

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

Necdettin SAGLAM^{1*}

Soner ONDER¹

¹Gaziosmanpasa University, Faculty of Agriculture, Department of Horticulture, Tokat, Turkey

*Corresponding Author:

E-mail:necdettin.saglam@gop.edu.tr

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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/m²) 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/m²). It was 13.71 kg/m² in open field. According to varieties, the highest total marketable yield was determined on Merkur F₁ (24.94 kg/m²), Asya F₁ (20.69 kg/m²), and Cemile F₁ (20.41 kg/m²) 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 P₂O₅, 300 kg/ha K₂O 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/m²). 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/m²) 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 F₁ (171.00 g), Gulpembe F₁ (163.52 g), Yuksel Koy F₁ (142.02 g), Pembepanter F₁ (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/m²) was higher than open field (13.71 kg/m²) due to more fruit number per plant. According to varieties, the highest total marketable yield was determined on Merkur F₁ (24.94 kg/m²), Asya F₁ (20.69 kg/m²), and Cemile F₁ (20.41 kg/m²) 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/m²) 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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