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# EFFECT OF ORGANIC FERTILIZATION, IRRIGATION INTERVALS AND SOME ANTITRANSPIRANTS ON GROWTH AND PRODUCTIVITY OF EGGPLANT (*Solanum melongina* L.)

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## ABSTRACT

Two field experiments were carried out at the Horticulture experimental station of Ministry of Agricultural at El-Baramon experimental farm, Dakahlia Government, Egypt., during the two successive summer seasons of 2011 and 2012 to investigate the effect of irrigation intervals, foliar application of different antitranspirants under compost rates as well as their interactions on growth and productivity of eggplant (*Solanum melongena* L.).

Twenty four treatments were arranged in split-split plots design, which were the simple possible combination between three rates of organic manure (0, 50 and 100% from recommended doses), two treatments of irrigation intervals (10 and 20 days) and four treatments of foliar application from antitranspirants (control, kaoline, $CaCO_3$ and dyroton). Each treatment was replicated three times.

**The most important findings could be summarized as follows:**

Increasing compost from 0 to 4 ton/fed. significantly increased vegetative growth of eggplant, yield and its components, fruit quality and its chemical composition N, P, K%, Fe ppm, TSS% and VC(mg/100g) . Short irrigation intervals (10days) significantly increased all parameters under investigation. The spraying with dyroton at 3% led to significant increase in growth characters traits, N,P,K%, Fe ppm, TSS%, VC, firmness, fruit quality and yield as well as its components.

The interaction between organic manure and irrigation intervals significantly affected growth parameters, yield, fruit quality and its chemical composition except stem diameter in the 2nd season, N%, TSS% in the 1st season, K% and average fruit weight during both seasons.

Interaction effect of organic manure and antitranspirants significantly affected growth parameters, yield, fruit quality and its chemical composition except K% and stem diameter in the 2nd season; VC and average fruit weight during both seasons.

Interaction effect between irrigation intervals and antitranspirants characters under investigation had significant effect on all studied treats except TSS% in the 1st season, stem diameter in 2nd K, VC and average fruit weight during both seasons.

The interaction effect between organic manure, irrigation intervals and antitranspirants significantly affected to growth parameters, yield, fruit quality and its chemical composition except average fruit weight during both seasons.

**Keywords:**organic manure, irrigation intervals, antitranspirants and eggplant(*Solanum melongena* L.).

## INTRODUCTION

Eggplant (*solonum melongena L.*) is one of the most important crops in the summer season of Egypt. Eggplant fruits contain a considerable amount of carbohydrates, proteins, vitamins and some minerals. As a biennial crop, eggplant will require high quantity of nutrients to sustain its growth. These nutrients can easily be made available through the use of inorganic fertilizers but there are problems associated with its use which include: leaching, soil degradation, underground water pollution, fast release of nutrients.

In this respect, several investigators carried out a lot of trials. For example, Agbo *et al.*, (2009) and Abdel-Mouty-Mona *et al.*, (2011) found that vegetative growth of eggplant was increased by increasing the rate of organic manure and/or compost. Moreover, Christo *et al.*, (2011) indicated that pig slurry at the rate 7500 kg/ha gave rise to increase the plant height and number of branches of eggplant as compared with those of control. On the other hand, Karuppaiah *et al.*, (2003) found that antitranspirants (kaolin, phenyl mercuric acetate, salicylic acid and liquid paraffin) affect plant biomass, number of branches, plant height, leaf area and number of flowers. But, the most effective was Kaoline at 7.5% for plant biomass and number of flowers. As for the effect of irrigation intervals, Byari and Rabighis (1996) indicated that increasing irrigation frequency caused an increase in vegetative growth of eggplant. However, Abd El-Aal-Faten *et al.*, (2008) obtained the best result with plant vigor when eggplant was irrigated at 10 days intervals. While, Bahawireth (2011) found that 12 days intervals was the best for almost tested characters of eggplant. Otherwise, Amiri *et al.*, (2012) and Pirboneh *et al.*, (2012) found that the best interval was 6 days for eggplant characters.

This study was carried out as an attempt to improve eggplant productivity through using organic manure, chosen the best interval of irrigation and reduces the water losses by antitranspirants application under Egyptian conditions.

## MATERIALS AND METHODS

Two field experiments were carried out at the Horticulture experimental station of Ministry of Agricultural at El-Baramon experimental farm, Dakahlia Government, Egypt., during the two successive summer seasons of 2011 and 2012 to investigate the effect of irrigation intervals, foliar application of different antitranspirants under compost rates and their interactions on eggplant (*Solanum melongena* L.).

Twenty four treatments were arranged in split-split plots design, which were the simple possible combination between three rates of organic manure (0, 50 and 100% from recommended doses), two treatments of irrigation intervals (10 and 20 days) and four treatments of foliar application from antitranspirants (control, kaoline, $CaCO_3$ and dyroton) each at 3%. Each treatment was replicated three times.

Transplants of eggplant *(Solanum melongena* L*)* cv of Black Beauty were planted on 24 and 27 March of 2011 and 2012, respectively, on one side of ridges at 30 cm a part, ridges were 80 cm in width and 4 m length. Each plot included 4-ridges and the plot area was 12.8 $m^2$.

Compost as a source of organic manure was used. Before transplanting of eggplant seedlings; 24 plots were left without organic rates, the second 24 plots were mixed with compost at the rate of 50% from recommended doses (2 ton/ $fed^{-1}$) and the last 24 plots with 100% from recommended doses (4 ton/ $fed^{-1}$) and irrigated with tap water at the saturation percentage. Then, it is left for a month to elucidate the damage on seedlings and their roots which resulted from the heat of decomposition. Some chemical properties of compost used are presented in Table (1).

**Table 1: Some chemical properties of the used compost during both seasons of 2011 and 2012.**

| % | | | | | | | | E.C ($ds.m^{-1}$) 1:10 | pH 1: 10 |
|---|---|---|---|---|---|---|---|---|---|
| Moisture | O.M | Ash | C | Total N | C/N | Total P | Total K | | |
| 24 | 23.26 | 76.74 | 13.49 | 0.78 | 17.29:1 | 0.48 | 0.82 | 2.68 | 7.87 |

The fertilizers NPK were added at rate of 100 kg $N.fed^{-1}$ as ammonium sulphate (20.5% N), 60 kg $P_2O_5.fed^{-1}$ as super phosphate (15.5% $P_2O_5$) and 100 kg $K.fed^{-1}$ as Potassium sulphate (48%$K_2O$). Phosphorus fertilizer was added to the soil before planting, while N & K fertilizers were added in three doses; after one month, two month from planting and third dose was added during flowering stage.

Four foliar application treatments were used as follows: Control (water), Kaolin, $CaCO_3$ and Dyroton at the concentration of 3%. The antitranspirants were sprayed at 55 days old three times with 10 days intervals.

After 45 days from transplanting date, all experimental plots were divided into two main groups, the first was irrigated at 10 days interval, but the second, was irrigated at 20 days intervals.

Five plants were randomly taken from each treatment after 85 days from transplanting during both seasons and the vegetative growth parameters were measured in expression of Plant height (cm), number of branches/plant, number of leaves/plant, stem diameter (cm), leaf area/plant ($cm^2$) as well as fresh and dry weight of plant foliage (g/plant).

All harvested fruits from each plot were used to determined fruit quality and yield as well as its components (fruit length (cm), fruit diameter (cm), dry matter%, total fruit yield ton/fed and early yield ton/fed.).

Representative samples of eggplant fruits were randomly taken from each treatment at the fourth picking to determine the quality parameters of eggplant fruits (vitamin C (mg/100g), TSS% and firmness kg\$cm^2$). At 3rd picking; random samples of eggplant fruits were randomly chosen from each treatment, oven dried at 70°C and ground for the determination of N, P,K% contents and Fe(ppm).

**Plant Analysis:**

Total N, P, K% and Fe (ppm) were determined in the digested plant materials using the methods of *Pregle 1945, Jackson 1967, Black 1965 and Chapman and Pratt (1961).*

TSS%,and vitamin C were determined according to (*A.O.A.C.; 2000*). Firmness was recorded by penetrometer according to *(Reyes and Paull, 1995)*

All data were statistically analyzed according to the technique of analysis variance (ANOVA) and the least significant difference (L.S.D) method was used to compare the deference between the means of treatment values to the methods described by Gomez and Gomez, (1984). All statistical analyses were performed using analysis of variance technique by means of CoSTATE Computer Software.

## RESULTS AND DISCUSSION

**1.Vegetative growth parameters:**

Data of vegetative growth parameters, i.e., plant height (cm), stem diameter (cm), leaf area/plant ($cm^2$), number of leaves/plant, branches/plant as well as fresh and dry weight (g) of whole plant as affected by organic manure, irrigation intervals and foliar application of antitranspirants are presented in Table 2.

**1.1. Effect of organic manure:**

Concerning the effect of adding organic manure rates data at Table 2 reveal that; the mean values of plant height (cm), stem diameter (cm), leaf area/plant ($cm^2$), number of leaves, number of branches/plant as well as fresh and dry weight (g) of whole plant were significantly increased due to increasing organic manure (compost) up to 100% (4 ton/fed.) in the both seasons under study. Increases in the vegetative growth of eggplant after applying compost might be referred to its role in enhancing soil physical properties as soil texture, water holding capacity, providing energy for microorganisms activity, increasing nutrient supply and improving the efficiency of microelements as well as its ability to meet microelements requirements. Also, it creates good aeration in soils. This result is in agreement with Farrag-Amal and Hussein (2000) on onion, Abo El-Kheir (2004) on garlic and Abdel-Mouty-Mona *et al.,* (2011) who found that the vegetative growth parameters of eggplant (plant height, number of leaves and branches, fresh and dry weight of leaves and/or branches) were gradually increased significantly by increasing the level of compost.

**Table 2: Effect of organic manure, irrigation intervals and foliar application of antitranspirants as well as their interactions on plant height (cm), stem diameter (cm), leaf area/plant ($cm^2$), number of leaves, branches/plant and number, fresh and dry weight of plant foliage during seasons of 2011 and 2012.**

| Char. / Treat. | Plant height (cm) | | Stem diameter (cm) | | Leaf area/plant ($cm^2$) | | No. of leaves/plant | | No. of branches/plant | | Fresh weight of whole plants (g) | | Dry weight of whole plants (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| **A: compost rates** | | | | | | | | | | | | | | |
| Zero/fed | 64.19 | 64.53 | 1.11 | 1.14 | 3588.80 | 3635.17 | 31.82 | 32.02 | 4.15 | 4.18 | 249.03 | 250.93 | 42.89 | 43.19 |
| 2 ton/fed | 81.90 | 82.34 | 1.41 | 1.45 | 4578.41 | 4639.04 | 40.60 | 40.85 | 5.30 | 5.34 | 317.70 | 320.12 | 54.72 | 55.13 |
| 4 ton/fed | 100.91 | 101.46 | 1.74 | 1.78 | 5641.30 | 5715.23 | 50.02 | 50.34 | 6.52 | 6.57 | 391.46 | 394.47 | 67.42 | 67.87 |
| LSD at 5% | 0.46 | 0.27 | 0.02 | 0.01 | 32.21 | 16.09 | 0.53 | 0.14 | 0.07 | 0.02 | 4.13 | 1.11 | 0.71 | 0.19 |
| **B: Irrigation period** | | | | | | | | | | | | | | |
| 10 days | 82.60 | 83.03 | 1.42 | 1.46 | 4617.97 | 4678.50 | 40.95 | 41.22 | 5.34 | 5.38 | 320.45 | 322.90 | 55.19 | 55.59 |
| 20 days | 82.06 | 82.52 | 1.41 | 1.45 | 4587.71 | 4647.80 | 40.68 | 40.92 | 5.31 | 5.34 | 318.35 | 320.78 | 54.83 | 55.20 |
| LSD at 5% | 0.09 | 0.03 | 0.01 | N.S | 4.05 | 1.45 | 0.10 | 0.01 | 0.01 | 0.01 | 0.82 | 0.10 | 0.14 | 0.02 |
| **C: Antitranspirants source** | | | | | | | | | | | | | | |
| Water | 74.78 | 75.08 | 1.29 | 1.32 | 4180.66 | 4230.81 | 37.07 | 37.25 | 4.84 | 4.88 | 290.10 | 292.77 | 49.96 | 50.39 |
| Kaolin | 80.15 | 80.60 | 1.38 | 1.41 | 4480.70 | 4520.91 | 39.73 | 39.98 | 5.18 | 5.19 | 310.92 | 311.60 | 53.55 | 53.66 |
| $CaCO_3$ | 85.26 | 85.82 | 1.47 | 1.51 | 4766.48 | 4857.27 | 42.26 | 42.59 | 5.51 | 5.56 | 330.75 | 333.73 | 56.96 | 57.47 |
| Dyroton | 89.14 | 89.62 | 1.54 | 1.58 | 4983.51 | 5043.60 | 44.19 | 44.47 | 5.76 | 5.81 | 345.81 | 349.27 | 59.56 | 60.07 |
| LSD at 5% | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 2.23 | 0.50 | 0.38 | 0.09 |
| **D: interactions** | | | | | | | | | | | | | | |
| AXB | ** | ** | ** | N.S | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| AXC | ** | ** | ** | N.S | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| BXC | ** | ** | ** | N.S | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| AXBXC | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

**1.2. Effect of irrigation intervals:**

Regarding to the effect of irrigation intervals on vegetative growth parameters data in Table 2 clearly show that the highest significant values of the studied parameters were recorded under 10 days from irrigation intervals during both seasons except stem diameter (cm) in the 2nd season. It could be suggested that increasing water quantity applied to plant led to keep higher moisture content in the soil and this in turn might the plant metabolism that leads to increase plant growth characters and to produce higher dry matter. This result is in agreement with those of Saied (2000) on sugar beet, Abd El-Aal-Faten *et al.*, (2008) and Bahawireth (2011) on eggplant.

**1.3. Effect of antitranspirants:**

It is clear from the data present in Table 2 that, the effect of foliar application treatments of antitranspirants on all growth parameters were significantly increased in response to spraying all foliar application as compared to the untreated plants (water). Data from the same Table clearly show that the highest significant values of the mentioned parameters were recorded with spraying plants by dyroton (3%) followed by spraying $CaCO_3$ (3%). These increases were true in the two seasons of the experiment. It could be summarized that, foliar application of antitranspirants gained superiority in plant growth characters if compared with control treatments, and antitranspirants application of dyroton gave the greatest vigor of plant growth. The use of antitranspirants which are biodegradable organic film formulated to protect plants from injury caused by excessive transpiration or water loss through leaves, stems and branches may help in keeping healthy plant during the growing season. So, it is quite sufficient from our results here to recognize that the increments happened in vegetative growth on eggplant, i.e. plant height, number of leaves and shoots, fresh and dry weights treated with antitranspirants such as dyroton comparatively to those of control was possibly due to two aspects. First is the protection of tissues from climatic condition, and second is the increase of water potential at a time when the growth plant was more dependants on water status than on photosynthesis . This positive effect on vegetative growth has reflection on total fruits yield and its contents (Abou-Hadid, 1984). This, it is not surprising to obtain fruits heavier, and taller or width. However, the previous findings coincided with those obtained by Irmak *et al.*, 1999 and Yadav and Dashora, 2003.

**1.4. Interaction effect:**

In the present investigation, application of organic manure and irrigation intervals had significantly marked effect on growth parameters of eggplants except stem diameter in the 2nd season. Similar results were recorded by Abd Rabbo *et al.*, (2007) on potato, Abd El-Aal-Faten (2008) on eggplant and Saif EL-IDeen and Abd El-Hameed (2010) on globe artichoke.

Data presented in the same Table show that the parameters of growth plant of eggplants were significantly affected by the interaction between organic manure and foliar application of antitranspirants treatments in the two seasons except stem diameter in the 2nd season.

Data illustrated in Table 2 show that there was a significant increase in growth parameters of eggplant due to the interaction effect between

irrigation interval and foliar antitranspirants treatments except stem diameter in the 2nd season. Similar results are reported by Anwar (2005) and Abd El-Aal-Faten *et al.,* (2008).

Data in Table 2, show that plants fertilized with 4 ton/fed. compost, irrigation at 10 days interval and sprayed with dyroton, $CaCO_3$, kaoline had more vegetative growth compared with the untreated plants. Plants fertilized with 4 ton/fed. compost, irrigation at 10 days interval and sprayed with dyroton recorded the highest values of fresh and dry weight during both seasons of the experiment.

**2. Yield and its components:**

**2.1. Effect of organic manure:**

Comparing the effect of organic manure on yield and its components of eggplant, the results in Table 3 showed that the application of 100% compost (4 ton/fed.) significantly increased yield (ton/fed), early yield (ton/fed.) and dry matter% of eggplant in both seasons. Eggplant fertilized with 100% compost had the highest values of all studied parameters, while the lowest ones recorded with the untreated plants. These result might be due to the increase in vegetative growth and dry weight contents (Table 2). These results are in agreement with those reported by Aujla *et al.,* (2007), Abdel-Mouty-Mona *et al.,* (2011) and Suge *et al.,* (2011).

**2.2. Effect of irrigation intervals:**

Response of yield (ton/fed), early yield (ton/fed) and dry matter% of eggplant to irrigation intervals during both seasons was found to be decreased significantly with increasing irrigation intervals as shown in Table 3. Eggplant under short irrigation interval recorded the highest values of yield (ton/fed), early yield (ton/fed) and dry matter% of eggplant during both seasons of the experiment. The higher total fruits yield was obtained from irrigation the eggplant at shorter period, i.e. 10 days intervals may be due to the increase in one or more of the estimated attributes either in fresh or dry weight of where eggplant. However, the picture reflected significant increase on leaves and shoots number, fresh and dry weight of plant. So, these increments lead to the favorable Jump in production of eggplant in this experiment. The obtained results are in good harmony with those of Ibrahim and Selim (2007) on squash, Abd El-Aal-Faten *et al.,* (2008) and Amiri *et al.,* (2012) on eggplant.

**2.3. Effect of antitranspirants:**

The influence of studied antitranspirants treatments on total eggplant fruits yield and its components was illustrated in Table 3, show clearly, that, all antitranspirants treatments caused an increment in total fruits yield as tons/fed., early yield ton/fed. as well as improved the dry matter % compared with control (no antitranspirants) plants. Moreover, the application of dyroton gave rise to the heaviest fruits tonnage (20.58 and 20.82 tons/fed., in 1st and 2nd seasons, heaviest early yield (9.05 and 9.16 tons/fed.) and heaviest dry matter (9.61 and 9.67%) respectively. It could be concluded that, the antitranspirants as foliar for eggplant enhanced the total fruits yield and its components, and the application of dyroton gave the best fruits yield.This result, point out to the good effect of the antitranspirants which are

biodegradable organic film formulated to protect plants from injury of shock caused by excessive transpiration of water loss through different vegetative plant organs, consequently enhancing the vegetative growth.

This positive effect on vegetative growth has reflection on fruits yield and its quantity. In our studies, dyroton as antitranspirants at 3 % was still the most superior effective in inducing the heaviest fruits yield. This result was clearly coincided with that obtained by Shafeek (1990) on pepper plant. In this respect, many other investigators had results which in good harmony with those obtained here Govindakrishnan *et al.*, (2003) and Abd El-Aal-Faten *et al.*, (2008).

**2.4. Effect of interaction:**

In the present investigation, application of organic manure and irrigation intervals had a significant marked effect on yield (ton/fed), early yield (ton/fed) and dry matter% during both seasons of the experiments as illustrated in Table 3. These results are in agreement with Saif Eldeen and Abd El-Hameed (2010).

**Table 3: Effect of organic manure, irrigation intervals and foliar application of antitranspirants as well as their interactions on fruit yield (ton/fed), early yield (ton/fed) and dry matter% of eggplants during seasons of 2011 and 2012.**

| Char. / Treat. | Fruit yield (ton/fed.) | | Early yield (ton/fed.) | | Dry matter% | |
|---|---|---|---|---|---|---|
| | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| **A: compost rates** | | | | | | |
| Zero/fed | 14.82 | 15.01 | 6.52 | 6.60 | 6.92 | 6.96 |
| 2 ton/fed | 18.90 | 19.15 | 8.32 | 8.43 | 8.83 | 8.88 |
| 4 ton/fed | 23.29 | 23.60 | 10.25 | 10.38 | 10.87 | 10.95 |
| LSD at 5% | 0.20 | 0.10 | 0.10 | 0.05 | 0.12 | 0.03 |
| **B: Irrigation period** | | | | | | |
| 10 days | 19.07 | 19.32 | 8.39 | 8.50 | 8.90 | 8.96 |
| 20 days | 18.94 | 19.19 | 8.33 | 8.44 | 8.84 | 8.90 |
| LSD at 5% | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 |
| **C: Antitranspirants source** | | | | | | |
| Water | 17.26 | 17.47 | 7.59 | 7.69 | 8.06 | 8.10 |
| Kaolin | 18.50 | 18.67 | 8.14 | 8.21 | 8.64 | 8.69 |
| $CaCO_3$ | 19.68 | 20.05 | 8.66 | 8.82 | 9.19 | 9.26 |
| Dyroton | 20.58 | 20.82 | 9.05 | 9.16 | 9.61 | 9.67 |
| LSD at 5% | 0.02 | 0.04 | 0.01 | 0.02 | 0.03 | 0.01 |
| **D: interactions** | | | | | | |
| AXB | ** | ** | ** | ** | ** | ** |
| AXC | ** | ** | ** | ** | ** | ** |
| BXC | ** | ** | ** | ** | ** | ** |
| AXBXC | ** | ** | ** | ** | ** | ** |

Applying organic manure and foliar antitranspirants enhanced yield (ton/fed), earl yield (ton/fed) and dry matter% of eggplants in two seasons as shown in Table 3. Such effect was true and significant during both seasons.

Data illustrate in Table 3 showed the response of yield (ton/fed), earl yield (ton/fed) and dry matter% of eggplant to the interaction between irrigation intervals and foliar antitranspirants during both seasons. The interaction caused significant increments in all mentioned parameters in both seasons.

Illustrate data in Table 3, indicate that the interaction between organic manure, irrigation intervals and foliar antitranspirants had significant effect on yield (ton/fed), early yield (ton/fed) and dry matter% of eggplants in both seasons. As it has been mentioned, higher compost at rate (4 ton/fed.) under short irrigation intervals (10 days) applied to plants beside spraying with dyroton (3%) gave the highest values of all studied characters eggplant.

**3. Fruit quality:**

**3.1. Effect of organic manure:**

Concerning to the effect of organic manure on fruit quality of eggplant, the presented results in Table 4 show that the application of organic manure significantly increased fruit length (cm), fruit diameter (cm), TSS%, vitamin C(mg/100g) and firmness(kg\cm$^2$) during both seasons except average fruit weight during both seasons. Eggplant fertilized with compost at the rate 100% (4 ton/fed.) recorded the highest values of parameters under investigation, while the lowest ones were recorded with the untreated plants. These finding are in agreement with those of Mahmoud-Hosna *et al.,* (2000) and Sarhan *et al.,* (2011).

**3.2. Effect of irrigation intervals:**

Concerning to the effect of the irrigation intervals, it was found as shown in Table 4 that irrigation intervals significantly enhanced the parameters of fruit length (cm), fruit diameter (cm), TSS%, vitamin C(mg/100g) and firmness(kg\cm$^2$) during both seasons except average fruit weight. The highest values of all parameter were recorded under the short irrigation intervals during both seasons. Abd El-Aal-Faten *et al.,* (2008).

**3.3. Effect of antitranspirants:**

Values of fruit length (cm), fruit diameter (cm), average fruit weight, TSS%, vitamin C(mg/100g) and firmness((kg\cm$^2$) of eggplant as affected by to foliar application, Table 4, was found to be increased significantly with sprayed antitranspirants in two successive seasons except average fruit weight during both seasons. The highest values were recorded with sprayed dyroton compared with the other treatments. This results are in line with Abd El-Aal-Faten *et al.,* (2008) and Saif El-Deen and Abd El-Hameed (2010).

**3.4 Effect of interaction:**

In the present investigation, application of organic manure and irrigation intervals had significantly effect on fruit length (cm), fruit diameter (cm), TSS% and firmness except TSS% in the 1$^{st}$ season, VC (mg\100g and average fruit weight of eggplant during both seasons.

Data in Table 4 present positive effect of organic manure and different spraying of antitranspirants on fruit length (cm), fruit diameter (cm), TSS % and firmness of eggplant fruits except VC (mg\100g) and average fruit weight during both seasons.

Data illustrate in Table 4 show the reflection of fruit quality of eggplant in response to the interaction between irrigation intervals (10 and 20 days) and different foliar antitranspirants during both seasons. The interaction caused significant increments in the parameters except TSS% in the 1st sseason, VC (mg/100g) and average fruit weight during both seasons .

It was found that interaction among organic manure, irrigation intervals and foliar antitranspirants had positive effect on fruit quality i.e; fruit length (cm), fruit diameter, TSS%, VC (mg\100g) and firmness(kg\cm$^2$) of eggplant fruits except average fruit weight during both seasons.

**Table 4: Effect of organic manure, irrigation intervals and foliar application of antitranspirants as well as their interactions on fruit quality during seasons of 2011 and 2012.**

| Char. Treat. | Fruit length (cm) | | Fruit diameter (cm) | | Average fruit weight (g) | | TSS% | | VC (mg\100g) | | Firmness (kg\cm$^2$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| **A: compost rates** | | | | | | | | | | | | |
| Zero/fed | 6.18 | 6.26 | 5.53 | 5.57 | 289.71 | 287.11 | 3.18 | 3.20 | 1.38 | 1.42 | 4.43 | 4.45 |
| 2 ton/fed | 7.88 | 7.98 | 7.06 | 7.11 | 282.14 | 280.33 | 4.06 | 4.08 | 1.77 | 1.80 | 5.65 | 5.68 |
| 4 ton/fed | 9.71 | 9.84 | 8.70 | 8.76 | 275.60 | 274.39 | 5.00 | 5.04 | 2.17 | 2.22 | 6.96 | 7.00 |
| LSD at 5% | 0.03 | 0.03 | 0.09 | 0.03 | N.S | N.S | 0.05 | 0.01 | 0.02 | 0.01 | 0.07 | 0.02 |
| **B: Irrigation period** | | | | | | | | | | | | |
| 10 days | 7.95 | 8.05 | 7.12 | 7.17 | 281.39 | 280.10 | 4.09 | 4.12 | 1.78 | 1.82 | 5.70 | 5.73 |
| 20 days | 7.90 | 8.00 | 7.07 | 7.12 | 283.58 | 281.12 | 4.07 | 4.09 | 1.77 | 1.80 | 5.66 | 5.69 |
| LSD at 5% | 0.01 | 0.01 | 0.02 | 0.01 | N.S | N.S | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| **C: Antitranspirants source** | | | | | | | | | | | | |
| Water | 7.20 | 7.30 | 6.45 | 6.48 | 286.10 | 281.09 | 3.71 | 3.73 | 1.61 | 1.64 | 5.16 | 5.18 |
| Kaolin | 7.71 | 7.83 | 6.91 | 6.95 | 286.12 | 282.58 | 3.97 | 4.00 | 1.73 | 1.76 | 5.53 | 5.56 |
| $CaCO_3$ | 8.21 | 8.29 | 7.35 | 7.41 | 282.33 | 284.32 | 4.23 | 4.26 | 1.84 | 1.88 | 5.88 | 5.92 |
| Dyroton | 8.58 | 8.68 | 7.69 | 7.74 | 275.38 | 274.46 | 4.42 | 4.45 | 1.92 | 1.97 | 6.15 | 6.18 |
| LSD at 5% | 0.02 | 0.01 | 0.05 | 0.01 | N.S | N.S | 0.03 | 0.01 | 0.01 | 0.01 | 0.04 | 0.01 |
| **D: interactions** | | | | | | | | | | | | |
| AXB | ** | ** | ** | ** | N.S | N.S | N.S | ** | N.S | N.S | ** | ** |
| AXC | ** | ** | ** | ** | N.S | N.S | ** | ** | N.S | N.S | ** | ** |
| BXC | ** | ** | ** | ** | N.S | N.S | N.S | ** | N.S | N.S | ** | ** |
| AXBXC | ** | ** | ** | ** | N.S | N.S | ** | ** | ** | ** | ** | ** |

**4. Chemical composition of fruits:**

**4.1. Effect of organic manure:**

Obtained results in Table 5 show that adding of organic manure in both seasons of the experiment significantly increased the average values of N, P, K concentration and Fe ppm of eggplant. The application of 100% (4 t/fed.) from compost gave the highest values of N, P, K concentration and Fe ppm as compared to 50%(2 t/fed.) of compost. These results may be attributed to the roles of organic manures in soil properties which production humus substances wherein improved the physical and chemical soil properties leading to increasing nutrients release availability, i.e. N, P and K uptake. Moreover incorporation of composts in soils can further increase

NPK availability by increasing $CO_2$ forming $H_2CO_3$ in the soil solution. In the same connection, found that inorganic NPK fractions were increased due to application of organic amendments such as compost. Similar result was reported by Othman-Sanaa *et al.*, (2005), El-Hamdi *et al.*, (2008) and Abdel-Mouty, Mona (2011).

**4.2. Effect of irrigation intervals:**

Respecting the nutritional status of eggplant fruits as influenced by two irrigation regime in two experiments are shown in Table 5, the content of N, P, K and Fe in fruits tissues recorded its higher values with irrigation at the shorter regime, i.e. at 10 days intervals except P% in the second season and K% during both seasons. This finding could be attributing to the fact that when soil moisture decreased, the mobility of nutrient in the soil is towered and the rate of nutrients flow to root absorption zone decreased. Moreover the statistical calculation of the collected data reveals that the values of the above contents significantly varied within the irrigation treatments. These were true in both seasons. The results obtained by Mahmoud and Hafiz (2002) and Erdal *et al.*, (2007) support the results obtained in this investigation which found that content of protein, N, P, K, Fe and Mn in fruits tissues of eggplant and tomato recorded its higher values with irrigation at the shorter regime.

**4.3. Effect of antitranspirants:**

Regarding to the effect of spraying eggplant with kaoline, $CaCO_3$ and dyroton data in Table 5 indicate a significantly effect on N, P, K percentage and Fe ppm in fruits of eggplant compared with the untreated plants during both seasons of 2011 and 2012. Data clearly show that the highest significant values of N, P, K percentage and Fe ppm were recorded with spraying dyroton extract followed by $CaCO_3$ and finally Kaoline. While the untreated plants recorded the lowest values of the mentioned chemical parameters in both seasons. The obtained results are in agreement with the most previous investigation which pointed out the same direct correlation between antitranspirants materials and some elemental nutrition in tissues of plant Moftah (1997), Yadov and Dashora (2003) and Al-Moftah *et al.*, (2005).

**4.4. Effect of interaction:**

The effect of interaction between organic manure and irrigation intervals on chemical contents of eggplant fruit, i.e; N, P, K percentage and Fe ppm are presented in Table 5, in the present investigation, application of compost under irrigation intervals had a significant effect on N, P percentage and Fe ppm in eggplant fruits except N% in the 1$^{st}$ season and K% during both seasons. (Anwar, 2005 and Saif El-Deen and Abd El-Hameed, 2010).

Data present in Table 5 showed that the parameters of N, P, K percentage and Fe ppm in eggplant fruits were significantly affected by the interaction between organic manure and foliar application of antitranspirants treatments during both seasons except K% in the 2$^{nd}$ season.

Data illustrate in Table 5, show that there was a significant increase in N, P percentage and Fe ppm of eggplant fruits in both seasons as affected by foliar with different antitranspirants under shorted irrigation intervals except

K% during both seasons. This observation agree with the report by Abd El-Aal-Faten *et al.*, (2008).

With respect to the effect of interaction among organic manure, irrigation intervals and foliar application of different antitranspirants on chemical composition of eggplant fruits, it is evident from such data present in Table 5 that the mean values of N, P, K percentage and Fe ppm in eggplant fruits were significantly affected and the best records of previous characters were obtained by plants fertilized with 100% compost (4 ton/fed) and sprayed with dyroton (3%) under shortage irrigation interval (10 days) compared with the other treatments during both seasons of the experiments.

**Table 5: Effect of organic manure, irrigation intervals and foliar application of antitranspirants as well as their interactions on N, P, K percentage and Fe ppm in eggplant fruits during seasons of 2011 and 2012.**

| Char. / Treat. | N% | | P% | | K% | | Fe ppm | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| **A: compost rates** | | | | | | | | |
| **Zero/fed** | 2.24 | 2.27 | 0.692 | 0.697 | 1.33 | 1.37 | 52.57 | 52.94 |
| **2 ton/fed** | 2.86 | 2.90 | 0.883 | 0.889 | 1.69 | 1.72 | 67.07 | 67.58 |
| **4 ton/fed** | 3.52 | 3.57 | 1.087 | 1.095 | 2.09 | 2.13 | 82.64 | 83.20 |
| **LSD at 5%** | **0.04** | **0.01** | **0.006** | **0.003** | **0.02** | **0.01** | **0.47** | **0.23** |
| **B: Irrigation period** | | | | | | | | |
| **10 days** | 2.88 | 2.92 | 0.890 | 0.897 | 1.71 | 1.75 | 67.65 | 68.15 |
| **20 days** | 2.87 | 2.90 | 0.884 | 0.891 | 1.70 | 1.73 | 67.21 | 67.67 |
| **LSD at 5%** | **0.01** | **0.01** | **0.002** | **N.S** | **N.S** | **N.S** | **0.06** | **0.02** |
| **C: Antitranspirants source** | | | | | | | | |
| **Water** | 2.61 | 2.65 | 0.806 | 0.813 | 1.55 | 1.59 | 61.24 | 61.76 |
| **Kaolin** | 2.80 | 2.84 | 0.864 | 0.866 | 1.66 | 1.69 | 65.64 | 65.79 |
| **$CaCO_3$** | 2.98 | 3.01 | 0.919 | 0.927 | 1.76 | 1.80 | 69.83 | 70.45 |
| **Dyroton** | 3.11 | 3.15 | 0.961 | 0.969 | 1.84 | 1.89 | 73.00 | 73.63 |
| **LSD at 5%** | **0.02** | **0.01** | **0.002** | **0.001** | **0.01** | **0.01** | **0.06** | **0.11** |
| **D: interactions** | | | | | | | | |
| AXB | **N.S** | ** | ** | ** | **N.S** | **N.S** | ** | ** |
| AXC | ** | ** | ** | ** | ** | **N.S** | ** | ** |
| BXC | ** | ** | ** | ** | **N.S** | **N.S** | ** | ** |
| AXBXC | ** | ** | ** | ** | ** | ** | ** | ** |

## CONCLUSION

These all finding emphasize the importance of determining the interactive effects between organic manure, irrigation intervals and antitranspirants to find out the optimum combinations for maximum early, total yield and special fruit quality. The treatment of 4 ton/fed. compost as organic manure under 10 days irrigation interval with 3% of dyroton sprayed as antitranspirants application was the best combination and it is recommended for eggplant grown under similar field conditions in order to get higher economical yield.

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## تأثير التسميد العضوى و فترات الرى وبعض مضادات النتح على النمو والإنتاجية فى الباذنجان

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نفذت تجربتان حقليتان فى مزرعه محطه بحوث البساتين بالبرامون محافظة الدقهلية بمصر خلال الموسمين الصيفيين ٢٠١١ و ٢٠١٢ ذلك لدراسه تأثير فترات الرى وبعض مضادات النتح تحت معدلات من سماد الكمبوست والتفاعل بينهم على نمو وانتاجية الباذنجان صنف بلاك بيوتى.

اشتملت التجربه على أربعه وعشرون معامله فى تصميم قطع منشقه مرتان فى قطاعات كامله العشوائيه وهى تمثل كل التفاعلات الممكنه بين٣ معدلات من التسميد العضوى (٠، ٥٠ و ١٠٠% من الموصى به)و معاملتان من فترات الرى (١٠ و ٢٠ يوم) بالاضافه الى ٤ معاملات

من الرش بمضادات النتح (كنترول، كاؤولين، كربونات كالسيوم و ديريتون) كررت جميع المعاملات ٣ مرات.

**وقد اظهرت نتائج التجربه ان:-**

* بزياده معدل اضافه الكمبوست من ٠ الى ١٠٠% (٠ الى ٤ طن/فدان) أدى لحدوث زياده معنويه فى كل من الصفات الخضريه ، المحصول ومكوناته للباذنجان بالاضافه الى صفات الثمار ومكوناتها الكيميائيه مثل النيتروجين ، الفوسفور، البوتاسيوم ،الحديد، المواد الصلبه الكليه و فيتامين سى. كذلك وجد ان اقل فتره رى (١٠ ايام) ادت الى حدوث زياده معنويه فى معظم/كل الصفات تحت الدراسه. ايضا وجد ان الرش بالديريتون عند معدل ٣% كمضاد للنتح ادى لحدوث زياده معنويه فى الصفات الخضريه و النيتروجين، الفوسفور، البوتاسيوم، المواد الصلبه الكليه، فيتامين سى و الصلابه كذلك المحصول ومكوناته.
* التفاعل بين السماد العضوى وفترات الرى اثر معنويا على صفات الباذنجان الخضريه ، المحصول وصفات الثمره فى كلا الموسمين ماعدا فيتامين سي فى الموسمين و النيتروجين ، المواد الصلبه الكليه فى الموسم الاول وقطر الساق فى الموسم الثانى وكذلك البوتاسيوم ومتوسط وزن الثمره فى كلا الموسمين لم يحدث بهم اى تاثير معنوى.
* من ناحيه اخرى أثر التفاعل بين السماد العضوى ومضادات النتح معنويا فى الصفات تحت الدراسه فيماعدا البوتاسيوم وقطر الساق فى الموسم الثاني وفيتامين سى كذلك متوسط وزن الثمره فى كلا الموسمين.
* أدى التفاعل بين فترات الرى ومضادات النتح إلى حدوث تاثيرمعنوى فى جميع الصفات ماعدا المواد الصلبه الكليه فى الموسم الاول وقطر الساق فى الموسم الثانى و فيتامين سى ، البوتاسيوم و متوسط وزن الثمره خلال كلا الموسمين.
* اما بالنسبه للتفاعل بين المعاملات تحت الدراسه وجد أن السماد العضوى وفترات الرى كذلك الرش بمضادات النتح أدى الى زياده معنويه فى الصفات الخضريه للباذنجان وصفات المحصول ومكوناته كذلك صفات الثمره ماعدا متوسط وزن الثمره خلال كلا الموسمين. وكان افضل المستويات المستخدمة ( ٤ طن كومبوست \ فدان + الرش بالديرتون ٣ % تحت فترات ري كل ١٠ أيام ) خلال كلا الموسمين.

**قام بتحكيم البحث**

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