

TECHNOLOGICAL FEATURES OF CULTIVATING INDETERMINATE TOMATO HYBRIDS DEVELOPED UNDER LOCAL CONDITIONS IN THE ANDIJAN REGION DURING THE SUMMER-AUTUMN SEASON

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Abstract. The article describes the most effective technologies for growing indeterminate tomato hybrids in greenhouses, created in local conditions by the private enterprise "GREEN VALLEY SEEDS". The results of phenological observation of tomato hybrids planted in greenhouses during the summer-autumn season in the experiments during 2022-2024 are presented in Table 1.

It was observed that when the seedling density of tomato hybrids planted in the greenhouse was 2.8-3.2 seedlings per 1 m², the yield increased significantly (0.8-1.1 kg-m²) compared to the standard (2.5 seedlings per 1 m²).

In addition, the experiment studied the effect of shaping tomato seedlings in different ways on yield. According to the results of the experiments, when 25% of the seedlings were left with additional shoots, the yield increased significantly compared to the one grown as a single-stem variety without side shoots. It was found that the yield of the Tong F₁ hybrid was 5.3 kg/m² without side shoots, 6.2 kg/m² when 20% of the seedlings were left with side shoots, and 6.5 kg/m² when 25% of the seedlings were left with side shoots, which is 1 kg/m² more than the standard. As a result of the experiments, the most effective variant of the standardization method of yield crowns was found to be the standardization method of 5 crowns. When using this method, it was found that the yield of the Tong F₁ hybrid increased by 1.6 kg/m² compared to the standard variant.

Keywords: Indeterminate tomato hybrids, greenhouse cultivation technology, planting density, plant training methods, fruit load regulation, yield standardization, phenological observation, biometric indicators, summer–autumn season, drip irrigation system, local hybrid development, yield productivity.

Introduction. Tomato is one of the main crops cultivated in greenhouses. In terms of cultivation area and total yield, it ranks second after cucumber. Due to the high content of valuable nutrients in tomato fruits, consumer demand for this crop is steadily increasing.

To obtain consistently high yields of tomatoes in greenhouse conditions, it is necessary to select varieties and hybrids that meet consumer requirements and to develop appropriate cultivation technologies for these hybrids. In recent years, farmers have shown increasing interest in generative-type indeterminate hybrids for greenhouse production. To achieve high yields from these hybrids, it is essential to select an appropriate planting scheme based on their biological characteristics, properly train the plants, and regulate fruit load.

The purpose of the study. To study the varietal characteristics of newly created indeterminate tomato hybrids in the conditions of the Andijan region and to develop the most optimal technologies for their cultivation in the summer-autumn seasons.

Objectives of the study:

- To evaluate the growth, development, and economically valuable traits of new tomato hybrids during the summer–autumn period.

- To investigate the effect of seedling density and plant training methods on yield.

To determine the effect of fruit load regulation on the fruiting process of tomatoes.

The novelty of the study. For the first time, the most effective methods for cultivating indeterminate tomato hybrids developed under local conditions were established in the greenhouses of “GREEN VALLEY SEEDS”, a private enterprise specializing in seed production in the Andijan region.

Location and conditions of the study. The study was conducted in the greenhouses of the private enterprise “GREEN VALLEY SEEDS”, which specializes in seed production, located in the Altinkul district of Andijan region during 2022–2024. The greenhouse is of block-type construction, with each block divided into four sections. Each section measures 7 m in width and 35 m in length. The greenhouse has an arched roof, and the total construction area is 980 m². Irrigation was performed using drip irrigation equipment supplied by the company “EKO DRIP LYX”.

Research object. The study focused on the indeterminate tomato hybrids Nafis F1 and Tong F1, developed under local conditions by the private enterprise “GREEN VALLEY SEEDS”, and the foreign Alamina F1 hybrid from ENZA ZADEN, used as a reference.

Phenological observations, biometric measurements, and assessments of yield and marketable quality were conducted in accordance with generally accepted standards. Phenological observations included the date of seed sowing, seedling emergence, appearance of the first true leaf, date of pricking out, transplanting to the permanent location, formation of the first flowers, number of leaves between fruiting shoots, and the initial and final harvest dates. The initial stage of each phase was recorded when 10% of the seedlings in the experiment reached that phase, and the full stage was recorded when 75% of the seedlings exhibited it. In addition, biometric measurements were taken, including seedling quality indicators, the number of flowers per plant, and the number of flowers that set fruit.

Table 1

Phenological observations of the experimental hybrids during the summer–autumn seasons (2022–2024)

Hybrids	Growth and development stages								Harvest period days
	Germination day		3rd leaf	Flowering period		Formation of the first fruits	First harvest	Last harvest	
	10%	75%		10%	75%				
Alamina F ₁ st	4	7	18	65	72	75	107	197	90
Nafis F ₁	3	5	15	60	63	67	100	190	90

Tong F ₁	3	5	17	62	66	68	102	192	90
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The difference between 10 and 75% germination of hybrid seeds in the experiment was 2-3 days between hybrids. Seeds of Nafis F₁ and TongF₁ hybrids fully germinated 2 days earlier than the standard Alamina F₁ hybrid. When the 3rd leaf development phase was observed in seedlings, the indicators for this phase were 18 days for the standard Alamina F₁ hybrid, 15 days for the Nafis F₁ hybrid, and 17 days for the Tong F₁ hybrid.

The period from germination to full flowering was recorded as 72 days for the standard Alamina F₁ hybrid, 63 days for the Nafis F₁ hybrid, and 62 days for the Tong F₁ hybrid. The first fruits were formed on the 75th day after full germination for the Alamina F₁ hybrid, 67 days for the Nafis F₁ hybrid, and 68 days for the Tong F₁ hybrid. The first harvest of ripe fruits was carried out on the 107th day after full germination of the seedlings in the standard Alamina F₁ hybrid, 100th day in the Nafis F₁ hybrid, and 102nd day in the Tong F₁ hybrid. The period from full germination of the seedlings to the last harvest was 197 days in the Alamina F₁ hybrid, 190 days in the Nafis F₁ hybrid, and 192 days in the Tong F₁ hybrid. The total yield period in the Bacha hybrids was 90 days. In all the above-mentioned indicators, the Nafis F₁ and Tong F₁ hybrids created in local conditions showed better results than the standard Alamina F₁ hybrid.

The light level in the greenhouse was measured at the initial crown of the stem, the crown of the middle part of the stem, and the crown of the tip of the stem (1.5-1.8 m). A YU-116 luxmeter was used to measure the light level.

Table 2

**Effect of seedling thickness on yield in experimental hybrids
(Average for 2022-2024) kg/m²**

Hybrid yield	Seedling density (pcs per 1m ²)				Average kg/m ² by hybrid NSR0.5=0.5
	2.2	2.5 st	2.8	3.2	
Alamina F ₁ (st)	3.7	5.4	5.5	5.7	5.07
Nafis F ₁	3.6	5.5	6.3	6.5	5.45
Tong F ₁	3.9	4.9	6.5	6.7	5.5
Average NSR0.5=0.2 by seedling thickness	3.7	5.2	6.0	6.3	

According to the results of experiments conducted during 2022-2024, it was observed that when the seedling density was 2.8-3.2 seedlings per 1 m² of area, the yield of the experimental hybrids increased significantly (0.8-1.1 kg-m²) compared to the standard (2.5 seedlings per 1 m²). The highest inter-hybrid indicator was recorded in the Tong F1 hybrid (6.7 kg/m²) at a seedling density of 3.2 seedlings per 1 m². In the Nafis F1 hybrid, this indicator was 6.5 kg/m² and in the standard Alamina F1 hybrid, it was 5.7 kg/m².

According to the results of the experiments, when 25% of the seedlings were left with additional crowns, the yield increased significantly compared to the one-stemmed variety without lateral crowns. In the Andozha Alamina F1 hybrid, when the plants were grown in a single-stemmed variety without lateral crowns, the yield was 5.1 kg/m², and when 20% of the seedlings were left with lateral crowns, the yield was 5.1 kg/m².

The yield was 5.3 kg/m² in the case of 25% of the seedlings left with side shoots, and 5.5 kg/m² in the case of 25% of the seedlings left with side shoots.

Table 3

The effect of different methods of shaping hybrids on yield (2022-2024) kg/m²

How to shape seedlings	Hybrids F1			Average by shaping method NSR0.5=0.2
	Alamina st.	Elegant	Dawn	
Single stem without side branches (size)	5.1	5.2	5.3	5.2
20% of the cots have an extra king left.	5.3	5.4	6.2	5.6
25% of seedlings have an extra king left	5.5	5.7	6.5	5.9
Average NSR0.5=0.1 for each hybrid	5.3	5.4	5.9	5.5

The yield of the Nafis F1 hybrid was 5.2 kg/m² without side shoots, 5.4 kg/m² with side shoots left in 20% of the seedlings, and 5.7 kg/m² with side shoots left in 25% of the seedlings. The yield of the Tong F1 hybrid was 5.3 kg/m² without side shoots, 6.2 kg/m² with side shoots left in 20% of the seedlings, and 6.5 kg/m² with side shoots left in 25% of the seedlings, which was 1 kg/m² higher than the standard.

As a result of the experiments, the most effective variant of the yield standardization method was found to be the 5-crop standardization method (Table 5). When using this method, it was found that the yield of the TongF1 hybrid increased by 1.6 kg/m² compared to the standard variant.

It was found that by applying the tomato crop crown standardization measure in the summer-autumn season, the yield increased by 0.4 kg/m² in the variant with 5 fruits left in the 1st crown, 0.7 kg/m² in the variant with 5 fruits left in the 1st-2nd crowns, and 1.6 kg/m² in the variant with 6 fruits left in the additional 3rd-5th crowns, compared to the standard variant.

Table 4

Standardization of harvest kings	Hybrids			Average yield by standardization in different ways NSR0.5=0.2
	Alamina F1 st kg/m ²	Nafis F1 kg/m ²	Tong F1 kg/m ²	
Harvest kings are not standardized	5.2	4.9	5.3	5.1
5 fruits in the 1st harvest	5.5	5.3	5.7	5.5
5 fruits left in the 1st harvester, 5 fruits left in the 2nd harvester	5.6	5.6	6.2	5.8
5 fruits were left in 1-2 harvests, 6 fruits in 3-5 harvests.	5.8	6.2	6.9	6.3
Average NSR for hybrids 0.5=0.1	5.5	5.4	6.0	

The impact of standardization of tomato hybrids on yield (2022-2024) kg/m²

CONCLUSIONS

According to the results of experiments and observations conducted during 2022–2024, the Nafis F1 hybrid was identified as the earliest-ripening among the tested hybrids. In the summer–autumn season, the duration from complete seedling emergence to fruit ripening on the first harvest shoot was 100 days for the Nafis F1 hybrid. For the Tong F1 hybrid, this period was 102 days, and for the standard Alamina F1 hybrid, it was 107 days.

The results of the observations showed that the optimal seedling density for growing indeterminate tomato hybrids in the summer-autumn season is 2.8-3.2 plants/m². The highest inter-hybrid indicator was recorded in the Tong F1 hybrid with a seedling density of 3.2 plants/m².

Indeterminate tomato hybrids grown in the summer-autumn season, it was observed that by leaving lateral shoots on 20-25% of the seedlings, the yield increased significantly. In the variant where additional lateral shoots were left on 25% of the seedlings, the yield of the Tong F1 hybrid increased by 1 kg/m² compared to the plants grown as single-stemmed plants.

By normalizing the initial fruiting stems of indeterminate tomato hybrids grown in the summer-autumn season, full fruiting of flowers on subsequent fruiting stems was achieved, and this significantly increased the overall yield. In the variant with 6 fruits left on 3-5 fruiting stems, the yield was 1.6 kg/m² higher than the standard variant.

PRODUCTION RECOMMENDATIONS

1. Indeterminate tomato hybrids “Nafis” F1 and Tong F1 are recommended for cultivation in greenhouses in the summer-autumn season.
2. For growing indeterminate tomato hybrids Nafis F1 and Tong F1 in the summer-autumn season, it is recommended to use a planting scheme of 90x70x40, with 3.2 seedlings per 1 m² of area.
3. When growing hybrids in the summer-autumn season, it is recommended to standardize the fruiting heads by leaving 5 fruits on the first 2 fruiting heads and 6 fruits on the subsequent fruiting heads to ensure full fruiting of the flowers on the fruiting heads at the top of the plant and to increase overall yield.

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