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FIRST-GENERATION F1 HYBRID TOMATO VARIETIES FOR OPEN FIELD CULTIVATION IN SOUTHERN UZBEKISTAN, RESISTANT TO ROOT-KNOT NEMATODES, AND SUITABLE FOR EXPORT

P.N. Khojayev* – PhD student

*Tashkent State Agrarian University

J.N. Nadjiev* – DSc (Agricultural Sciences)

*Termez State University of Engineering and Agrotechnologies

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Abstract

The article presents the results of the study of new F1 hybrids of tomatoes selected by the Surkhandarya Research and Experimental Station in 2020-2021, high-yielding, transportable and resistant to root-knot nematode, as a result, F1Namuna x L-46 hybrids with high total yield and F1Dystlik x L-46 hybrids with the highest heterosis effect in total and early yield were isolated.

In addition, the hybrids F1 On the Moon Shackle, F1 Namuna x L-59 and F1Dystlik x L-46 are considered resistant to the root-knot nematode.

INTRODUCTION

Vegetable production is currently the fastest-growing sector. Globally, vegetable production has reached 50-60 million tons annually in recent years. Tomatoes are among the most valuable vegetables.

Tomatoes contain 4.5-8.1% dry matter, 3.5-8.5% organic acids, 0.13-0.23% pectin, 3-7% sugars, as well as mineral salts and vitamins C, B, and PP. Tomatoes are not only sweet and tasty but also possess several beneficial and medicinal properties. They contain a large amount of various vitamins, including B1, B2, B3, B6, B9, and E, with vitamin E being the most abundant. Tomatoes not only positively affect the human body but also improve mood. They contain tyramine, an organic compound that converts to serotonin in the body. Therefore, they help improve mood and combat depression and sadness. Based on this, increasing the yield and quality of this crop and creating varieties and hybrids resistant to biotic and abiotic factors is a pressing task. The only way to achieve this is through breeding.

World breeders emphasize that resistance to a single disease does not guarantee consistently high yields. Therefore, it is necessary to combine resistance to major diseases in one genotype and create varieties with complex resistance

Consequently, research on creating tomato varieties and hybrids resistant to root-knot nematodes and cladosporium has been conducted at the Surkhandarya Scientific Experimental Station since 1990.

In 2020-2021, four hybrids—F1H/03 x Zak/06, F1H/03 x MJ-46, F1H/03 x MJ-59/14, and F1Dk/04 x MJ-46/14—were studied in a nursery for early maturity and root-knot nematode resistance, comparing them to the parent lines and the control variety Surkhan 142.

MATERIALS AND METHODS

The experiment was conducted in accordance with the "Methodological Guidelines for the Study and Maintenance of the World Collection of Vegetable Solanaceous Crops (tomatoes, peppers, eggplants)" (L., 1977), "Methodological Guidelines for the Breeding of Tomato Varieties and Hybrids for Open and Protected Ground" (M., 1986), and OST 4671-78 (Stage II).

The experiment was non-repeatable. The plot area was 6.3 m^2, with 20 plants in 2 rows. Planting scheme: 210:2 x 30 cm.

Seeds were sown under film cover in the first ten days of February. Seedlings were transplanted to the open field in the first ten days of April.

During the growing season, phenological observations (sowing date, germination (10%, 75%), transplanting date, flowering (10%, 75%), appearance of the first flower clusters, fruit ripening (10%, 75%)) and morphobiological descriptions (leaf size, plant type, leaf and fruit color, plant height, fruit shape, etc.) were conducted, along with yield assessment.

The earliness of the hybrids was determined by calculating the yield of the first three harvests.

The level of resistance to root-knot nematodes was assessed at the end of the growing season by excavating the root system and evaluating it according to the method of Kondakova, Kvasnikov, and Ignatova (1976).

Heterosis effect in hybrids was determined using the formula proposed by Alpatev (1981).

Mathematical data processing was performed according to the method of Dospekhov (1985).

In 2020, the growing season of tomato plants was observed to be 5-10 days longer compared to previous years. This can be explained by the fact that the growing season of the early-maturing Dostlik variety lasted 113 days.

Table 1. Agronomic and morphobiological characteristics of first-generation (F1) tomato hybrids, 2020-2021.

Hybrid and parental lines:	Duration of action, days	Plant		Fruit			
		type	height, sm.	shape	color	weight, g.	hardness, score
Surkhan-142, .k.n.	117	standard.	95	round.	red	125	2,5
L-Namuna	122	standard.	75	round.	red	130	2,5
Zakovat	121	standard.	75	round.	red	90	4,5
D'ostlik	113	standard.	50	round.	red	95	2,5
L-46	122	standard.	65	round.	red	135	4,5
L-59	119	standard.	80	round.	red	130	4,5
G'1Namuna x Zakovat	123	standard.	70	round.	red	120	4,5
G'1Namuna x L-46	116	standard.	120	round.	red	135	4,0
G'1Namuna x L-59	121	standard.	110	round.	red	110	4,0
G'1D'ostlik x L-46	113	standard.	110	round.	red	110	4,0

The shortest growing season among the studied hybrids was observed in the F1 Dostlik x L-46 combination, lasting 113 days, equal to the growing season of the early-maturing parent Dostlik variety; therefore, this hybrid is considered early-maturing (Table 1).

Plant height in the F1 Namuna x L-46, F1 Namuna x L-59, and F1 Dostlik x L-46 hybrids ranged from 110-120 cm, classifying them as tall hybrids.

The fruit shape in all hybrids was round, and the color was red. This indicates the dominance of these traits in the first generation.

Fruit weight was high in all hybrids, ranging from 110-135 g.

The firmness trait confirmed its dominance and was expressed in all first-generation hybrids, reaching 4.0-4.5 points.

As shown in Table 2, the highest yield was observed in the F1 Namuna x L-46 hybrid, reaching 55.5 t/ha, which is 28.0 t/ha higher than the control variety. The other hybrids also showed high yields, ranging from 50.0-54.5 t/ha, exceeding the control variety by 23.1-27.0 t/ha.

Table 2. Total and early yield and heterosis effect of tomato F1 hybrids, 2020-2021.

Hybrid and parent forms	Total yield, t/ha	Heterosis effect, %	Marketable yield, %	Early yield, t/ha	Heterosis effect, %
Surkhandarya-142 (Control)	35,4		85,6	22,3	
L-Namuna (Parent)	38,6		87,0	20,8	
Zakovate (Parent)	30,8		92,5	10,5	
Dostlik (Parent)	21,4		74,0	12,3	
L-46 (Parent)	32,0		90,5	15,7	
L-59 (Parent)	38,5		94,6	19,2	
F1 Namuna x Zakovate (Hybrid)	54,4	41,0	94,5	22,5	8,2
F1 Namuna x L-46 (Hybrid)	55,5	43,8	94.0	26,3	26,4
F1 Namuna x L-59 (Hybrid)	50,6	31,1	93,3	20,6	-
F1 Dostlik x L-46 (Hybrid)	54,5	70,3	96,0	32,6	107,6

The marketable yield in all hybrids was 6.0-8.7% higher than the control variety, reaching 93.3-96.0%. The marketable yield of the control variety was 87.3%. This characteristic allows these hybrids to be stored longer in the field.

The highest heterosis effect was observed in the F1 Dostlik x L-46 hybrid, reaching 70.3%. The other hybrids, F1 Namuna x Zakovate, F1 Namuna x L-46, and F1 Namuna x L-59, also exhibited heterosis, ranging from 31.1-43.8%; all studied hybrids exhibited heterosis.

The highest early yield among the first-generation hybrids was observed in the F1 Dostlik x L-46 combination, reaching 32.6 t/ha. The heterosis effect in terms of early yield was also highest in the F1 Dostlik x L-46 combination, reaching 107.6%. A lower but still significant heterosis effect in terms of early yield was also observed in the F1 Namuna x L-46 hybrid, reaching 26.4%.

At the end of the growing season, the roots of the hybrids were examined to assess their resistance to root-knot nematodes. As a result, 100% of the plants in the F1 Namuna x Zakovate, F1 Namuna x L-59, and F1 Dostlik x L-46 hybrids showed high resistance; these hybrids are considered resistant to root-knot nematodes (Table 3). In the F1 Example x L-46 hybrid, 83.3% of the plants showed resistance to root-knot nematodes, with disease development at 6.25%, spread at 15.0%, and a resistance index of 93.7%; this hybrid is considered practically resistant.

Table 3. Root-knot nematode damage (in points) in tomato F1 hybrids, 2020-2021.

Hybrid and parent forms	Number of plants	Points					Average damage, points (or score)	C, %	R, %
		0	1	2	3	4			
Surkhandarya-142 (control variety)	20	85,0	5,0	5,0	5,0	0	0,3	7,5	15,0
L-Namuna (parent variety)	20	100	0	0	0	0	0	0	0
Zakovate (parent variety)	20	80	20,0	0	0	0	0,2	5,0	20
Dostlik (parent variety)	20	0	0	0	15	85	3,85	96,2	100
L-46 (parent variety)	20	95,0	0	5,0	0	0	0.1	2,5	5,0

L-59 (parent variety)	20	100	0	0	0	0	0	0	0
F1 Namuna x Zakovate (hybrid)	20	100	0	0	0	0	0	0	0
F1 Namuna x L-46 (hybrid)	18	83,3	5,5	11,1	0	0	0,3	6.25	15,0
F1 Namuna x L-59 (hybrid)	12	100	0	0	0	0	0	0	0
F1 Dostlik x L-46 (hybrid)	20	100	0	0	0	0	0	0	0

Thus, among the studied hybrids, the F1 Namuna x L-46 hybrid was distinguished by its highest total yield. The F1 Dostlik x L-46 hybrid exhibited the highest total and early yield and heterosis effect. The F1 Namuna x Zakovate, F1 Namuna x L-59, and F1 Dostlik x L-46 hybrids were distinguished by their resistance to root-knot nematodes.

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