrogen fertilizer levels from 50 up to 100 kg N/fed and the differences between them were obvious in both seasons. Application the highest level of nitrogen fertilizer (100 kg N/fed) produced the highest values of growth, yield and its attributes in both seasons. Fertilizing maize plants with 75 kg N/fed came in the second rank after fertilizing with 100 kg N/fed with respect to these characters in both seasons. The lowest values of maize growth, yield and its attributes characters were resulted from fertilizing plants with the lowest nitrogen fertilizer level (50 kg N/fed) in both seasons. The increases in productivity of maize crop as a result of increasing nitrogen fertilizer level up to 100 kg N/fed can be ascribed to the role of N element in monitoring of many basic physiological processes in maize plants such as pholosynthetic rate and the accumulation of more metabolites partitioned to plant organs, reflecting therefore better growth of both maize. Also, the positive response of maize plants and in turn the studied characters to the N levels applied could be attributed to the reduction of the organic matter and available N in the experimental soils of this study. Similar results were in coincidence with those stated by Akmal *et al.* [20], Hassan *et al.* [21], Soliman and Gharib [23] and Wopereis *et al.* [24].

Table 5- Ear grains weight, shelling percentage, 100-grain weight and grain yield/fed of maize as affected by organic and foliar fertilization under nitrogen fertilizer levels during 2010 and 2011 seasons.

Characters	Ear Grains Weight (g)		Shelling (%)		100-Grain Weight (g)		Grain Yield (ardab/fed)	
Treatments	2010	2011	2010	2011	2010	2011	2010	2011
A- Organic fertilization:								
Control	194.4	221.3	78.08	86.51	26.63	28.03	20.26	22.9
FYM	221.2	228.5	79.3	86.97	28.26	29.61	22.18	23.88
Compost	223.6	243.2	79.85	91.43	29.92	30.92	23.07	24.78
F. test	*	*	*	*	*	*	*	*
NLSD 5 %	1.8	0.9	0.35	0.45	0.11	0.07	0.05	0.05
B-Foliar fertilization:								
Control	198.9	202.6	75.86	83.49	24.15	25.69	18	19.62
Water	204.9	224.3	78.65	87.77	27.03	28.22	20.57	22.25
Crystal Nasr	215.3	241	80.44	90.45	29.71	30.85	23.05	25.33
Melagrow	233.2	256.1	81.36	91.5	32.19	33.32	25.71	28.21
F. test	*	*	*	*	*	*	*	*
NLSD 5 %	2	1	0.9	0.52	0.13	0.08	0.06	0.06
C- Nitrogen fertilizer levels:								
50 kg N/fed	207.4	225	77.82	87.73	27.38	28.62	20.97	22.95
75 kg N/fed	212.5	231.2	79.61	88.4	28.23	29.51	21.85	23.86
100 kg N/fed	219.3	236.8	79.8	88.78	29.2	30.43	22.68	24.74
	*	*	*	*	*	*	*	*
	1.5	0.6	0.2	0.22	0.13	0.07	0.04	0.04

Effect of Interactions

With regard to the interactions between the studied factors, great deals of them were statistically significant in most cases. Thus, the authors will discuss only some of them dealing with grain yield only as flows; the effect of interaction between organic and foliar fertilization on grain yield (ardab/fed) was significant in the two growing seasons. The optimum treatment that produced the highest values of grain yield was utilization of compost besides foliar spraying with Melagrow, where its results were 27.25 and 29.20 ardab/fed in the first and the second seasons, respectively as illustrated in [Table-6].

Table 6- Grain yield/fed of maize as affected by the interaction between organic and foliar fertilization during 2010 and 2011 seasons.

Organic Fertilization	Foliar Fertilization			
	Control	Water	Crystal Nasr	Melagrow
2010 Season				
Control	16.69	19.07	21.32	23.95
FYM	18.19	21.05	23.54	25.92
Compost	19.12	21.61	24.3	27.25
F. test		*		
NLSD 5 %		0.1		
2011 Season				
Control	18.94	21.18	24.29	27.2
FYM	19.59	22.31	25.39	28.22
Compost	20.32	23.27	26.33	29.2
F. test		*		
NLSD 5 %		0.1		

It was followed by the treatment of using organic fertilizing with FYM in addition foliar spraying with Melagrow in both seasons. The lowest means of grain yield (16.69 and 18.94 ardab/fed) were resulted from control treatment of both factors in the first and second seasons, respectively.

Table 7- Grain yield/fed of maize as affected by the interaction between organic fertilization and nitrogen fertilizer levels during 2010 and 2011 seasons.

Organic Fertilization	Nitrogen Fertilizer Levels		
	50 kg N/fed	75 kg N/fed	100 kg N/fed
2010 season			
Control	19.55	20.15	21.07
FYM	21.25	22.24	23.04
Compost	22.12	23.14	23.94
F. test		*	
NLSD 5 %		0.07	
2011 season			
Control	22.02	22.93	23.76
FYM	22.98	23.89	24.75
Compost	23.86	24.77	25.71
F. test		*	
NLSD 5 %		0.06	

Data presented in [Table-7] indicate that the interaction between organic fertilization and nitrogen fertilizer levels had a significant effect on grain yield (ardab/fed) during the first and second seasons. Grain yield (ardab/fed) was significantly increased with every increase in nitrogen fertilizer under studied organic fertilization treatments. Moreover, the highest means of grain yield were produced with using compost + 100 kg N/fed, which gave 23.94 and 25.71ardab/fed in the first and second seasons, respectively. On the other wise, the lowest means of grain yield/fed were obtained from without organic fertilization + 50 kg N/fed, which findings were

19.55 and 22.02 ardab/fed in the first and second seasons, respectively.

Table 8- Grain yield/fed of maize as affected by the interaction between foliar fertilization and nitrogen fertilizer levels during 2010 and 2011 seasons.

Foliar Fertilization	Nitrogen Fertilizer Levels		
	50 kg N/fed	75 kg N/fed	100 kg N/fed
2010 Season			
Control	17.27	17.95	18.77
Water	19.58	20.69	21.45
Crystal Nasr	22.15	23.08	23.93
Melagrow	24.88	25.66	26.58
F. test		*	
NLSD 5 %		0.08	
2011 Season			
Control	18.94	19.57	20.34
Water	21.25	22.25	23.27
Crystal Nasr	24.34	25.3	26.35
Melagrow	27.29	28.34	29
F. test		*	
NLSD 5 %		0.07	

Table 9- Grain yield/fed of maize as affected by the interaction among organic, foliar fertilization and nitrogen fertilizer levels during 2010 and 2011 seasons.

Organic and foliar fertilization		Foliar fertilization		
		50 kg N/fed	75 kg N/fed	100 kg N/fed
2010 season				
Control	Control	16.25	16.58	17.24
	Water	18.16	18.95	20.08
	Crystal Nasr	20.5	21.25	22.21
	Melagrow	23.29	23.83	24.75
FYM	Control	17.29	18.04	19.24
	Water	19.87	21.45	21.83
	Crystal Nasr	22.66	23.67	24.29
	Melagrow	25.16	25.83	26.79
Compost	Control	18.29	19.25	19.83
	Water	20.71	21.67	22.45
	Crystal Nasr	23.29	24.33	25.29
	Melagrow	26.21	27.33	28.21
F. test			*	
NLSD 5 %			0.14	
2011 season				
Control	Control	18.33	19	19.5
	Water	20.17	21.17	22.21
	Crystal Nasr	23.29	24.25	25.33
	Melagrow	26.29	27.33	28
FYM	Control	19	19.5	20.29
	Water	21.29	22.33	23.33
	Crystal Nasr	24.41	25.33	26.41
	Melagrow	27.25	28.41	29
Compost	Control	19.5	20.21	21.25
	Water	22.29	23.25	24.29
	Crystal Nasr	25.33	26.33	27.33
	Melagrow	28.33	29.29	30
F. test			*	
NLSD 5 %			0.12	

The effect of the interaction between foliar fertilization and nitrogen fertilizer levels on grain yield (ardab/fed) was significant in both seasons as shown in [Table-8]. Maximum values of on grain yield were obtained from foliar fertilizing maize plants with Melagrow in addition mineral fertilizing with 100 kg N/fed, which the results were 26.58 and 29.00 ardab/fed in the first and second seasons, respectively. Foliar fertilizing maize plants with Melagrow in addition fertilizing plants with 75 kg N/fed came in the second rank. Whereas, using control treatment (without foliar fertilization) + 50 kg N/fed tended to produce the lowest values of grain yield (17.27 and 18.94 ardab/fed) in the first and second seasons, respectively.

The effect of interaction among organic, foliar fertilization and nitrogen fertilizer levels on grain yield (ardab/fed) was significant in the first and second seasons as presented in [Table-9].

It can be observed that, the highest values of grain yield (28.21 and 30.00 ardab/fed) were resulted from organic fertilizing with compost and foliar spraying with Melagrow in addition of 100 kg N/fed in the first and second seasons, respectively. Application compost and foliar spraying with Melagrow besides adding 75 kg N/fed came to in the second rank after previously mentioned treatment in both seasons.

It can be concluded that fertilizing maize plants hybrid TWC 324 by compost at a rate of 4 t/fed and foliar spraying with Melagrow twice after 25 and 45 days from sowing in addition mineral fertilizing with 100 kg N/fed in order to maximizing its productivity under the environmental conditions of El-Sinbelaween Center, Dakahlia Governorate, Egypt.

Conflicts of Interest: None declare.

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