

Materials of Conferences

EFFICIENCY OF SMALL-VOLUME TECHNOLOGY OF CULTIVATION OF TOMATOES IN THE GREENHOUSE OF THE PREARAL AREA (KAZAKHSTAN)

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This article is devoted to research of efficiency of cultivation of various hybrids of tomatoes by a method of a small-volume hydroponics in the greenhouse in the conditions of the PreAral area of Kazakhstan.

Relevance of the research. Currently the key problem of saturation of the domestic market of Kazakhstan for fruits and vegetables is associated with a pronounced seasonal nature of vegetables and fruits.

However, if we compare Kazakhstan with countries that have similar climatic conditions, the availability of greenhouse area per an inhabitant in the country is several times lower than the world average and is only 0,1 % of the total vegetable production.

The situation is compounded by a lack of existing facilities of closed ground and their technological backwardness. Deficit areas of protected ground in different parts of Kazakhstan range from 4 to 35 ha, in the PreAral area – 5 hectares [1].

As a result, there is a seasonal lack of fresh vegetables in the country every year; therefore, the prices are increasing in the offseason.

Solving the problem of providing the population with vegetables throughout the year cannot be done without the intensification of the horticulture industry of protected ground which main and decisive factor is the development and implementation of scientific and technological progress.

A world trend in greenhouse production development is almost universal shift to intensive tech-

nologies and methods for growing plants in protected ground.

To date, these requirements are satisfied by small-volume system technology – growing plants on soil substrate using a drip irrigation system [2].

Insufficient level of development and the relevance of many of the issues of improving the efficiency of production of a protected ground, including the question of selection of new indeterminate tomato hybrids with generative type of development and the development of high-quality technology elements determined the direction of research.

Purpose and objectives of the research The aim of research was to conduct variety trials of indeterminate tomato hybrids such as small volume elements and rationale of their cultivation techniques adapted to the climatic conditions of the PreAral region.

Objectives and methods of research The object of the study is a full low-volume process of growing vegetables, tomato hybrids.

The studies included the consistent implementation of laboratory semi-industrial and industrial experiments using conventional methods in vegetable protected ground.

The scheme based on the method of split plots with randomized placement of options within each block was chosen for the experiment.

Because now all the production of vegetable crops in the greenhouses of Kazakhstan is based on the cultivation of hybrids of foreign selection, so 7 indeterminate tomato hybrids were chosen for this study: three Israeli selections – Sharlotta F1, Garem F1, Franchesca F1 and four selections – Dutch – Sample F1, Lilos F1, Favorita F1, Grace F1.

Cultures were grown in the extended circulation (Fig. 1) on a substrate of sawdust.

For mineral nutrition of plants the nutrient mixture, fully balanced in all macro- and micronutrients was used (Table 1) [4].

Month	YII			YIII			IX			X			XI			XII			I			II			III			IV			V			VI		
Decade	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
		-	-	-	-	-	-	-	-																											

- - period of cultivation of seedling - vegetation period ■ - fruiting season

Fig. 1. Extension of the cultivation of tomatoes in a greenhouse

Table 1

Composition of nutrient mixtures for growing tomatoes, ppm

N	P	K	Ca	Mg	Mn	Fe	Cu	B	Zn	Mo
200	55	300	200	55	0,5	3,0	0,12	0,09	0,2	0,12

Watering and feeding of tomato plants was carried out by drip method. Plants were watered every hour from 7.00 a.m to 17.00 p.m. so that a certain percentage of the nutrient solution was withdrawn from the substrate through the drain with every watering (total drainage per day – 30%).

Power level was maintained depending on the phase of plant development from 0,5 to 3,0 Ms/cm, a pH of the nutrient solution was 5,5 – 6,5.

During the growing season the following stages were performed:

- phenological observations of plant growth and development,
- control of greenhouse microclimate parameters,
- monitoring of phytosanitary condition of landings and preventive measures,
- measures to build the plant, – measurement of the volume and concentration of the nutrient solution and drainage (daily),
- yielding and accounting.

The disperse analysis of variance results for their yield results was performed to test the statistical null hypothesis H_0 that there are significant differences in the productivity of the studied hybrids and validation [3].

Results of research. Research has shown that the use of small-volume technology of growing indeterminate tomato hybrids in greenhouses adapted

- amount of fetus
- average weight of 1 fetus
- yield

to the climatic conditions of the PreAral region allows to obtain a high yield of quality products. The investigated hybrids of tomato were significantly different in terms of yield from each other.

Under the experimental conditions in terms of yield the tomato hybrids were located in the following descending order: Franchesca F1> Lilos F1> Grace F1> Gare F1> Sample F1> Favorita F1> Sharlotta F 1.

The highest yield was demonstrated by a hybrid Franchesca F1 11,2 kg /plant. Enough fruitful hybrids were Lilos F1, Grace F1, Gare F1. The lowest yields compared with other studied hybrids were shown by Sharlotta F1 hybrids, Sample F1 and Favorita F1.

Such parameters as the number of mature fruit, the average weight of one fetus and uniform crop returns during the period of cultivation influence on tomato yield (Table 2, Fig. 2).

Since the highest yield of Franchesca F1 hybrid is explained by the fact that during the vegetation period of the plants at a hybrid the largest amount of 112 fruits was formed, though fruit weight was even lower than that of other hybrids – 100.0 g.

Sufficiently high yield of Lilos F1 and Grace F1 hybrids was identified contrary not by amount of fruits and a high average of one fetus weight. The same dependence of yield had the rest of hybrids:

Gare F1 = Favorita F1 = Sharlotta F 1;
Grace F1 = Sample F1
Gare F1 > Favorita F1 > Sharlotta F 1;
Grace F1 > Sample F1
Gare F1 > Favorita F1 > Sharlotta F 1;
Grace F1 > Sample F1

Table 2

Yields of hybrid tomatoes grown by small-volume hydroponics

Hybrid	Number of fetus of 1 plant, pieces	Average mass of 1 fetus, g	Yield of 1 plant, kg
Sharlotta F 1	86	91,0	7,8
Gare F1	88	106,5	9,4
Franchesca F1	112	100,0	11,2
Sample F1	73	124,6	9,1
Lilos F1	80	126,2	10,1
Favorita F1	85	113,3	8,5
Grace F1	75	129,3	9,7
LED ₀₅ = 0,37			

An important role in obtaining high yields of vegetables under growing in the greenhouse has such a record as the uniformity of the crop. Dynamics yields results shown in Fig. 2 demonstrate that during the rearing period was uneven efficiency and yield was cyclical.

This is due primarily to the fact that the middle period of growing tomatoes in extended trade turnover is in the winter months, at a time when the main limiting factor is light.

The lowest yield of all hybrids was observed in February and March, as the flowering and the maturing of fruit was in the shortest day of the light period (December-January) and cloudy weather.

Most crop output was observed in all hybrids between April and June, because during this period the light factor ceased to be a limiting factor.

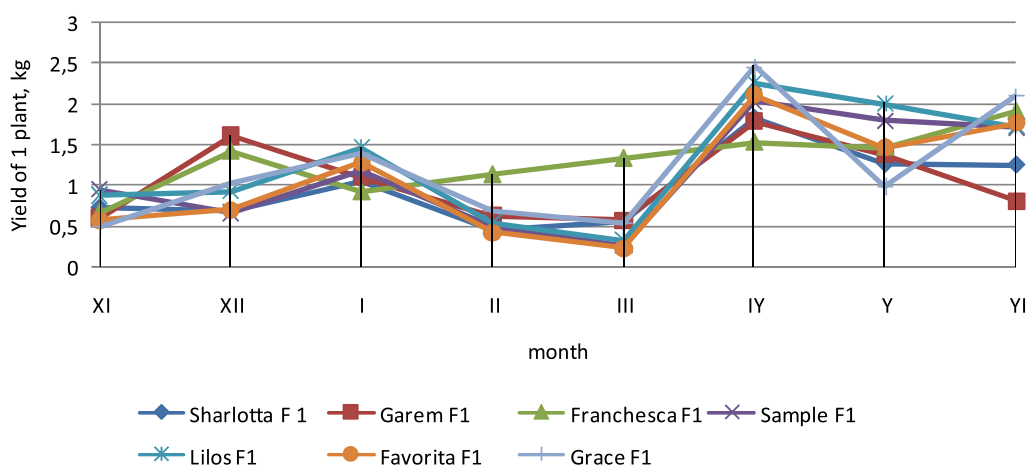


Fig. 2. Dynamics of the yield of tomatoes in the extended rotation, kg /1 plant

Table 3

Cost-effectiveness of small-volume method of growing tomatoes hydroponically on the substrate of sawdust

Index	Hybrids						
	Sharlotta F1	Gareem F1	Franchesca F1	Sample F1	Lilos F1	Favorita F1	Grace F1
Yield net, kg/1 plant	7,8	9,4	11,2	9,1	10,1	8,5	9,4
Cost, \$ USA/ kg	1,08	0,98	0,66	1,10	0,84	1,16	0,98
Cost, \$ USA/ 1 plant	8,42	9,21	7,39	10,01	8,48	9,86	9,21
Price, \$ USA /kg	1,59	1,59	1,59	1,59	1,59	1,59	1,59
Total sum of sell, \$ USA	12,40	14,95	17,81	14,45	16,06	13,51	14,95
Profit, \$ USA	3,98	5,74	9,88	4,49	7,58	3,65	5,74
Profitability, %	47,3	62,3	124,6	44,3	89,4	37,0	62,3

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Uniform crop out within the growing season was demonstrated by hybrid Franchesca F1 that explains its high yield compared to other hybrids.

Indicators of economic efficiency of small-volume method of growing tomatoes hydroponically on substrates of sawdust demonstrate that the intensification of production of tomatoes in the greenhouse through the introduction of small-volume technology of cultivation of high-yielding hybrids significantly increases the profitability of industry and guarantees getting profit.

Conclusion

A fundamental factor in increasing the efficiency of tomatoes production in greenhouses is the use of small-volume hydroponics technology adapted to the conditions of a particular region and enterprises, as well as to the requirements of a particular genotype varieties (hybrid).

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