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CULTIVATION OF TOMATOES IN GREENHOUSES WITH DOUBLE-COATED FILM IN UZBEKISTAN

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ABSTRACT
The scientific cooperation with Uzbekistan – South Korea project of International Agriculture (KOPIA) and by support of Rural Development Administration (RDA) on the territory of the experimental station of RIVMCP have been constructed greenhouses with double plastic coverage. Objectives of the trial were to evaluate and select more suitable tomato varieties for growing in double layered plastic greenhouses in the climatic conditions of Tashkent region. The seven tomato varieties were studied in double-layered plastic greenhouses. The highest yield was obtained from F_1 Buran, F_1 Saykhun and F_1 Bahor with standard hybrid F_1 Belle. However further investigation will be needed to evaluate the resistance to common pests and diseases and fruit quality of these varieties.

KEYWORDS: *tomato, varieties, hybrids, yield, two-layer film, black film.*

INTRODUCTION

Tomatoes are leading vegetable crop in open fields as well as in greenhouses in Uzbekistan. The 20% of fresh tomatoes from the open field production and almost 60% from the protected areas go to the export and it makes tomatoes economically valuable crop which can increase income of greenhouse farmers. Due to sharp increase in recent years areas under modern plastic greenhouses in Uzbekistan it became necessary the breeding of tomato hybrids for growing in this constructions. Nowadays in Uzbekistan almost 90 % of greenhouses are covered by plastic film and basically it is a LDPE [9].

In the 80-s of the last century in greenhouses were grown only few tomato varieties, however by the development of protected horticulture increased also demand for the special varieties for different greenhouse constructions which should have higher yields, good marketable view, complex resistance to the main diseases and good growing abilities even in a low light and temperature conditions. In winter-spring growing season (January-June) greenhouse vegetable crop hybrids should to have a high fruit setting abilities, especially in a low winter and following a high spring temperatures [4, 11, 12].

In 2010 under the scientific cooperation with South Korea project of International Agriculture (KOPIA) and by support of Rural Development Administration (RDA) on the territory of the experimental station of RIVMCP have been constructed greenhouses with double plastic coverage, area and (0,15 ha). Objectives of the present trial were to evaluate and select more suitable tomato varieties for growing in double layered plastic greenhouses in the climatic conditions of Tashkent region and recommend them to State Variety Testing.

MATERIALS AND METHODS

Overview of climatic conditions. Tomato variety trials were carried out in winter-spring season of 2011 - 2018 at the experimental station of Research Institute of Vegetable Melon Crops and Potato, Tashkent region. The climate of Tashkent region, with an abundance of solar radiation and heat.

The annual radiation balance in the lowlands of the Tashkent region is 2100 – 2300 MJ/m^2. The average annual temperature is + 13.0…+14.0ºC, the average minimum temperature is + 3.1…+5.5ºC, with an absolute minimum of – 28.0…-35.0ºC, the average maximum temperature is + 36.0…+36.5ºC, with an absolute maximum of +43.0…+47.0ºC, daily amplitude of air temperature is +13.0…+18.0ºC. The frost-free period is 220 days. The period with temperatures above +5.0ºC is 268 days (from 11 March to 3 November), above +10.0ºC – 190 days (from 25 March to 31 October), above 15.0ºC – 173 days (from April 14 to October 5). The sum of effective temperatures above +5.0ºC is 3490.0ºC, above +10ºC – 2290ºC and above + 15.0ºC – 1310.0ºC. In the plain areas of Tashkent region fall 206 – 316 mm precipitation annually. Most precipitation occur in late autumn, winter and early spring period November to Match. The relative humidity in winter is 80 – 90%, in summer – 20 – 30% [1, 6].

In experiments evaluated seven accessions of tomato, the standard was taken hybrid F_1 Belle, experiments laid in the double film greenhouses coating, air circulation is carried out through the side wall (Table 1).

Table-1
Tomato varieties used in trial

#	Tomato variety or hybrid	Production company	Origin
1	F_1 Belle (st)	Enza Zaden	Netherlands
2	F_1 Saykhun	RIVMCP*	Uzbekistan
3	F_1 Bahor	RIVMCP	Uzbekistan
4	Turon	RIVMCP	Uzbekistan
5	AVE-Maria	RIVMCP	Uzbekistan
6	F_1 Fenda	France	France
7	F_1 Buran	Enza Zaden	Netherlands

** Research Institute of Vegetable Melon Crops and Potato*

During winter months greenhouses were heated with hot air heaters. Greenhouses were equipped with drip irrigation system. Prior to transplanting black plastic mulch film (thickness-0.03 mm) laid after drip system installation.

Tomato seeds were sown in the transplanting branch in pots the size of 10×10 cm in the first decade of January and after 45 days (from mass of shoots) transplants tomatoes was planted in the greenhouses [5, 8]. The soil in the greenhouse was a typical serozem slightly saline (Table 2).

Before transplanting soil was plowed for 20 cm, manure compost was as an organic amendment, also rice husk and river sand was added to increase soil friability. Tomatoes were grown on a black plastic mulch with drip irrigation and conventional soluble fertilizers. Tomato transplants were transplanted onto the double rows with 80 cm spacing between the rows and 40 cm between plants on each row. The 120 cm walkway was considered between 2 double rows. Then plans were tied to the strings supported with overhead wires, stem formed as a single stem [3, 8].

Table-2
Soil properties in greenhouses

pH (1:5)	7.01
EC (dS/m)	0.81
Av. P (mg/kg)	119
Av. K (mg/kg)	420
N-NH (mg/kg)	64.35
N-NO (mg/kg)	64.35
Na ($cmol^+$/kg)	0.11
OM (g/kg)	15.6
Texture	Silt loam

During the growing period 5 foliar nutrient applications were applied (2500 l/ha per application). After the appearance of the 7th cluster, plants growing point was removed to stimulate growth and development fruits in lower clusters (conventional growing technique). Standard variety for our trials was F_1 Belle – popular commercial hybrid among greenhouse farmers.

Trials were conducted in randomized complete block design with four replications. Data was analyzed using Analysis of Variance ANOVA (Crop Stat) procedure and treatment means were separated using Fisher's least Significant Difference Test ($p<0.05$).

RESULTS AND DISCUSSION

In winter-spring growing season greenhouse tomatoes should have a strong stems with short internodes because plants tend to have a high fruit load in conditions where gradual increase of air temperature and solar radiation occurs. Research shows that all evaluated hybrids has the same growing habits except for local cultivar Turon, which growth and development in greenhouses were relatively weaker in comparison with F_1 hybrids [2, 7].

There were significant difference among tested cultivars in average fruit weight. Fruit weight ranged from 120 to 215 g. it should be noted that in Uzbekistan the most popular fruit size among population is varied from 150 to 220 g for medium and beef tomato fruits respectively. Since F_1 Chelbas had fruits with average weight of around 120 g, however they had intensive red and uniform colored skin, shiny appearance and well marketable view. Marketable fraction of the total yield for all tested varieties was high and consisted 95-98% from the total yield. The fraction of unmarketable fruits consisted predominantly from fruit with physiological disorders (sunscald, skin cracks, blossom end rot).

High significant differences in yield were observed among tested tomato varieties. Total yield was ranged from 13.5 to 18.4 kg/m^2. Significantly high total as well as a marketable yields were obtained for F_1 Buran and F_1 Bahor compared to standard variety (Table 3).

Table-3
Mean fruit weight and marketable yield of tomato varieties

Variety	Number of fruit (peice/plant)	Mean fruit weight (g)	Marketable yield (kg/m^2)
F_1 Belle (st)	34	215±5.3	16.75
F_1 Saykhun	32	120±7.9	17.10
F_1 Bahor	30	125±4.6	17.65
Turon	29	185±6.5	15.20
AVE-Maria	60	120±5.4	13.50
F_1 Fenda	41	160±9.2	16.50
F_1 Buran	45	170±4.2	18.40
		Mean±SE	*LSD=0.90*

Local hybrids F_1 Saykhun and F_1 Bahor showed higher marketable yield in comparison with standard. The lowest yield (13.5 kg/m^2) was observed for cultivar – Turon.

Relatively high content of sugar (3.9%) and vitamin C (14.4 mg%) was observed in fruits of domestic variety – Turon (Table 4). The smallest content of sugar (3.16 %) and vitamin C (13.0 mg/%) was observed in standard variety – F_1 Belle. Nitrogen (N-NO_3) accumulation in all tested varieties was low – 19.3 – 34.5 mg/kg of wet fruit weight, since maximum allowable concentration for greenhouses tomatoes is 150 mg/kg [10].

Early marketable yield (until May 1) was obtained hybrid F_1 Saykhun. In all tested varieties a bulk of the total yield (80%) was harvested between May and June. In our trials seeds were sown relatively late compared to sowing dates recommended in standard production guides. To increase early yield in winter-spring season it is recommended Lyan E.E. sowing tomato seeds on the first decade of November with further transplanting of 45-50 days-old seedlings in greenhouses on the first decade of January. Standard recommendation developed by RIVMCP also recommended early sowing and transplanting dates Bakuras N.N.

Table-4
Biochemical composition of tomato fruits

Cultivars	Dry matter (%)	Total sugar (%)	Ascorbic acid (mg/%)	N-NO_3 content (mg/kg)
F_1 Belle (st)	5.3	3.16	13.0	34.5
F_1 Saykhun	5.4	3.75	13.1	29.2
F_1 Bahor	5.4	3.42	13.4	27.1
Turon	5.2	3.90	14.4	19.3
AVE-Maria	5.6	3.60	13.6	24.4
F_1 Fenda	5.5	3.55	13.2	29.1
F_1 Buran	5.4	3.44	14.1	33.8

CONCLUSION

Greenhouse tomatoes are highly valued vegetable crop in Uzbekistan. In winter-spring growing season tomatoes can be grown without supplemental lighting, moreover relatively mild winter conditions gives opportunity to reduce costs for greenhouse heating when used modern greenhouse construction and high-yielding varieties. Our research results showed that double layered plastic greenhouses can be more energy efficient in comparison with single layered greenhouses. In this context double layered plastic greenhouses can be a good option for greenhouse farmers to increase profit from vegetable production by decreasing heating costs.

In 2010 in the experimental station of Research Institute of Vegetable Melon Crops and Potato double-layered plastic greenhouses were constructed in cooperation with South Korea project. Research experiences on cultures cucumbers, tomatoes, strawberries, investigations have been started on energy saving abilities of these greenhouses in comparison with conventional single layered greenhouses in Tashkent region climatic conditions. In our trials seven tomato varieties were studied in double-layered plastic greenhouses. The highest yield was obtained from F_1 Buran, F_1 Saykhun and F_1 Bahor with standard variety F_1 Belle. However further investigation will be needed to evaluate the resistance to common pests and diseases and fruit quality of these varieties.

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