J. Agric. Sci. Mansoura Univ., 26 (9): 5651 - 5669, 2001

EFFECT OF NITROGEN FERTILIZATION ON YIELD, QUALITYAND STORABILITY OF SOME NEW TOMATO HYBRIDS

Abd El-Rahman, S.Z.
Hort. Res. Inst. , Agric. Res. Cent.

ABSTRACT

An experiment was carried out at Kaha vegetable Research farm, Horticulturee Research Institute during 1996 and 1997 seasons to study the effect of nitrogen levels on yield, quality and storability of three new tomato hybrids, i.e Madeer as a processing type, Alex 63 as a fresh market type and Nema 1400 as a double purpose.

Results indicated that tomato hybrids showed variable response to nitrogen levels, Madeer hybrid gave the highest number of fruit per plant when the plants were fertilized with 200 kg/Fed. but Alex 63 gave the highest fruit weight in the level of nitrogen 150 kg.N/Fed. There was significant delaying and reduction in the amount of early yield with increasing nitrogen fertilization. Total yield were higher under treatment of Madeer and Nema1400 hybrids with 200 kg.N/Fed. while, Alex 63 hybrid responded to 150 kg.N/Fed. concerning marketable yield, the highest value was recorded in all hybrids used fertilizer with the level of 150 kg.N/Fed.

Average fruit length, diameter and flesh thickness of tomato fruits were significantly increased with increasing nitrogen fertilization but nitrogen at the rate of 100 and 150 kg.N/Fed. seemed to be optimum for getting the highest fruit firmness, T.S.S, Vit. C and lycopene contents.

Tomato fruits of all hybrids used treated with 150 kg.N/Fed. improved tomato fruit quality and storability by decreasing weight loss and decay percentages and maintained the fruit quality during storage. This improvement was much pronounced at the Madeer hybrid.

INTRODUCTION

Improving the utilization efficiency of applied fertilizers is one way of reducing production costs and minimizing potential ground water contamination. Nitrogen is the most important nutrient in any fertilization program. Yearly, there are many recommendations for new cultivars and hybrids. The new hybrids differ in its response to nitrogenous fertilization. In this respect the application of nitrogen fertilizer to tomato plants has been widly studied. Hewedy *et al.* (1994) found that tomato cultivars castle rock and flora dade markedly affected with high nitrogen level(200kg N/fed.), while peto 86 produced the same yield at low level. Many investigators found that tomatoes responded well to nitrogenous fertilizers. The increase in nitrogen resulted in an increase in the yield as it was found by Hernandez and Cornius (1991), and Cerne(1992). On the other hand, early yield reduced with increasing rate of nitrogen Midan and El sayed (1984), Kaniszewski and Slkner(1993) and Shahien *et al*.(1995)on tomato. They found also that the highest non-marketable yield was found by applying the highest level of nitrogen. Ahmed and Chaudhry(1992) and Hewedy *et al*. (1994) reported that yield parameters including number of fruits per plant and average fruit weight of tomato significantly responded to high level of nitrogen fertilizer. Kooner

and Randhawa(1993) and Trapevski *et al.* (1993) observed obvious differences between tomato cvs in the response to nitrogen levels.

For fruit quality, several studies were conducted dealing with the effect of N fertilizer on fruit physical characters. Hewady *et al.*(1994) showed that length, diameter and firmness of tomato fruits increased with nitrogen application. Concerning fruit chemical composition shahien *et al.*(1995) revealed that by increasing nitrogen rate total soluble solids and titratable acidity of three hybrids were increased , while ascorbic acid was decreased by increasing nitrogen rate.

Adams and Winsor(1973) and Hassanen(1991)showed that physical and chemical characters of tomato fruits were lightly affected by cultivars.

For keeping quality, Shafshake(1961) and Santos(1972) reported that high rates of nitrogen fertilizer increased the decay and fresh weight loss percentages of tomato fruits during storage and decreased their storage life. El-Sheikh (1988) and Hassanen(1991) stated that the percentages of weight loss, decay and lycopene were increased and firmness and acidity of tomato fruits were decreased with the prolongation of storage period but total soulble solids and vit. C content increased initially then decreased at the end of storage period .

Consequently this study was performed to investigate and compare between the response of different types of tomato hybrids to nitrogen fertilization on yields, fruit quality and storageability of tomatoes.

MATERIALS AND METHODS

Two field experiments were performed for two successive summer seasons of 1996 and 1997 at Kaha vegetable research station to investigate the response of some hybrids (, i.e. Alex 63 as a fresh market type; Madeer as a processing type and Nema 1400 as a double purpose type) to different rates of nitrogen fertilization (, i.e. zero, 100, 150 and 200 kg N/fed.). Ammonium sulphate containing 20% N was used as a source of nitrogen. Seeds of these tomato hybrids were sown in seedling trays contained a mixture of peat moss and vermiculite on 26th and 28th of February and the seedling were transplanted into the field on ridges 3.5m long and 1m wide on 6th and 8th of April in both 1996 and 1997 seasons consecutively. Single plants were set 35cm apart each plot consisted of 2 ridges and each ridge contained 10 plants, thus the plot area was 7m² and contained 20 plants. The rate of nitrogen fertilizer were applied in three portions , i.e. 25%, 50% and 25% from the total amount at three time of application , i.e. 20, 45 and 70 days from transplanting respectively. Irrigation, phosphorus, potassium fertilization and pests and disease management were applied as the recommendations of the Ministry of Agriculture.

A split plot design with 3 replicates was adopts and hybrids were arranged in the main plots and nitrogen levels at sub plots the physical and chemical properties of the soil are shown in table (1).

Table (1): the physical and chemical properties of the sample were analyzed

Variable	1996 season		1997 season	
	0-30cm depth	30-60 cm depth	0-30cm depth	30-60 cm depth
i) Physical properties				
- sand %	12.4	18.6	13.8	19.6
- silt %	24.2	28.2	22.6	24.3
- Clay %	60.4	58.8	62.3	61.7
b)chemical properties				
PH	8.0	7.8	8.1	8.0
Available N ppm	90.4	110.2	83.5	96.7
Available P ppm	6.8	6.6	5.4	5.2
Available K ppm	220.0	210.5	211.4	200.7
Total $CaCo_3$ 3%	2.5	2.85	2.6	2.7
Organic mater	4.2	2.6	3.7	1.9

The samples were analyzed at the water and soil Research Institute.
The following data were recorded

1- Number of fruits per plant: five plants in each plot were labeled for this determination.
2- Early yield : the yield of the first three pickings(kg/plot).
3- Total yield(kg/plot).
4- Marketable yield(kg/plot).
5- Fruit quality: a random sample of 30 fruits from each treatment was taken at the day of harvest and examined for the following characters: average fruit weight(g); average length and diameter(cm) using vernier calypar; firmness(N); total soluble solids(%); Vit. C, acidity and lycopene as mg/100g fresh weight of fruit juice.

Tomato fruits at the pink stage were picked at the third picking time and transported immediately to the laboratory at Giza, where sound and healthy fruits were chosen and cleaned with dry towels for storage experiment.

A split split plot design was adopted having the hybrids as main plots; nitrogen levels as sub plots and shelf life period (five periods) as sub sub plots. About one kilogram of tomato fruit were put in carton box(30 x 20 x 10cm) as one replicate. Fifteen replicates of each treatment were stored at cold storage 10°C and 85-90% RH . random samples of 3 replicates of each treatment were taken to be examined every 3 days intervals for post-harvest properties as follows:

a) Weight loss, decay and total soulble solids(in percent).
b) Fruit firmness was measured in Ib/in^2 by magness at ballauf pressure taster equipped with 3/16 inch plunger and adjusted in Newton(as recommended by ASHS post-harvest Working Group)
c) Ascorbic acid (Vit. C), total acidity and lycopene were determined according(A.O.A.C., 1985) as mg/100g fresh weight.

Statistical analysis of data was done according to Snedecor and Cochran(1980).

RESULTS AND DISCUSSION

Number of fruit per plant and average fruit weight of different tomato hybrids are presented in table (2), it is clear that Madeer hybrid produced the greatest number of fruits per plant followed by Nema 1400, while alex 63 was the lowest. The average fruit weight of Alex 63 hybrid was significantly greater than that of Nema 1400 or Madeer hybrids, the lowest fruit weight was recorded by Nema 1400 hybrid, these results are true in the two seasons. Adel El-Bogdady *et al.* (1993).

For the effect of nitrogen levels, data in the same table for the two seasons revealed that number of fruits per plant and average fruit weight were significantly affected by increasing nitrogen levels. The highest number of fruits per plant and fruit weight resulted by the application of 200 kg.N/fed.

These results are also true regarding the effect of nitrogen level on average fruit weight where it was proved that there was gradual increase in the individual fruit weight reaching its peak at 200 kg.N/fed. These results are in agreement with those obtained by Hewedy *et al.*(1994).

As for the interaction between hybrids and nitrogen levels, data in Table (2) showed that within hybrid, the highest fruit number per plant and fruit weight were observed for all hybrids when 150 or 200kg N/fed was used in the two successive seasons. Moreover, Madeer hybrid as compared with Alex63 and Nema1400 hybrids gave the highest number of fruit per plant when the plants were fertilized with 200kg N/fed. But Alex63 gave the highest fruit weight by using nitrogen level of 150kg/fed. In this connection, Kooner and Randhawa (1993) found that there was a significant interaction between the rate of nitrogen and tomato cvs on the number of fruit per plant and fruit weight.

Significant differences in early and total and marketable yield tomato fruit were noticed between hybrids Table(2). The top yielding hybrids was Madeer, on the other hand, the lowest values of early and marketable and total yield were obtained from Nema1400. Alex63 hybrid was in between. These results are true in the two seasons.

It has to be mentioned here that the increase in total yield of Madeer hybrid could be due to the increase in number of fruits rather than the average fruit weight. In this connection Hernandez and Cornius(1991) pointed out that, the number of fruit per plant and per truss were the major variables affecting yields.

Data in Table (2) showed that there was significant delaying (Midan and El-Sayed, 1984, and Shahien, *et al.,* 1995) and reduction in the amount of early yield (Kamiszewski and Slkner, 1993) with increasing nitrogen fertilization level. In other words, the lowest nitrogen level produced higher early yield than other ones i.e. 150 and 200 kg N/fed.

These results might owe much to that nitrogenous fertilization retarted flowering(Hewedy *et al.*, 1994 and Shahien, *et al*., 1995) and thereby, may reduced early yield. On the other hand the total yield positively to all rates of applied nitrogen. The increase in nitrogen resulted in an

increase in yield. This results is true in both seasons. In another words, the highest total yield were obtained by the level of 200kg.N/fed..

The favorable effect of N-fertilization on tomato productivity may attributed to improving nutritioned status in plants(Pochaszka and Hamer, 1977). Many investigators reported that tomato fruit yield increased significantly by nitrogen application at rate of 150 to 240 kg.N/h.(Ahmed and Chaudhry 1992 and Trpevski *et al*., 1993).

With regard to marketable yield, data in Table (2) showed that the three nitrogen fertilization levels 100, 150 and 200 kg.N/fed. were differed in their marketable yield. Nitrogen level(150 kg.N/fed.) was superior in this respect where it produced 43.26 kg/plot comparing with 35.02 and 40.00 kg/plot produced by the lowest and the highest N levels(100 and 200 kg.N/fed.). These results were in agreement with obtained by Kaniszewski, and Slkner (1993) and Shahien *et al*(1995) who found that the highest non-marketable fruits was found by application the highest level of nitrogen.

The interaction between tomato hybrids and nitrogen levels of early, total and marketable yields were significant. early yield decreased at the treatment of 200kg.N x Nema1400 hybrid and was more at the treatment of 0 N/fed. x Madeer hybrid. These results are in harmony with those reported by Kooner and Randhawa(1993). All hybrids exhibited significantly higher total and marketable yields in all rates of nitrogen than control. Total yield were higher under treatment of Madeer and Nema1400 hybrids with 200 kg.N/fed. , while, Alex63 hybrid responded to the level of nitrogen 150 kg.N/fed(Trpevski *et al.,* 1993 and Hewedy *et al.,* 1994). Concerning marketable yield, data indicated that the highest value was recorded in all hybrids used fertilizer with the level of 150 kg.N/fed..

Data of fruit length, diameter and flesh thickness of the studied tomato hybrids are presented in Table (3). It should be noted that there were significant differences among the hybrids in their characters. The maximum values of fruit length and diameter were obtained by Alex63 hybrid. The minimum value was obtained by Nema1400 hybrid. these results are true in both seasons. Concerning fruit flesh thickness, Madeer hybrid obtained the highest value in the two seasons. These results are in harmony with these obtained by Hassanen (1991).

Regarding the nitrogen fertilizer effect, data in table (3) showed that nitrogen average fruit length, diameter and flesh thickness significantly responded to N fertilizer. The maximum fruit length and diameter were obtained from the levels of 200 kg.N/fed. But the highest flesh thickness was obtained by fertilizing tomato plants with 150 kg.N/fed. These results hold true in the two seasons. This increment might be attributed to the enhancing effect of nitrogen application on plant growth which will be reflected on these fruit characters.

The interaction between tomato hybrids and nitrogen levels fertilizer on fruit length, diameter and flesh thickness was significant in the first season only. The highest fruit length, diameter and thickness were obtained from fruit of Alex63 plants treated by 150 and 200 kg.N/fed.

The studied hybrids were differed significantly in fruit firmness(table 3). Madeer hybrid as a processing type has the highest value of firmness followed by Nema1400, while Alex63 as a fresh market type was the lowest

value. These results in the two seasons agree with the findings of Ishiuchi(1993) and Hewedy (1988).

Concerning the effect of nitrogen fertilizer, the rate of 150kg.N/fed. enhanced fruit firmness, whereas the highest rate i.e. 200kg.N/fed unfavorably affected this character. The results in both seasons are in agreement with those obtained by Hewedy *et al.*(1994) who found that tomatoes grown with the Medium or low Levels of nitrogen fertilizer gave fruits with highest values of firmness than fruits from plants grown under a high nitrogen fertilizer.

The interaction between hybrid and the rate of nitrogen fertilizer on fruit firmness was also significant in the first season only. All hybrids exhibited significantly higher fruit firmness in all rates of nitrogen fertilizer than the control(on/fed.). The highest value was obtained from fruits of Madeer hybrid treated with 150 kg.N/fed. The lowest value was observed in fruit of Alex63 hybrid fertilized with 200 kg.N/fed. . These results were in line with those reported by Trapevski *et al.*(1993).

Differences in T.S.S acidity, ascorbic acid and lycopene in fruit of tomato hybrids are shown in Table (4). The higher contents of total soluble solid ascorbic acid and lycopene were obtained from Madeer hybrid fruits comparing with other hybrids. On the other hand, Madeer hybrid fruits gave the lowest value of titratable acidity. These results are true in the two seasons.

The present data in Table(4) showed that nitrogen at the rates of 100 and 150 kg/fed. in both seasons seemed to be optimum for getting the highest ascorbic acid content of tomato fruits. In this concern, any increase in the nitrogen level caused a decrease in this parameter. This reduction may be a result of increasing carbohydrate consumption in protein synthesis and respiration process, thereby decreasing Carbohydrate incorporation in ascorbic acid formation. Similar results were obtained by Shahien *et al* (1993) on tomato, who reported a significant negative effect on fruit.

Regarding T.S.S and titratable acidity data in Table (4) revealed that increasing nitrogen level in the present study from 100 to 150 kg/fed. encourage a higher accumulation of total soulble solids and titratable acidity in fruits. Although the farther increase in the rate of nitrogen fertilization to 200kg.N/fed caused a further significant increase in the titratable acidity of fruits only, it strinkly decreased the percentage of T.S.S in fruits. The accumulation of titratable acidity in fruits is a result of increasing of metabolic activities in plants, these results are true in both seasons. These results go along with those of Midan and El-Sayed (1995) and Shahein *et al*. (1995) on tomato.

Regarding Lycopene contents in fruits, the medium rate of applied nitrogen(150 kg/fed.) exerted an increase in this compound, whereas, the highest nitrogen rate decreases it Table(4) . These results are in agreement with that of Shafshake (1961) on tomato, who found that tomato plants treated with high level of nitrogen were poorly coloured fruits.

The interaction between tomato hybrid and the rate of nitrogen fertilizer on T.S.S and ascorbic acid content were non significant but on titratable acidity and lycopene contents were significant in the two seasons.

Data in Table (5) showed that the tested cultivars showed significant difference in their fruit weight loss. In this respect, fruits of Madeer exhibited the least loss, while fruits of Alex63 hybrid showed the highest weight loss, whereas this of Nema1400 was in between, these results are true for both seasons. Similar results concerning varietal difference in fruit weight loss were also reported by Hassanen(1991) who found that the difference in weight loss among the tested hybrids may be due to the genetic difference which cause variation in physical properties of the fruits.

With respect to decay percentage of different hybrids of tomato, data presented in table (5) reveal in both seasons that the result of decay was variable among studied hybrids. The highest percentages of decay was found in fruit of Alex63 hybrids, while the lowest one was observed in fruits of Madeer and Nema1400 hybrids. This is a result of changes in fruits during storage, which caused the increase of moisture condensation in exterior of fruits, the decrease of firmness and the transformation of complex compounds to simple form of more liability to fungus infection. These results obtained by El-Sheikh(1988) and Hassanen(1991) on tomato.

Data concerned with fruit firmness of the two seasons in Table (5) show clearly that fruit firmness was significantly affected by cultivars where fruits of Madeer hybrid exhibited the highest values of firmness followed by Nema1400 hybrid fruits, while Alex63 hybrid gave the lowest value of firmness, such varietal difference in physical properties of the fruits are mainly due to genetic difference. It could be also attributed to thickness of flesh . The fruit of hybrid Madeer which showed the highest firmness had thicker flesh wall.

With respect to T.S.S, ascorbic acid, titratable acidity and lycopene contents of different hybrids of tomato fruits during storage, data presented in table (5) reveal that Madeer cultivar gave fruits with highest total soluble solids, ascorbic acid and lycopene contents but with the lowest content of titratable acidity, while the fruits obtained from Alex63 hybrid gave the opposite results. These results were true in the two seasons.

Data in Table (6) showed that the highest value of weight loss and decay percentages were obtained in tomato fruits of the non nitrogen fertilization followed by those plants treated with 200kg/fed. in the two seasons. On the other hand, in both seasons the lowest weight loss and decay percentages were recorded in fruits from plants treated with the level of 150 kg.N/fed followed by the level of 100 kg.N/fed. These results might owe much to that high level of nitrogen increases the respiration rate, this increment in respiration increased the loss of dry matter and water loss consequence. These results are in agreement with those obtained by Shafshak(1961). He noticed that tomatoes treated with high nitrogen content increased the percentages of weight loss and decay and had a greater rate of respiration during storage.

With respect to fruit firmness, T.S.S, ascorbic acid and lycopene, data in Table (6) show clearly significant differences between nitrogen levels used. The lowest content of these characters during storage were more obvious in fruits of the non nitrogenous fertilization followed by the fruits of plants treated with the highest rate of nitrogen compared with other

treatments. On the contrary, the lowest values of the above mentioned characters of tomato fruits were in fruits of plants treated with 150 kg.N/fed. Followed by fruits of treated plants by 100 kg.N/fed. These results were true in the two seasons.

These results suggested that adding nitrogen at the rate of 150 kg.N/fed or 100 kg.N/fed minimized the losses in firmness, T.S.S, vit. C and lycopene of tomato fruits during storage, whereas, added 150 kg.N/fed being the most effective treatment.

These results where in according with those of Shafshak (1961) who found that tomato plants treated with high nitrogen level had a poorer keeping quality.

Regarding tomato fruit acidity, it is quite clear that increasing in titratable acidity content of tomato fruits produced by increasing the rate of added nitrogen to tomato plants Table (6). In other words, tomato fruits treated with high level of nitrogen(200 kg.N/fed) produced fruits contain the highest values of acidity during storage. However, the lowest value of acidity was in fruits of untreated plants. Meanwhile the level of 100 and 150 kg.N/fed lay in between. These results are true in both seasons. These results are in harmony with the result obtained by Shafshak (1961) who cleared that N application increased the titratable acidity of tomato fruits during storage.

Data in Table(7) show a progressive increase in the percentage of weight loss of tomato fruits during storage in the two seasons. These increases in weight loss % might be attributed to the loss in moisture through transpiration and loss in dry matter content through respiration. The percentages of fresh weight loss of tomato fruit increased considerably and consistently with the prolongation storage period(El-Sheikh ,1988).

With respect to decay percentage in Table (7) revealed that the decay started after 6 days from storage. Decay percentage started slowly and successively increased till the end of the storage period during the two seasons. These were the results of the changes occurred in the tomato fruit during storage, which caused the increase in loss in weight and moisture condensation on the exterior of the fruits. Also the decrease in fruit firmness and the transformation of complex compounds to simple form of more liability to fungus infection. Hassanen(1991) and El-Sheikh (1988) obtained similar results on tomato fruits.

Data in Table (7) show that there was a progressive and constant decrease in firmness and titratable acidity of tomato fruits with prolongation of storage period during the two seasons. The reduction in fruit firmness might be attributed with the conversion of protopectin to soluble pectin and conversion of starch or other carbohydrates to soluble sugers. The decline in acidity of tomato fruit during storage may be attributed to the rapid rate of oxidation of pyruvic acid and other acids to carbon dioxide. These results are in line with by Abd-Allah *et al*.,(1985) and Hassanen(1991) on tomato fruits.

Data in Table (7) indicated that T.S.S and ascorbic acid(vit. C) in tomato fruits increased till 4 days from storage, and then decreased till the end of storage period, these are true in both seasons. The increase in T.S.S and vit. C in the first period might owe much to the higher rate of moisture loss through transpiration than the rate of dry matter through respiration. The

reduction in T.S.S and vit. C during the last period of storage might be attributed to the higher rate of sugar and vit. C loss through respiration than water loss through transpiration(Wills *et al*.,1981).

Data in table (7) stated that there was a progressive increase in lycopene percentage of tomato fruits with prolongation of storage period. The increase in lycopene with prolongation storage may be due to the destruction of chlorophyll and transformation of chloroplasts to chromoplasts.

Regarding the interaction effect of variety and fertilizer during storage, data in Table(8) showed that the lowest weight loss of tomato plants were recorded in fruits of Madeer plants treated with 150 kg.N/Fed. followed by Nema 1400 treated with the same level of nitrogen, however, the highest values of weight loss was recorded in fruits of untreated plants of Alex 63 cultivar.

Data in Table(8) show that the greatest decay percent was occurred with untreated fruits of Alex 63 hybrid, while, the lowest value were recorded by 150 kg.N/Fed. of Madeer hybrid followed by fruits of the same levels on the nitrogen of 1400 cultivar. These results were held true in both seasons.

Studying the effect of hybrid and nitrogen fertilizer on tomato fruit firmness and T.S.S percentage. Data in Table (8) indicated clearly that the greatest values of fruit firmness and T.S.S of tomato fruits were recorded in Madeer plants treated with 150 kg.N/Fed. However, the lowest values of these indices were obtained in fruits of untreated plants with nitrogen at Alex 63 hybrid for firmness and Nema 1400 cultivar for T.S.S. The fruit firmness was higher in Madeer cultivar under all fertilizer rates compared with other cultivars.

With respect of acidity, the highest values of titratable acidity were recorded in tomato fruits obtained from plants treated with 200 kg.N/Fed. at the three hybrids tests. i.e. Madeer, Nema 1400 and Alex 63 in both seasons. On the other hand, the lowest acidity content were recorded in fruits from untreated plants at the all cultivars.

Results in Table(8) indicated that the ascorbic acid and lycopene contents were statistically influenced by the compined effect of rates of nitrogen fertilizer and their effects on the hybrids, whereas, the highest values of both Vit. C at Madeer cultivar and the concentration of lycopene at Nema 1400 cultivar were recorded in fruits obtained from plants fertilized with 150 kg.N/Fed. On the other hand, the lowest values of these characters were noticed in fruits obtained from untreated plants at Alex 63 cultivar.

From the previous results, it can be concluded that total yield were higher in Madeer and Nema1400 treated with the high level of nitrogen(200 kg.N/fed.), while Alex63 hybrid responded to 150 kg.N/fed. On the other hand, tomato fruits of all used hybrids treated with 150 kg.N/fed. Gave the highest marketable yield and improved tomato fruit quality and storability by decreasing weight loss and decay percentages and increasing firmness, T.S.S, ascorbic acid and Lycopene contents at harvest and during storage. This improvement was much pronounced at the Madeer hybrid.

REFERENCES

Abd-Allah, I.M.; M.R. Gabal; F.M. Hassan; T.A. Abed and S.M Hassanen (1985). physical properties of tomato fruits as affected by cultivar, ripening stage and storage conditions. Annals of agricultural science. Moshtohor, 22(2) 501-517(en, ar, 22 ref.) Zagazig University, Moshtohor, Egypt.

Adams, P. and G.W.Winsor (1973). The effects of nitrogen, phosphorus and potassium subirrigation on the yield quality and composition of single truss tomatoes. J. Hort. Sci., 48: 123-133.

Adel E. El-Bogdady: A.M. Hewedy and Usama A.E. (1993). Evaluation of some tomato cultivar. In early summer trials. Minia Journal of Agricultural Research and Development, Vol, 15-1993. 1-vegetable crops, 54-70.

Ahmed, C. M.S and M.A Chaudhry (1992). Effect of nitrogen on some yield parameters in tomato*(Lycopersicon esculentum Mill.)* under Maidugari enviromental conditions. Sarhad Jou. Of Agri. (1990) 6 (2): 155-158 [En, 11 ref.] Barani Agric. College. Rawslpindi, Pakistan. [C.F. Hort. Abst. 62. No. 1: 364.]

A.O.A.C. (1985). Official methods of analysis. 10th Ed. Association Official Agricultural Chemists Washington, D.C. U.S.A.

Cerne, M. (1992). Different kinds and levels of nitrogen in tomato. Acta Horticulture(1990), No. 277, 179 – 182. [C.F. Hort. Abst. 62. No. 7: 5869].

El-Sayed, S.F. (1995): Response of three sweet pepper cultivars to Biozyme under unheated plastic house conditions. Scientia Horticulture, 61:285-290.

El-Sheikh, T.M. (1988). Effect of some agricultural treatments on the storageability of some vegetable crops. Ph. D. Thsis, Fac. Of Agric.,Zagazig Univ., Egypt.

Hassanen, S.M. (1991). Effect of some cultural treatments on storageability of some tomato cultivars. Ph.D. Thesis, Fac. Of Agric., Zagazig Univ.

Hewedy, A.M., (1988). Effect of some Physiological treatments on some tomato varieties. Ph. D. Thesis Fac. Agric. Zgazig Univ., Egypt.

----------, Adel El-Bogdady and A.M. Morsy (1994). Influence of nitrogen fertilization on yield and fruit constituents of some new tomato cultivars. Minofiya J. Agric. Res., 19(1994) (3): 1343-1564.

Hernandez, M.M. and M.T. Cornius (1991). The performance of tomato *(Lycopersicon esculentum, Mill.)* cultivars introduced in Cuba. Relation-ships between morphylogical variables and yield. Comportamiento de variedodes de tomato *(Lycopersicon esculentum Mill.)* introducidas en Cuba. Relaciones entre variables morfologicas de rendimiento. Cultivos Tropicales (1989) 11 (1) 11 – 18 [Es, en, 9 ref.] Instituto Nacional de ciencias Agricolas, to Habara, Cuba. (C.F. Hort. Abst. 61 No 4: 2855).

Ishiuchi, D. (1993). Studies on the physical properties of tomato[Varietal differences and changes with ripening in the physical properties using

the tomato flesh compression test.] Bullatin of the National Res. Institute of Veg. Ornamental plants and Tea (1990) No. 1, 31 – 44 (Ja, en, 19 ref.), (C.F. Hort Abst. 63. No. 2: 1261).

Kaniszewski, S.; K. Slkner (1993). Effect of nitrogen fertilization and irrigation on yield and fruit quality of 2 staked tomato cultivar. Biuletyn warzywniczy(1990) No. 36, 85 – 94 Pl. en 6 ref. Instytuk warryunictwa skiemiexice, polland (C.F. Hort Abst. 63. No. 1: 406).

Kooner, K. S.; K. J. Randhawa (1993). Effect of varying levels and sources of nitrogen on yield and processing qualities of tomato varieties. Acta Hortic, (1990) No. 267, 99 ISBN 90 – 6605 – 134 – 5. Department of vegetable crops, pum) al – Agricultural Univ. Ludheana 141001, India, (C.F. Hort Abst. 63. No. 6: 4295).

Midan, A.A. and M.M. El-Sayed (1982). Growth, Chemical constituents and yield of tomato in relation to chlormequat and nitrogenous fertilizer. Minufiya, J. Agric. Res., 9: 25 – 35.

Pochaszka, K. and N. Hamer (1997). Effect of Nutrition on the nutrient composition in different parts of tomatoes. Acta Agronomic Academiac Scientiarm Hungaricae (1997) 26 (112) : 167 – 175. (C.F. Hort Abst., 48(2): 1491, 1978).

Santos , G. A.; Er. B. Pntastico and L.V. Uri (1972). Pre-harvest factors affecting tomato fruit quality . Mineral nutrition. Philippine Agric., 55. 7/8: 289 – 309.

Shafshak, S. A.(1961). Influence of fertilizer on the growth, chemical composition, keeping quality and yield of tomatoes. Ph. D. Thesis, Fac. Agric., Ain-Shams Univ., Egypt.

Shahien, A.H.; S.A. Esmaile and Agwah (1995). Effect of nitrogen and potassium rates on tomato growth, yield and uptake of some macro nutrients. Minia J. Agric. Res. Dep., 16 (4): 1113 – 1128.

Snedecor, G. W. and W.G. Cochran(1980). Statistical method. 7th edition. Lowa state University Press. Amer, Lowa, USA.

Trapevski, V.; V. Demirovska;l L. Stoj cewska and V. Ognenovski(1993). The effect of different rates of nitrogen on the quality and yield of some tomato cultivars. Savzemena Polyoprivreda (1992) 40 (1- 2) 100 – 102 sh, en, 3 ref zemyodelski Fakultet Skoplje, Macodonia. (C.F. Hort Abst. 63. No. 9: 6749).

Wills. R.H.H.; T.H. Lee ; D. Gerham ; W.B. McGlasson and E.G. Hall (1981). Postharvest, an introduction to physiology and handling of fruits and vegetables. The AVF publishing comp. Inc. Westport. Conn.

تأثير التسميد النيتروجينى على المحصول و الجوده و القدره التخزينيه لبعض هجن الطماطم الجديده

سعيد زكريا عبد الرحمن
معهد بحوث البساتين – مركز البحوث الزراعيه

اجريت التجربه بمزرعة قها التابعه لمعهد بحوث البساتين خلال موسمى 1996 و 1997 و ذلك لدراسة تأثير مستويات مختلفة من النيتروجين على المحصول و الجوده و القدره التخزينية لثلاث هجن جديده من الطماطم و هى مادير الذى يمثل مجموعة التصنيع و الكس 63 الذى يمثل مجموعة الاستهلاك الطازج و هجين نيما 1400 و هو ثنائى الغرض.

و قد أوضحت النتائج اختلاف استجابة هجن الطماطم لمستويات النيتروجين المختلفه فقد أعطى هجين الطماطم مادير اكبر عدد من الثمار لكل نبات عند استخدام معدل 200 كجم ازوت للفدان بينما اعطى الكس 63 اكبر وزن ثمره عند مستوى 150 كجم ازوت للفدان. كما ادى زيادة معدل التسميد الأزوتى الى تأخير و نقص المحصول المبكر. تم الحصول على أعلى محصول كلى للهجين مادير و نيما1400 عند مستوى 200 كجم ازوت للفدان بينما استجاب الهجين الكس 63 للمعدل 150 كجم ازوت للفدان. اما بخصوص المحصول القابل للتسويق فقد استجابت كل الهجن المستخدمه لمعدل 150 كجم ازوت للفدان.

كما أوضحت النتائج أن هناك زيادة معنويه فى طول و قطر و سمك اللحم فى ثمار الطماطم مع زيادة معدلات النيتروجين بينما أدى استخدام معدل 100-150 كجم ازوت للفدان الىالحصول على ثمار ذات صلابه عاليه و تحتوى على اكبر كمية من المواد الصلبه الذائبة و فيتامين ج و الليكوبين.

أوضحت النتائج أن تسميد كل الهجن المستخدمة بمعدل 150 كجم ازوت للفدان قد أدى الي تحسن صفات الجودة و القدره التخزينية لثمار الطماطم حيث اعطت اقل نسبة فقد وزن و تالف مع احتفاظ الثمار بصفات الجودة أثناء التخزين و كان هذا التحسين أكثر وضوحا فى هجين الطماطم مادير.

Table (2): Effect of nitrogen fertilizer level on the yield and yield components of some tomato hybrids in 1996 and 1997 seasons.

Tomato Hybrid	Number of fruits /plants					Average fruit weight (g)					Early yield (kg/plot)					Total yield (kg/plot)					Marketable yield (kg/plot)				
	0 N/fed. Control	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. control	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. control	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. Control	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. control	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean
1996 season																									
Nema1400	16.07	26.58	33.87	31.48	27.00	84.10	92.13	98.33	104.20	94.69	11.59	10.83	10.91	8.17	10.38	27.84	39.83	45.57	49.18	40.61	14.85	28.42	36.42	34.00	28.42
Alex 63	14.09	25.53	28.11	32.83	24.64	97.67	115.00	119.47	119.00	112.78	15.33	14.42	11.33	10.48	12.88	27.75	40.08	50.75	48.34	41.73	13.64	28.11	39.18	33.60	28.63
Madeer	20.42	27.47	30.62	35.92	28.60	89.63	95.50	106.93	106.58	99.66	15.58	13.58	14.17	10.08	13.35	28.50	47.00	49.25	56.58	45.33	16.80	37.62	42.63	39.61	34.17
Mean	16.86	26.53	30.86	32.74		90.47	100.88	108.22	109.92		14.17	12.94	12.14	9.55		28.03	42.31	48.53	51.37		15.10	31.38	38.74	35.74	
L.S.D at 5% of																									
Tomato Hybrids	0.99					2.53					0.42					1.50					0.92				
Nitrogen treatments	1.15					2.92					0.49					1.74					1.34				
Hybrid x N level	2.00					5.06					0.84					3.00					2.11				
1997 season																									
Nema1400	19.17	27.67	35.25	33.58	28.92	84.80	98.97	101.47	102.27	96.88	13.75	12.75	10.92	7.50	11.24	24.92	45.92	49.33	55.33	43.88	13.20	33.50	39.20	41.25	31.79
Alex 63	17.42	26.33	30.49	33.08	26.83	91.63	109.73	113.80	110.73	106.48	17.25	15.92	13.00	9.33	13.88	27.16	54.25	63.08	61.92	51.61	13.50	37.80	51.03	42.70	36.26
Madeer	24.08	28.83	35.75	38.42	31.77	88.17	102.60	104.30	109.80	101.23	18.00	17.83	13.75	12.08	15.42	30.17	56.50	61.17	69.42	54.31	18.41	44.80	53.07	48.80	41.27
Mean	20.22	27.61	33.83	35.03		88.20	103.77	106.52	107.60		16.33	15.49	12.56	9.64		27.42	52.21	57.86	62.22		15.04	38.70	47.77	44.25	
L.S.D at 5% of																									
Tomato Hybrids	0.82					2.56					0.54					1.04					0.84				
Nitrogen treatments	0.95					2.96					0.62					1.20					1.08				
Hybrid x N level	1.64					N.S					1.08					2.07					1.93				

Table (3): Effect of nitrogen level on fruit physical properties of some tomato hybrids at harvest in 1996 at 1997 seasons

Nitrogen Treatment	Fruit length (cm)					Fruit diameter (cm)					Flesh thickness (cm)					Firmness (N)				
Tomato hybrids	**0 N/fed. control**	**100kg N/fed.**	**150kg N/fed.**	**200kg N/fed.**	**Mean**	**0 N/fed. control**	**100kg N/fed.**	**150kg N/fed.**	**200kg N/fed.**	**Mean**	**0 N/fed. control**	**100kg N/fed.**	**150kg N/fed.**	**200kg N/fed.**	**Mean**	**0 N/fed. control**	**100kg N/fed.**	**150kg N/fed.**	**200kg N/fed.**	**Mean**
						1996 Season														
Nema1400	5.33	5.50	5.93	5.97	5.68	5.07	5.40	5.67	5.90	5.51	0.37	0.43	0.48	0.45	0.43	42.70	48.04	50.71	44.48	46.48
Alex 63	6.03	6.23	6.37	6.37	6.25	5.73	5.90	6.10	6.07	5.95	0.37	0.44	0.47	0.45	0.43	36.69	45.37	45.58	38.81	41.61
Madeer	5.47	5.90	6.17	6.20	5.94	5.17	5.37	5.73	5.83	5.53	0.43	0.53	0.60	0.57	0.53	55.16	56.05	61.83	57.26	57.57
Mean	5.61	5.88	6.16	6.18		5.32	5.56	5.83	5.93		0.39	0.47	0.52	0.49		44.85	49.82	52.71	46.85	
L.S.D at 5% of																				
Tomato Hybrids			0.08					0.09					0.04					0.69		
Nitrogen treatments			0.09					0.10					0.05					0.80		
Hybrids x N level			0.16					0.18					0.08					1.39		
						1997 Season														
Nema1400	5.33	5.57	5.67	5.80	5.60	5.10	5.30	5.45	5.48	5.33	0.43	0.50	0.53	0.50	0.49	48.19	48.93	51.19	48.04	49.08
Alex 63	5.83	6.00	6.18	6.15	6.05	5.53	5.70	5.98	5.95	5.79	0.40	0.47	0.50	0.50	0.47	35.58	41.32	44.48	40.03	40.36
Madeer	5.57	5.77	5.93	5.97	5.81	5.27	5.53	5.60	5.77	5.54	0.43	0.53	0.63	0.60	0.55	48.83	54.12	55.60	50.93	52.37
Mean	5.58	5.78	5.93	5.97		5.30	5.51	5.68	5.73		0.42	0.50	0.56	0.53		44.20	48.12	50.41	46.33	
L.S.D at 5% of																				
Tomato Hybrids			0.05					0.08					0.03					1.94		
Nitrogen treatments			0.06					0.10					0.04					2.24		
Hybrids x N level			N.S					N.S					N.S					N.S		

Table (4): Effect of nitrogen fertilizer level on fruit chemical properties of some tomato hybrids at harvest in 1996 at 1997 seasons

Nitrogen Treatment	T.S.S %					Ascorbic acid(mg/100f.w)					Acidity(mg/100f.w)					Lycopene (mg/100f.g)				
Tomato hybrids	0 N/fed. (control)	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. (control)	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. (control)	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean	0 N/fed. (control)	100kg N/fed.	150kg N/fed.	200kg N/fed.	Mean
1996 season																				
Nema1400	3.80	4.50	4.60	4.00	4.23	16.40	20.80	21.70	18.30	19.30	0.37	0.39	0.42	0.44	0.40	0.52	0.53	0.56	0.52	0.53
Alex 63	3.80	4.20	4.50	4.00	4.13	14.60	19.20	18.80	18.60	17.80	0.41	0.41	0.42	0.47	0.43	0.48	0.50	0.53	0.50	0.50
Madeer	4.20	4.60	4.80	4.40	4.50	20.70	21.70	24.80	17.60	21.20	0.34	0.37	0.38	0.41	0.38	0.53	0.55	0.59	0.57	0.56
Mean	3.93	4.40	4.63	4.13		17.23	20.57	21.77	18.17		0.37	0.39	0.41	0.44		0.51	0.53	0.56	0.53	
L.S.D at 5% of																				
Tomato Hybrids			N.S					1.75					0.019					0.021		
Nitrogen treatments			0.43					2.02					0.022					0.026		
Hybrid x N level			N.S					N.S					0.040					0.038		
1997 season																				
Nema1400	3.80	4.20	4.50	4.00	4.13	14.40	20.20	19.50	22.20	19.08	0.36	0.39	0.42	0.52	0.42	0.50	0.55	0.58	0.51	0.54
Alex 63	3.50	3.80	4.20	3.80	3.83	17.20	18.30	18.70	18.20	18.10	0.38	0.41	0.44	0.52	0.44	0.46	0.51	0.52	0.48	0.49
Madeer	4.00	4.10	4.50	3.90	4.13	18.40	22.80	23.50	17.20	20.48	0.36	0.38	0.43	0.43	0.40	0.49	0.55	0.58	0.52	0.54
Mean	3.77	4.03	4.40	3.90		16.67	20.43	20.57	19.20		0.37	0.39	0.43	0.49		0.48	0.54	0.56	0.50	

Table (5): Effect of tomato hybrids on physical and chemical properties of tomato fruits during storage in 1996 and 1997 seasons

Tomato Hybrids	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100f.w	Acidity mg/100f.w	Lycopene mg/100f.w	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100f.w	Acidity mg/100f.w	Lycopene mg/100f.w
	1997 season							**1998 season**						
Nema1400	4.07	7.49	42.13	4.52	19.58	0.34	0.57	4.7	8.55	45.03	4.36	19.89	0.36	0.58
Alex 63	4.54	10.69	37.22	4.33	17.99	0.37	0.55	4.78	11.58	34.46	4.12	18.65	0.36	0.54
Madeer	3.77	6.62	53.17	4.74	21.88	0.32	0.58	3.78	7.98	47.83	4.41	21.17	0.35	0.58
L.S.D at 5%	0.069	-----	0.29	0.05	0.63	0.008	0.013	0.046	----	0.75	0.07	0.55	0.008	0.007

Table (6) effect of Nitrogen fertilizer level on physical and chemical properties of tomato fruits during storage in 1996 and 1997 seasons

Nitrogen Level	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/ 100f.w	Acidity mg/100f. w	Lycopene mg/100f.w	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/ 100f.w	Acidity mg/100f. w	Lycopene mg/100f.w
	1997 season							**1998 season**						
Control	4.78	12.11	40.82	4.23	17.5	0.31	0.55	4.86	12.75	38.98	4.09	16.96	0.31	0.53
100kg N/fed.	3.77	6.79	45.29	4.65	21.09	0.33	0.57	4.25	7.75	43.87	4.31	21.24	0.34	0.58
150kg N/fed.	3.51	5.23	47.82	4.87	22.53	0.35	0.6	4.01	6.45	45.67	4.64	21.36	0.37	0.6
200kg N/fed.	4.45	8.93	42.76	4.36	18.16	0.38	0.56	4.55	10.53	41.25	4.13	20.05	0.41	0.55
L.S.D at 5%	0.074	----	0.34	0.06	0.73	0.009	0.015	0.049	----	0.86	0.08	0.64	0.01	0.008

Table (7): Effect of storage period on physical and chemical properties of tomato fruits during storage in 1996 and 1997 seasons

Storage period in days	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100f.w	Acidity mg/100f.w	Lycopene mg/100f.w	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100f.w	Acidity mg/100f.w	Lycopene mg/100f.w
	1996 season							1997 season						
0	--	--	48.56	4.28	19.43	0.40	0.53	--	--	47.27	4.03	19.21	0.42	0.52
2	1.73	0.00	46.96	4.62	20.88	0.38	0.54	1.94	0	45.4	4.38	21.17	0.39	0.54
4	3.27	0.00	44.81	4.93	22.79	0.34	0.57	3.62	0	42.91	4.67	23.23	0.36	0.57
6	4.73	5.31	41.80	4.57	19.77	0.31	0.59	4.94	6.18	39.86	4.35	19.91	0.33	0.58
8	6.79	27.75	38.74	4.24	16.22	0.28	0.61	7.18	31.39	36.78	4.04	15.99	0.29	0.61
L.S.D at 5%	0.08	-----	0.38	0.07	0.82	0.10	0.02	0.053	----	0.96	0.09	0.71	0.011	0.009

Table (8): Effect of interaction(hybrids N level fertilizer) on physical and chemical constituents of tomato fruits.

Tomato hybrids	Nitrogen level kg/fed.	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100F.W	Acidity mg/100F.W	Lycopene mg/100F.W	Weight loss %	Decay %	Firmness (N)	T.S.S %	Ascorbic acid mg/100F.W	Acidity mg/100F.W	Lycopene mg/100F.W
		1996 season							1997 season						
Nema1400	0(control)	4.95	11.97	39.02	4.02	16.3	0.3	0.56	4.91	12.99	43.02	4.31	14.87	0.33	0.55
	100	3.44	5.18	44.03	4.75	21.35	0.33	0.59	4.6	5.95	46	4.4	21.17	0.35	0.59
	150	3.36	4.63	45.13	4.8	22.25	0.36	0.62	4.53	5.37	47.09	4.67	20.47	0.38	0.63
	200	4.54	8.18	40.33	4.31	18.45	0.37	0.52	4.76	9.88	44	4.25	23.06	0.39	0.55
Alex 63	0(control)	5.01	14.15	32.72	4.04	15.47	0.35	0.53	5.21	14.2	30.16	3.91	17.62	0.3	0.51
	100	4.45	9.9	39.23	4.36	18.72	0.36	0.54	4.71	11.02	35.66	4.11	19.07	0.33	0.54
	150	4.06	6.86	41.79	4.7	19.74	0.36	0.58	4.27	8.45	38.17	4.44	19.05	0.36	0.57
	200	4.66	11.84	35.13	4.2	18.04	0.4	0.56	4.95	12.65	33.86	4	18.85	0.45	0.53
Madeer	0(control)	4.37	10.23	50.71	4.45	20.75	0.39	0.55	4.48	11.05	43.76	4.27	18.38	0.3	0.53
	100	3.42	5.28	52.61	4.84	23.2	0.31	0.57	3.46	6.28	49.94	4.43	23.48	0.33	0.6
	150	3.11	4.18	56.55	5.11	25.59	0.33	0.59	3.24	5.53	51.75	4.81	24.57	0.38	0.61
	200	4.16	6.79	52.81	4.57	17.99	0.36	0.59	3.93	9.05	45.86	4.14	18.24	0.39	0.57
L.S.D at 5%		0.14		0.59	0.11	1.27	0.015	0.026	0.09		1.49	N.S	1.11	0.017	0.014