



## **Promising First-Generation Hybrids Of Tomato Similar To Stamps**

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**Introduction.** Sudden changes in the weather in recent years: a sharp increase in air temperature, a sharp decrease in relative humidity, and a wide spread of diseases and pests made it an important task to create tomato varieties and hybrids resistant to the stress factors of nature. Scientific research work was carried out in our country and abroad on the creation of stem-like varieties of tomatoes, and such varieties were created and introduced into production. In foreign countries, E.P. Venkadeswaran [2018], K. Okano [2000], E. Friedman [2002], G.E. Hobson [1989], A.P. Simonov [1975], Academician A.V. Alpatev [1981], Yu.I. Avdeev [1982] I.Yu. Kondrateva [2010], [Russian Federation], A.S. Medvedeva [1964], V.A. Kravchenko, A.V. Kuzemsky, V.V. Eremenko [1999] [Ukraine] and others conducted research in this direction, and stem varieties were created.

Although special researches on the creation of stem varieties have not been conducted in our republic, M.Kh.Aramov [1994], J.N.Nadjiev [2018], N.J.Nurmatov [2020] paid special attention to stem varieties in their work, the initial source was allocated, promising series and varieties were created and included in the State Register.

According to most scientists, the type of plant, its shape is one of the important signs that determine the practical use of the variety. Therefore, the deterministic feature is widely used in the practical selection of tomatoes, and 90-95% of the tomato varieties grown in open fields have the deterministic type. Determinant varieties are short and medium-sized, which allows full mechanization of their cultivation. In addition, in recent years, more and more hybrid varieties and hybrids have been created, and there is a reason for this. Varieties belonging to the cylindrical type have several advantages over the varieties that belong to the simple type.

The hump and upright stem allow for inter-row processing throughout the entire operating period. It is possible to harvest the fruits of such varieties partially or completely with the help of mechanization. Their fruit almost does not touch the soil, and this allows them to be less diseased and less damaged by pests. It is possible to grow a seedling of stocky varieties a little thicker. In this case, they will not grow and it will be better if they catch when transplanted to the field. Such seedlings are more resistant to the effects of wind and heavy rain. Stem varieties are usually heavily leafed. They are large and medium in size, the band is very short, the color is dark green, and the top is very rough. Fruits are different colors and shapes. When transplanted in the field, the seedlings of stem-like varieties take root quickly, it allows to keep the turgor state in the plant for a long time and ensures that the seedlings take hold even in

conditions of low water and humidity. Due to the size of the leaves of the stem-like plants, their strong curvature and their location on the plant, they are resistant to unfavorable conditions of the external environment, are less damaged by the sun's rays, and their fruits are not damaged by the sun, and they keep their quality well.

Stemness, like determinism, is a specific type of plant - a new life form, which was formed against the background of morphobiological changes based on genetic (mutational) changes in the genome [Ignatova S.I., Zagidulina N.F. 57; 21-22 p. ], [Simoenov A.A. 102; p. 62-64. ], [Guseva L.I. 44; p. 224 ], [Boos G.V., Badina G.V., Burenin V.I. 31; p. 223 ], [Alpatev A.V. 21; p. 302], Kuzemensky [75; 105-115-b]; [Kondrateva I.Yu. 66; p. 268 ], Avdeev Yu.I. 19; 165-176-b] [Ognev V.V., 90; 9-11 p]. [Kravchenko V.A., Kuzemensky A.V., Eremenko V.V. 73; pp. 240-242]. [Makovei M.D., Kravchenko A.N. 85; pp. 202-204]. [Xikhlyukha E.A. 110; pp. 338-341], [Khrapalova I.A. 111; pp. 470-473].

Kondrateva [66; 268-b], in modern breeding, along with important economic traits, great attention is paid to environmental resistance of varieties, i.e. adaptability. Weather conditions in the central and northern regions of the Russian Federation are very unfavorable, even extreme, for growing tomatoes, forcing breeding scientists to create varieties that can produce good and high-quality crops every year. This showed that great attention should be paid to the selection of varieties with stem type, which is not characteristic of wild forms.

The sign of stomatism is closely related to a number of useful physiological and morphological characteristics. Stem varieties are usually distinguished by high resistance to heat and drought [Avdeev A.Yu. 134; 23-p., Avdeev A.Yu 17; p. 210, Kondrateva I.Yu. 66; p. 268]. Kuzemensky [76; 390-b], in the opinion of man, in the improvement of tomato cultivation, determining the deterministic sign and connecting it with the effect of the stem-like sign made it possible to create a completely new plant form.

**Object and method of research.** In 2020-2021, the study of hybrids in the nursery has different morphobiological characteristics: the plant is stem-like, and the shape of the fruit is round, flat-round, oval, the fruits are soft and portable; 10 hybrids of varieties and lines: F1 Dostlik x Marjona, F1 Dostlik x L-31, F1 Sevara x Taramata, F1 Surkhan 142 x Sevara, F1 Surkhan 142 x L-31, F1 Surkhan 142 x Taramata, F1 Volgogradsky 5/ 95 x Marjona, F1 Sevara x Volgogradsky 5/95, F1 Surkhan 142 x Marjona, F1 Surkhan 142 x Chelnok first generation (F1) hybrids were studied. Hybrids were studied in comparison with parental forms.

Studies " Guidelines for Researching and Maintaining the World Nightshade Vegetable Collection (tomato, pertsy, eggplant)". [9; 23-b], " Guidelines for breeding varieties and hybrids of tomato for open and protected ground ". [10; 52-b] and carried out in accordance with OST 4671-78 (Phase II).

Experience is non-refundable. The plot area is 4.5 m<sup>2</sup>, the number of plants is 20, the plot is 2 rows. Planting scheme 90x25 cm.

The experiment was conducted in two periods. In the first term, seeds were sown on January 10 and seedlings were transplanted under film covers on March 20. In the second period, the seeds were sown on February 12 and the seedlings were transplanted into the open field on April 10. During operation, phenological observations (the day of sowing seeds, their germination (10%, 75%), the day of planting in the field, flowering (10%, 75%), the emergence of the first flower buds on the plant, ripening of fruits (10%, 75%) and morphobiological characterization, determination of productivity was carried out.

Heterosis efficiency of hybrids A.V. Alpatev [21; 302-b] was determined using the proposed formula.

$$X = (F1 : P_{max}) \times 100$$

Here: X – heterosis efficiency, %

F1 – hybrid index;

P<sub>max</sub> is the best parent component indicator.

According to this formula, the effect of heterosis was determined by the hybrid being higher than the known indicator of the best parent.

Mathematical processing of the obtained data Dospekhov [7; 350-b] was carried out based on the method of field experiments.

**Research results.** The trait of stomatism is recessive and does not appear in the first generation. Therefore, 10 hybrids of the first generation obtained by cross-breeding only stem-like forms, i.e. cross-breeding in the stem x stem scheme, were comprehensively evaluated in 2020-2021 in order to show stemness in the first generation.

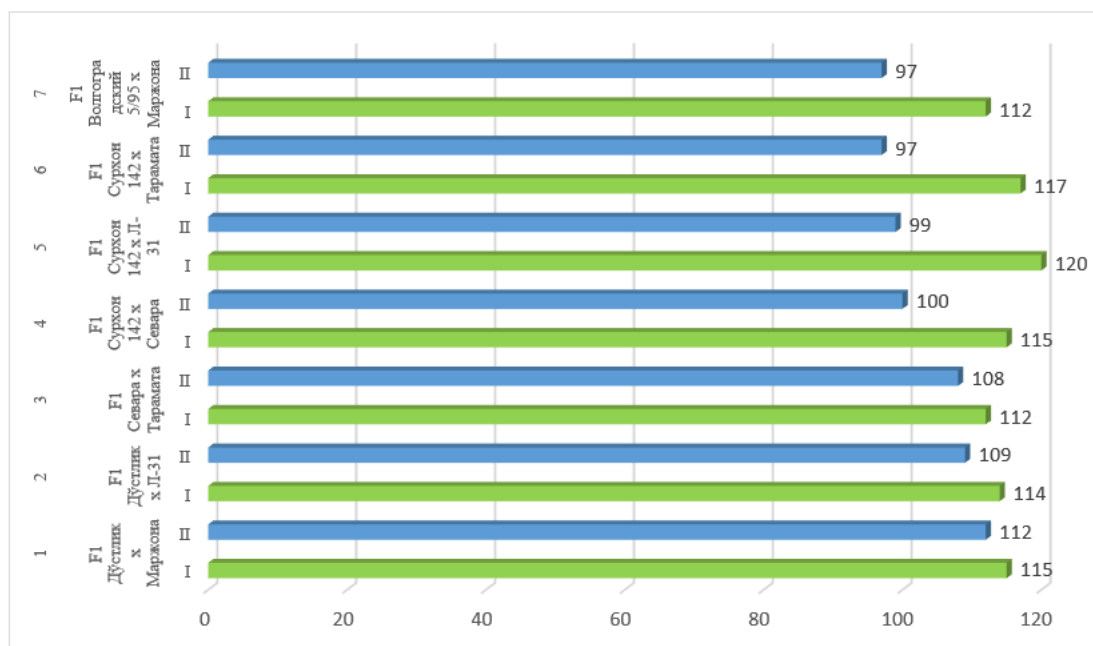
As can be seen from Table 1, F1 Surkhan 142 x L-31, F1 Surkhan 142 x Taramata, F1 Volgogradsky 5/95 x Marjona, F1 Sevara obtained with the participation of Sevara, L-31, Marjona, Chelnok, Taramata varieties in the second planting period x Volgogradsky 5/95, F1 Surkhan 142 x Marjona, F1 Surkhan 142 x Chelnok hybrids were observed and it was 91-99 days. This was mainly due to the shortening of the "flowering-fruit ripening" period. These hybrids showed precocity only in the second planting period. During the first planting period, their growth period did not differ much from the parental forms. In other studied hybrids, the growing period was 112-115 days in the first period and 100-112 days in the second planting period, and they were considered as early-mid-early and mid-early.

**Table 1** The duration of the development periods of the first generation hybrids of tomato stem (2019-2021)

№	F1 hybrids and their parental forms	Planting Term	The duration of the development phases, days		
			from germination to flowering	from flowering to ripening	validity period, day
<b>Types</b>					
1	Sevara	I	66	45	111
		II	63	49	112
2	Marjona	I	69	54	123
		II	67	34	111
3	Dostlik	I	67	46	113
		II	71	39	110
4	L-31	I	64	52	116
		II	67	40	107
5	Taramata	I	72	44	116
		II	71	36	107
6	Volgogradsky 5/95	I	66	47	113
		II	71	36	107
7	Surkhan 142	I	70	46	116
		II	66	38	104
8	Shuttle	I	62	43	105
		II	57	37	94
<b>Hybrids</b>					
9	F1 Friendship x Marjona	I	70	45	115
		II	71	41	112
10	F1 Friendship x L-31	I	70	44	114
		II	64	45	109
11	F1 Sevara x Taramata	I	67	45	112
		II	68	40	108
12	F1 Surkhan 142 x Sevara	I	72	43	115
		II	72	28	100
13	F1 Surkhan 142 x L-31	I	72	48	120
		II	59	40	99
14	F1 Surkhan 142 x Taramata	I	68	49	117
		II	63	34	97
15	F1 Volgogradsky 5/95 x Marjona	I	67	45	112
		II	59	38	97
16	F1 Sevara x Volgogradsky 5/95	I	69	44	113
		II	68	29	97
17	F1 Surkhan 142 x Marjona	I	67	48	115
		II	58	35	93
18	F1 Surkhan 142 x Shuttle	I	67	45	112
		II	59	32	91

The plant type is stem-like in all studied hybrids, and here we have achieved our goal. According to the plant height or the length of the main stem, the parent forms and the hybrids of the first generation were mainly divided into 2 groups: determinant and semi-determinant. Determinant varieties, as mentioned earlier, are characterized by the fact that after the formation of 4-6 flowers, the main stem stops growing and side branches grow. We included Dostlik, Sevara, L-31, Chelnok, Marjona and Dostlik x L-31, Dostlik x Marjona hybrids in this group of varieties and hybrids.

Plant height was 38-52 cm in the indicated varieties and 48-63 cm in hybrids, regardless of the planting period. We included Dostlik, Sevara, L-31, Chelnok, Marjona and Dostlik x L-31, Dostlik x Marjona hybrids in this group of varieties and hybrids.



**Figure 1.** The duration of the development periods of the first generation hybrids of tomato stem (2019-2021)

Plant height was 38-52 cm in the indicated varieties and 48-63 cm in hybrids, regardless of the planting period. Semi-determinant, that is, a weak manifestation of stem growth limitation.

**Table 2** Morphobiological description of the first generation tomato stem hybrids (2019-2021).

T/p	Types	Period of plant	Main length	Мева				
				weight, g	Height, cm	Width, cm	index	Color
1	Surkhan 142	I	84	67	4,0	5,1	0,8	red
		II	82	84	4,2	5,3	0,8	
2	Volgogradskiy 5/95	I	80	90	4,4	6,0	0,7	red
		II	78	56	4,0	4,7	0,9	
3	Taramata	I	81	68	5,0	5,1	1,0	red
		II	79	73	4,7	5,1	0,9	
4	Friendship	I	52	51	4,1	5,0	0,8	red
		II	50	73	4,7	5,2	0,9	
5	Sevara	I	46	63	4,5	4,8	0,9	red
		II	43	61	4,4	4,7	0,9	
6	L-31	I	43	80	5,1	5,3	1,0	red
		II	43	94	5,7	5,3	1,1	
7	Shuttle	I	39	39	6,0	3,3	1,8	red
		II	38	38	5,8	3,2	1,8	

8	Marjona	I	38	57	4,4	4,3	1,0	red
		II	38	57	4,4	4,1	1,1	
Hybrids								
9	F1 Sevara x Volgogradskiy 5/95	I	81	105	5,0	6,0	0,8	red
		II	79	65	3,9	4,9	0,8	
10	F1 Sevara x Taramata	I	80	93	5,2	5,4	1,0	red
		II	80	72	5,1	4,8	1,1	
11	F1 Surkhan 142 x Sevara	I	77	77	4,3	5,0	0,9	red
		II	79	92	4,5	6,0	0,8	
12	F1 Surkhan 142 x Chelnok	I	77	47	4,5	4,2	1,1	red
		II	77	56	4,8	4,4	1,1	
13	F1 Surkhan 142 x Taramata	I	76	92	5,0	6,0	0,8	red
		II	74	88	4,6	5,6	0,8	
14	F1 Surkhan 142 x L-31	I	75	112	5,0	6,0	0,8	red
		II	74	61	4,2	4,8	0,9	
15	F1 Surkhan 142 x Marjona	I	74	93	5,0	5,7	0,9	red
		II	76	88	4,8	5,4	0,9	
16	F1 Volgogradsky 5/95 x Marjona	I	70	83	5,0	5,4	0,9	red
		II	73	79	5,1	5,3	1,0	
17	F1 Friendship x L-31	I	63	58	4,1	5,0	0,8	red
		II	59	79	5,0	5,1	1,0	
18	F1 Friendship x Marjona	I	46	91	5,0	6,0	0,8	red
		II	48	76	5,0	5,0	1,0	

Surkhan 142, Volgogradsky 5/5, Taramata varieties and Surkhan 142, Volgogradsky 5/95 varieties were included in the group of varieties characterized by: G'1 Sevara x Volgogradsky 5/95, G'1 Sevara x Taramata, G'1 Surkhan 142 x Sevara, G'1 Surkhan 142 x Chelnok, G'1 Surkhan 142 x Taramata, G'1 Surkhan 142 x L-31, G'1 Surkhan 142 x Marjona, G'1 Volgogradsky 5/95 x Marjona hybrids were introduced.

Chelnok, Marjona varieties and G'1 Surkhan 142 x Chelnok, G'1 Dostlik x Marjona hybrids were included in the group of small fruits (up to 60 g) (Table 2).

The plant height was 70-84 cm in the first planting period and 74-82 cm in the second planting period.

Surkhan 142, Volgogradsky 5/95 varieties and G'1 Sevara x Volgogradsky 5/95, G'1 Surkhan 142 x L-31 hybrids were included in the group of large fruits (more than 100 g).

The group of medium fruits (60-100 g) includes Taramata, Dostlik, Sevara, L-31 varieties and G'1 Sevara x Taramata, G'1 Surkhan 142 x Sevara, G'1 Surkhan 142 x Taramata, G'1 Surkhan 142 x Marjona, G'1 Volgogradsky 5/95 x Marjona hybrids. entered.

The shape of the fruit was elongated only in the Chelnok variety, and its index was 1.8. In the F1 Surkhan 142 x Chelnok hybrid obtained with the participation of this variety, the fruit was oval and the index was 1.1.

In other studied cultivars and hybrids, the fruit index was 0.7-1.0 and they were mostly round in shape.

The color of the fruit was pink only in the Sevara variety, and red in the other studied varieties and hybrids. The pink color of the fruit is a recessive trait, and it does not appear in the hybrids of the first generation, so the fruit was red in the hybrids obtained with the participation of the Sevara variety. It should be mentioned that L-31, Marjona, Taramata, Chelnok varieties are distinguished by the hardness and transportability of their fruits. In the hybrids obtained with the participation of these varieties, the fruit was hard, that is, transportable observed. When one of the parent forms had hard fruit, the first generation hybrids also had hard fruit. Such hybrids included Surkhan 142 x Taramata, Taramata x Surkhan 142, Taramata x Volgogradsky 5/95, L-31 x Surkhan 142, L-31 x Sevara (Fig. 3).

It was observed that when the fruit of both varieties participating in the crossbreeding is soft, the fruit is soft in the hybrids.

As can be seen from Table 3, the yield of parent forms involved in crossbreeding was around 39.3-55.0 t/ha in the first term and 37.5-50.8 t/ha in the second term. The highest yield was observed in the first period in all varieties. In particular, the yield of Surkhan 142 variety in the first term is 55.0 t/ha, which means 8.3% more than in the second term. The highest productivity was observed in Surkhan 142, Sevara, Dostlik varieties. In the first period, their yield was 51.1-55.0 t/ha, and in the second period it was 40.4-50.8 t/ha.

The research has undoubtedly confirmed once again that the creation and wide use of hybrids of the first generation of stem tomatoes is a promising direction.

**Table 3** Productivity of first-generation tomato stem hybrids, (year 2019-2021)

№	Varieties and hybrids	Planting period	Ҳосилдорлик, т/га					
			General	Heterosis effect, %	The next one	Compared to the comparative variety, in %	Goods	Relative to the new one, in %
Types								
1	Surkhan 142	I	55,0	-	37,4	-	52,3	-
		II	50,8	-	34,2	-	48,3	-
2	Sevara	I	53,1	-	44,7	-	50,4	-
		II	47,7	-	32,3	-	45,3	-
3	Dostlik	I	51,1	-	37,5	-	48,5	-
		II	40,4	-	30,4	-	38,4	-
4	L-31	I	47,5	-	36,4	-	45,1	-
		II	43,8	-	27,6	-	41,6	-
5	Marjona	I	46,4	-	39,3	-	43,8	-
		II	37,2	-	26,9	-	35,3	-
6	Taramata	I	41,0	-	34,0	-	38,9	-
		II	39,4	-	26,9	-	37,4	-
7	Volgogradsky 5/95	I	40,0	-	29,5	-	38,0	-
		II	37,4	-	28,2	-	35,5	-
8	Shuttle	I	39,3	-	31,6	-	37,3	-
		II	37,5	-	28,3	-	35,6	-
Hybrids								
9	F1 Surkhan 142 x Sevara	I	83,0	151	61,4	164	78,9	151
		II	61,6	121	39,1	134	58,5	121
10	F1 Sevara x Taramata	I	83,0	156	58,8	132	78,9	157
		II	57,2	120	40,9	127	54,3	120
11	F1 Friendship x L-31	I	82,0	160	61,7	165	77,9	161
		II	71,6	163	49,3	179	68,0	163
12	F1 Surkhan 142 x Marjona	I	79,0	144	71,9	192	75,1	144
		II	62,5	123	40,3	118	59,4	123
13	F1 Surkhan 142 x L-31	I	72,0	131	50,1	134	68,4	131
		II	64,8	128	40,1	117	61,6	128
14	F1 Sevara x Volgogradsky 5/95	I	65,0	122	46,1	103	61,8	123
		II	46,7	98	31,4	98	44,4	98
15	F1 Friendship x Marjona	I	61,0	119	43,1	115	58,0	120
		II	52,5	130	32,2	106	49,9	130
16	F1 Surkhan 142 x Taramata	I	60,0	109	44,0	118	57,0	109
		II	50,0	98	34,2	100	47,5	98
17	F1 Volgogradsky 5/95 x Marjona	I	58,0	125	41,8	94	55,1	109
		II	57,8	155	41,8	148	54,9	155
18	F1 Surkhan 142 x Shuttle	I	44,0	80	28,8	77	41,8	80
		II	37,5	74	29,5	86	35,6	74

The highest total yield in first generation hybrids G'1 Surkhan 142 x Sevara, G'1 Sevara x Taramata, G'1 Dostlik x L-31, G'1 Surkhan 142 x Marjona, G'1 Surkhan 142 x L-31, G'1 Dostlik x Marjona, G'1 Volgogradsky 5/95 x Marjona was observed in combinations. The total productivity of these hybrids was 72.0-83.0 t/ha in the first period, and 57.2-71.6 t/ha in the second period. The highest heterosis effect in terms of total yield was also observed in these hybrids. The effect of heterosis in these hybrids was 131-160% in the first period, and 120-163% in the second period. At the same time, hybrids were identified with a low or no heterosis effect. This, in turn, academician A.V. Alpatov [(1981); 302-b] again confirmed that not all first-generation hybrids have high heterosis efficiency and not all first-generation hybrids are valuable.

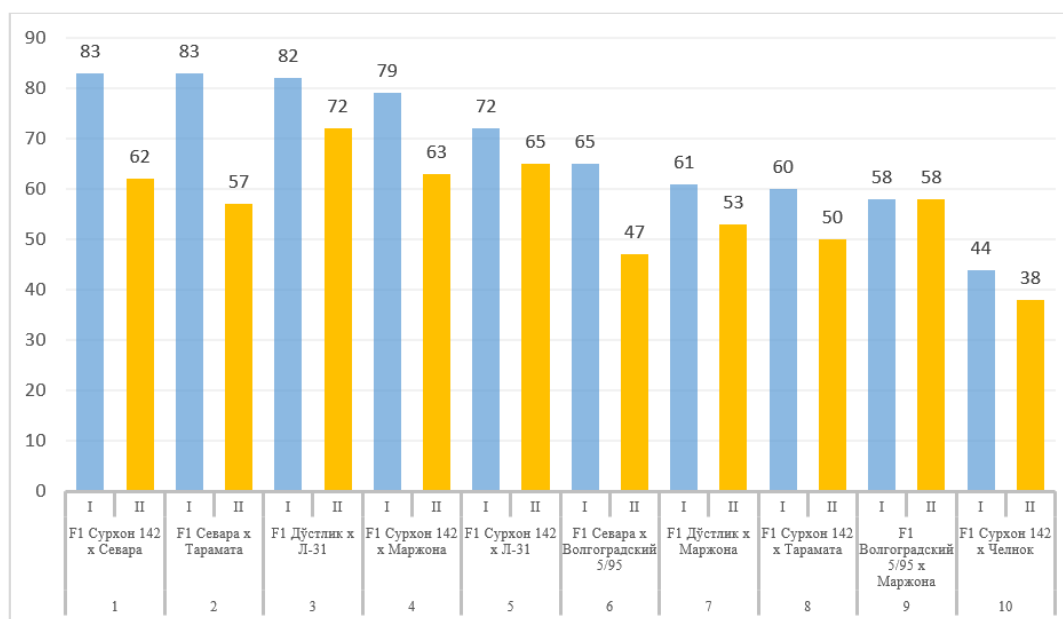


**Figure 2 F1 Surkhan 142 x L-31 hybrid**

The highest yield rate of the parental forms is observed in Surkhan 142, Dostlik, Marjona, Sevara, L-31, Chelnok varieties, which is 31.6-44.7 t/ha in the first term, and 26.9-34 t/ha in the second term. was 2 t/ha. Among the hybrids of the first generation, the highest yield was recorded in G'1 Surkhan 142 x Sevara, G'1 Sevara x Taramata, G'1 Dostlik x L-31, G'1 Surkhan 142 x Marjona, G'1 Surkhan 142 x L-31 hybrids. The yield of these hybrids was 50.1-71.9 t/ha in the first period, 39.1-49.3 t/ha in the second period.

It was in these hybrids that the highest heterosis effect was observed in terms of early yield: 134-192% in the first term and 117-179% in the second term.

Marketable yield was significantly higher in firm, transportable varieties. The marketable yield was also high in the hybrids whose fruits were obtained in the presence of hard varieties.



**Figure 3.** Tomato stem hybrids of the first generation

yield, (2019-2021 year)

Thus, as a result of the study of the first generation hybrids in 2020-2021, G'1 Surkhan 142 x Sevara, G'1 Sevara x Taramata, G'1 Dostlik x L-31, G'1 Surkhan 142 x Marjona, G'1 Surkhan 142 x L-31, G'1 with the highest total yield Friendship x Marjona, G'1 Volgogradsky 5/95 x Marjona hybrids were separated.

The effect of heterosis in these hybrids was 131-160% in the first period, and 120-163% in the second period. Among the hybrids of the first generation, the highest yield was recorded in G'1 Surkhan 142 x Sevara, G'1 Sevara x Taramata, G'1 Dostlik x L-31, G'1 Surkhan 142 x Marjona, G'1 Surkhan 142 x L-31 hybrids.

The yield of these hybrids was 50.1-71.9 t/ha in the first period, 39.1-49.3 t/ha in the second period. It was in these hybrids that the highest heterosis effect was observed in terms of early yield: 134-192% in the first period and 117-179% in the second period.

These hybrids can be recommended for production after certain trials and are a valuable starting source for the development of more perfect resistant cultivars and hybrids with valuable economic traits.

## CONCLUSIONS

1. For the first time, 10 stem-shaped G'1 hybrids were created and thoroughly studied, and it was determined that the use of stem-shaped hybrids is economically efficient.
2. In the first generation hybrids, the highest total yield was observed in combinations G'1 Surkhan 142 x Sevara, G'1 Sevara x Taramata, G'1 Dostlik x L-31, G'1 Surkhan 142 x Marjona, G'1 Surkhan 142 x L-31, G'1 Dostlik x Marjona, G'1 Volgogradskiy 5/95 x Marjona. The total productivity of these hybrids was 72.0-83.0 t/ha in the first period, and 57.2-71.6 t/ha in the second period.
3. The effect of heterosis in these hybrids was 131-160% in the first term, and 120-163% in the second term.

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