Journal of Applied Biological Sciences 10 (3): 39-42, 2016
ISSN: 1307-1130, E-ISSN: 2146-0108

Performances of Different Type Intermediate Tomato Varieties in Open Field and Screenhouse

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Received: August 05, 2016
Accepted: December 20, 2016

Abstract

This study was conducted out at Agricultural Application and Research Center of Gaziosmanpasa University between April and November in 2015. Aim of this study is to determine the effects on different intermediate tomato types in open field and screenhouse on yield and its parameters. The seeds were sown on April 20th, 2015. Seedlings were planted out in Open Field and Screen House in May 20th, 2015. The experiment was carried out randomized complete split plots in block design with three replications. Marketable fruit yield (kg) per plant, fruit number per plant, and total yield (kg/m^2) were significantly affected by both growing systems and varieties, whereas maturity duration (day) and average fruit weight (g) were significantly affected by only varieties. Interactions were no significantly affected. Maximum fruit yield per plant was obtained from screenhouse (3.14 kg), it was 2.57 kg in open field. According to varieties, it was highest on Merkur F1 (4.68 kg), Asya F1 (3.88 kg), and Cemile F1 (3.83 kg) varieties. The most fruit number per plant was observed in screenhouse (65.46 numbers per plant), it was 55.96 number per plant in open field. Maximum total marketable yield were obtained from screenhouse (16.71 kg/m^2). It was 13.71 kg/m^2 in open field. According to varieties, the highest total marketable yield was determined on Merkur F1 (24.94 kg/m^2), Asya F1 (20.69 kg/m^2), and Cemile F1 (20.41 kg/m^2) varieties.

Keywords: Screenhouse, tomato, ribbed, beef, cluster, cocktail, cherry, pink, chocolate, purple, yield

INTRODUCTION

Tomato is one of the most important vegetable crops in the world (163.434.041 tonnes), Turkey (11.820.000 tonnes), and Tokat province (502.242) [1,2]. There are many biotic and abiotic factors that limit tomato production such as insects and diseases [3,4,5]. Screenhouse also creates shading affects and improves fruit setting in August when temperatures are higher [6,7,8,9,10] and prevents sunburn, wind, hail, frost damages [11,12,13,14]. These adverse factors should be controlled for commercial production. It is easier to control in protected cultivation, but they are serious problems in open field.

Many viruses have been spread by insects and insecticides are used their control many times. It has increased expenses and also creates serious problems public health, and obstacles for export . Hail (May and June) and frost (September and October) have damaged tomatoes in open field some years. Farmers have replaced the seedlings and their expenses have increased. Furthermore, tomatoes have been destroyed by frost (September and October). Farmers have lost their products. Screenhouse can protect vegetables from insects, hail and frost damages and increase yield and profit.

All type (beef, cocktail, cluster, oval and cherry) and color (red, pink, chocolate and purple) tomatoes have own market. When income level increases, people want to consume different color and shaped tomato. Cluster, cocktail, chocolate, purple and cheery tomatoes have been sold higher price than traditional (red, smooth and round) tomatoes. Therefore, it is important to grown different type tomatoes.

Aim of this study is to determine of performances in different intermediate tomato types in screenhouse and open field on yield and its parameters.

MATERIALS and METHODS

This study was conducted out at Agricultural Application and Research Center of Gaziosmanpasa University among April-November in 2015. Tokat province where experiment carried out is situated between 39° 52'- 40° 55' North latitude and 35° 27'- 37° 39' east longitude and has 640 meter elevation.

13 different type tomato varieties were used in the experiment. Yuksel Koy F1 (red, ribbed shape and beef type), Asya F1, and Cemile F1, (red, smooth shape and beef type), Gulpembe F1 (pink, less ribbed shape and beef type) and Pembepanter F1 (pink, more ribbed shape and beef type), Vitamin F1 (red and cocktail type), Seyit F1 (red and cocktail type), Aroma F1 (red and cocktail type), Kaplan F1 (purple and cocktail type) Elips (red and oval type), Merkur F1 (red and cluster type), Margol F1 (red and cherry type), Ciko F1 (chocolate type) are varieties.

The seeds were sown in unheated greenhouse on April 20th, 2015. The seedlings were planted with double row (100 cm x 50 cm x 25 cm) in screenhouse (width: 3 m, length: 30 m, screen size: 50 mesh insect net which is used years and double door) and open field on May 20th, 2015. The experimental design was randomized complete split plots in block with three replications. 10 plants were allocated for each treatment. The plant apex was topped by hand over two leaves of eighth truss. Fertilization was done by fertigation system. 250 kg/ha N, 150 kg/ha P_2O_5, 300 kg/ha K_2O and necessary micro elements were applied [15]. Fungicide was applied both screenhouse and open field, but insecticide was applied only in open field. Yellow and blue insect traps were used both screenhouse and open field.

Data were collected on maturity duration (days from planting to first harvest), marketable fruit yield per plant (kg/plant), marketable fruit yield per plant (number/plant), average fruit weight (g) and total marketable yield (kg/m^2). They were analyzed with one-way analysis of variance (ANOVA). The means were separated using Duncan test for P=0.05.

RESULTS

Marketable fruit yield (kg) and fruit number per plant, and total yield (kg/m^2) were significantly affected by both growing systems and varieties, whereas maturity duration (day) and average fruit weight (g) were significantly affected by only varieties. Interactions were no significantly affected both growing systems and varieties.

There were no effect of growing systems on maturity duration (day), but it was significantly affected by varieties and changed between 71.00 – 74.83 days (Table 1).

Table 1. Effects of Open Field and Screenhouse on Maturity Duration (day) of Different Intermediate Tomato Types

Varieties	Open Field	Screenhouse	Average**
Ciko F_1	76.00	71.00	**73.50 ab**
Gulpembe F_1	74.67	75.00	**74.83 a**
Kaplan F_1	74.67	71.00	**72.83 bc**
Pembepanter F_1	71.00	71.00	**71.00 c**
Yuksel Koy F_1	71.00	71.00	**71.00 c**
Elips F_1	73.67	75.00	**74.33 ab**
Asya F_1	72.33	71.00	**71.67 c**
Cemile F_1	73.67	73.67	**73.67 ab**
Merkur F_1	75.00	75.00	**75.00 a**
Vitamin F_1	71.00	71.00	**71.00 c**
Seyit F_1	71.00	71.00	**71.00 c**
Aroma F_1	71.00	71.00	**71.00 c**
Margol F_1	71.00	71.00	**71.00 c**
Average^{NS}	**72.77**	**72.13**	

Growing Systems and Variety Interaction: *

Maximum fruit yield per plant was obtained from screenhouse (3.14 kg), it was 2.57 kg in open field. According to varieties, it was highest on Merkur F1 (4.68 kg), Asya F1 (3.88 kg), and Cemile F1 (3.83 kg) varieties (Table 2).

Table 2. Effects of Open Field and Screenhouse on Marketable Fruit Yield Per Plant (kg) of Different Intermediate Tomato Types

Varieties	Open Field	Screenhouse	Average**
Ciko F_1	2.82	2.89	**2.86 cde**
Gulpembe F_1	3.11	2.78	**2.95 cd**
Kaplan F_1	1.15	1.47	**1.31 h**
Pembepanter F_1	1.67	2.42	**2.05 fg**
Yuksel Koy F_1	3.26	3.52	**3.39 bc**
Elips F_1	3.19	3.34	**3.27 bc**
Asya F_1	3.44	4.33	**3.88 b**
Cemile F_1	3.27	4.39	**3.83 b**
Merkur F_1	3.81	5.55	**4.68 a**
Vitamin F_1	1.96	2.87	**2.42 defg**
Seyit F_1	1.56	1.99	**1.78 gh**
Aroma F_1	2.21	2.79	**2.50 def**
Margol F_1	1.98	2.41	**2.20 efg**
Average**	**2.57 b**	**3.14 a**	

Growing Systems and Variety Interaction: NS

The most fruit number per plant was observed in screenhouse (65.46 numbers per plant), it was 55.96 number per plant in open field. According to varieties, maximum fruit number per plant was obtained from cherry and cocktail type varieties (Table 3).

Table 3. Effects of Open Field and Screenhouse on Marketable Fruit Number Per Plant of Different Intermediate Tomato Types

Varieties	Open Field	Screenhouse	Average**
Ciko F_1	40.80	40.67	**40.74 f**
Gulpembe F_1	18.67	17.58	**18.13 g**
Kaplan F_1	60.22	76.19	**68.21 d**
Pembepanter F_1	15.42	22.17	**18.79 g**
Yuksel Koy F_1	23.89	23.50	**23.69 g**
Elips F_1	58.47	52.58	**55.53 e**
Asya F_1	19.67	25.83	**22.75 g**
Cemile F_1	22.25	30.92	**26.58 g**
Merkur F_1	46.72	68.67	**57.69 de**
Vitamin F_1	101.08	114.39	**107.74 b**
Seyit F_1	84.75	88.33	**86,54 c**
Aroma F_1	120.92	150.00	**135.46 a**
Margol F_1	114.64	140.17	**127.40 a**
Average**	**55.96 b**	**65.46 a**	

Growing Systems and Variety Interaction: NS

There were no effect of growing systems on average fruit weight (g)**,** but it was significantly affected by varieties. According to varieties, average fruit weight was observed 17.24 g-171.00 g. Beef type varieties, (Asya F_1 (171.00 g), Gulpembe F_1 (163.52 g), Yuksel Koy F_1 (142.02 g), Pembepanter F_1 (109.07 g). They were followed by cocktail and cherry types (Table 4).

Table 4. Effects of Open Field and Screenhouse on Average Fruit Weight (g) of Different Intermediate Tomato Types

Varieties	Open Field	Screenhouse	Average**
Ciko F_1	70.20	71.34	**70.77 de**
Gulpembe F_1	168.74	158.29	**163.52 a**
Kaplan F_1	19.47	19.18	**19.33 f**
Pembepanter F_1	108.61	109.54	**109.07 c**
Yuksel Koy F_1	134.28	149.75	**142.02 b**
Elips F_1	54.13	63.57	**58.85 e**
Asya F_1	174.50	167.51	**171.00 a**
Cemile F_1	143.85	142.75	**143.30 b**
Merkur F_1	82.01	80.85	**81.43 d**
Vitamin F_1	19.42	25.15	**22.28 f**
Seyit F_1	19.10	22.64	**20.87 f**
Aroma F_1	18.43	18.40	**18.42 f**
Margol F_1	17.27	17.21	**17.24 f**
Average^{NS}	**79.23**	**80.48**	

Growing Systems and Variety Interaction: NS

Screenhouse total marketable yield (16.71 kg/m^2) was higher than open field (13.71 kg/m^2) due to more fruit number per plant. According to varieties, the highest total marketable yield was determined on Merkur F1 (24.94 kg/m^2), Asya F1 (20.69 kg/m^2), and Cemile F1 (20.41 kg/m^2) varieties. Merkur F1 is cluster type tomato variety. Its adaptation was better than beef type varieties. Pink beef varieties had cracking problems caused by higher temperature differences between day and night (Table 5).

Table 5. Effects of Open Field and Screenhouse on Total Marketable Yield (kg/m^2) of Different Intermediate Tomato Types

Varieties	Open Field	Screenhouse	Average**
Ciko F_1	15.03	15.43	**15.23 cde**
Gulpembe F_1	16.56	14.84	**15.70 cd**
Kaplan F_1	6.16	7.80	**6.98 h**
Pembepanter F_1	8.89	12.91	**10.90 fg**
Yuksel Koy F_1	17.41	18.76	**18.09 bc**
Elips F_1	16.96	17.82	**17.39 bc**
Asya F_1	18.31	23.06	**20.69 b**
Cemile F_1	17.41	23.41	**20.41 b**
Merkur F_1	20.32	29.61	**24.96 a**
Vitamin F_1	10.45	15.30	**12.88 defg**
Seyit F_1	8.33	10.61	**9.47 gh**
Aroma F_1	11.78	14.84	**13.31 def**
Margol F_1	10.57	12.85	**11.71 efg**
Average**	**13.71 b**	**16.71 a**	

Growing Systems and Variety Interaction: ^{NS}

DISCUSSION

Marketable fruit yield per plant was increased by screenhouse because its marketable fruit number per plant was higher than open field. Marketable fruit number per plant was increased by screenhouse due to shading effect and better climate environment [5,6,7,8]. There is fruit setting problems in August owing to higher temperatures. Fruit number per cluster has been decreased by higher temperatures. Screenhouse has improved fruit setting and it has increased fruit number per plant [9,10,11,12].

Screenhouse also protects hail (May and June) and frost (September and October) problems. This is really important for some years. Furthermore, it prevents to enter insects, which carry some viruses and other disease agents, inside the screenhouse. No need to use insecticide for growing tomato in screenhouse.

Screenhouse can be used 6 years without replacing. When increased yield, 6 years using, protection hail and frost are combined, its using is economical.

All type (beef, cocktail, cluster, oval and cherry) and color (red, pink, chocolate and purple) tomatoes have own market. When income level increases, people want to consume different color and shaped tomato. Cluster, cocktail, chocolate, purple and cheery tomatoes have been sold higher price than traditional (red, smooth and round) tomatoes. Therefore, it is important to grow different type tomatoes.

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