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BREEDING OF GREENHOUSE MELON (CUCUMIS MELO L.) HYBRIDS FOR PROTECTED CULTIVATION CONDITIONS IN UZBEKISTAN

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Abstract: To date, no local melon varieties adapted for protected cultivation have been officially zoned in our republic. In 2022, for the first time, a new melon variety for greenhouse conditions was developed and submitted to the State Variety Testing Agency under the name *Zarkhal*. Currently, several hybrid combinations of greenhouse melons have been created, including L-160 × Kichkintoy, L-9 × L-22-17, L-7 × Zarkhal, Zarkhal × L-22-17, Zarkhal × L-22-20, Ananas × L-20-22, L-9 × Galia, L-22-17 × Galia, Dove × L-9, and L-22-17 × Ananas. These hybrids are characterized not only by high yield (5.0–8.0 kg/m²), but also by excellent taste qualities, with an average fruit weight ranging from 0.9 to 1.5 kg. In addition, they show resistance to diseases such as powdery mildew and Fusarium wilt. Their tasting scores ranged from 4.0 to 4.5 points.

Keywords: hybrid, melon, greenhouse, weight, kilogram, square meter, disease resistance.

Introduction: Cultivated melon (*Cucumis melo L.*) belongs to the genus *Cucumis* L. of the family *Cucurbitaceae* Juss. Melon is an annual creeping herbaceous plant, the edible part of which is the fruit flesh, characterized by high sugar content and excellent taste qualities. The flesh exhibits a wide range of textures and colors, and is distinguished by its delicate, refined aroma and pleasant flavor.

The nutritional value of melon is determined by the presence of 12–18% sugars in the fruit flesh, as well as vitamins such as B-complex, C, B1, B2, A, and PP, along with mineral elements including potassium, calcium, magnesium, phosphorus, iron, and others.

Uzbekistan is one of the leading countries in the production of cucurbit crops, particularly renowned for its valuable melon varieties, which are highly appreciated for their superior taste qualities not only within the country but also far beyond its borders.Despite this, until recently, no systematic breeding work on melon under protected cultivation conditions had been conducted in the republic.In this regard, starting from 2020, breeding programs aimed at developing greenhouse-adapted melon varieties in plastic film greenhouses have been initiated [4,5,8].

Materials and Methods: The research was conducted under both laboratory and field conditions in accordance with the following methodological guidelines: *Vegetable Production under Protected Cultivation* (Bryzgalov V.A., Sovetkina V.E., Savinova N.I., 1995), *Methodology of Conducting Experiments in Vegetable, Melon, and Potato Production* (Azimov B.J., Azimov B.B., Tashkent, 2002), *Methods of Experimental Research in Vegetable, Melon, and Potato Production* (Tashkent, 2023), and other relevant methodological recommendations.

The research was conducted at the Research Institute of Vegetable, Melon Crops and Potato, located in Tashkent District of Tashkent Region, approximately 3 km west of Tashkent city.

Results and Discussion: The technology for raising melon seedlings is similar to that used for cucumber seedlings. Prior to seedling emergence, it is recommended to maintain the substrate temperature at 28–30 °C; after emergence, it should be reduced to 20–25 °C. The optimal air temperature is 23–25 °C during the day and 20–21 °C at night.

The sowing period for seedlings intended for the spring cultivation cycle is February 1–5, with transplanting to the permanent location in early March. Seedlings were grown in plastic trays filled with a nutrient mixture consisting of humus, soil, and peat in a 1:1:1 ratio [2,5].

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The application of mineral fertilizers before transplanting and during the growing season was carried out based on the results of agrochemical soil analysis. Seedlings were transplanted at the age of 20–25 days. The use of overgrown seedlings (more than 30–35 days old) significantly reduced yield. During transplanting, the root collar was not buried, as the hypocotyl region is susceptible to fungal diseases [5].

Planting density depends on plant vigor, training method, agronomic practices, environmental conditions, and other factors. Excessively dense planting leads to reduced fruit size and lower sugar content. Under dense planting conditions, intensive elongation of the main stem is observed regardless of whether plants are trained in one or two stems [5].

In our experiments, melon plants were trained to a single stem. Only the main stem was vertically tied to a trellis using twine, while lateral shoots were pinched.

The development of heterotic hybrids represents a promising direction in melon breeding under protected cultivation. The greater the differences between parental forms in terms of ecological adaptation, earliness, origin, and morphological traits, the stronger the expression of heterosis [5,6,7].

In the 2020 experiments, 20 melon lines were studied and more than 30 hybrid combinations were developed. Among them, the following hybrids showed the most promising performance in terms of yield, taste, marketability, and disease resistance: L-160 × Kichkintoy, L-9 × L-22-17, L-7 × Zarkhal, Zarkhal × L-22-17, Zarkhal × L-22-20, Ananas × L-20-22, L-9 × Galiya, L-22-17 × Galiya, Dove × L-9, and L-22-17 × Ananas, in comparison with the standard variety Kichkintoy.

Due to the absence of a regionally adapted greenhouse melon variety in the republic, the small-fruited open-field variety Kichkintoy was used as a standard. The experimental plot size was 10 m². Plants were cultivated in a single-stem system and tied to a trellis using twine.

During the growing season, phonological observations, biometric measurements, and yield assessments (recalculated per 1 m²) were carried out. $\frac{\{120+80\} \times 50}{2}$ During the period of mass harvesting, biochemical analyses of fresh melon fruits were conducted. Weekly assessments of plant resistance to common greenhouse diseases (powdery mildew and Fusarium wilt) were performed in collaboration with phytopathologist K.Sh. Mamatov (Plant Protection Laboratory).

To monitor the growth and development of vegetative organs in melon accessions, biometric analysis was conducted (Table 1).

Plant growth vigor was characterized by the following parameters: length of the main stem, number of shoots, and number of leaves per plant.

During the assessment of vegetative organs in melon plants, the hybrid F_1 Zarkhal × L-22-20 showed notable performance, with a main stem length of 208.3 cm, 3 lateral branches, and 32 leaves per plant.

Table 1

Biometric measurements of melon accessions during the period of mass ripening (2025).

№	Accessions	Main stem length (cm)	Number of lateral branches (no.)	Number of leaves
ст	Kichkintoy	173.6	2	23
1	L-160 xKichkin	198.3	4	32
2	Zarkhal x L-20-17	205.3	4	31
3	Zarkhal x L-20-22	208.3	4	32
4	L-9 x L-20-17	199.3	3	26
5	L-7 x Zarkhal	206.0	3	26

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6	Ananas x L-22-20	204.0	2	28
7	L-9 x Galiya	196.0	3	27
8	L-22-17 x Galiya	212.6	3	29
9	Dave x L-9	215.0	4	28
10	L-22-17 x Ananas	220.0	3	32

During the assessment of vegetative organs in melon plants, the hybrid F_1 Zarkhal × L-22-20 showed notable performance, with a main stem length of 208.3 cm, 3 lateral branches, and 32 leaves per plant.

The lowest values were recorded in the hybrid L-22-17 × Ananas, which had a main stem length of 220.0 cm, 3 lateral branches, and 32 leaves per plant, while the standard variety Kichkintoy exhibited comparatively lower parameters: 173.6 cm in stem length, 2 lateral branches, and 23 leaves per plant. The remaining accessions demonstrated intermediate values.

A higher number of leaves in melon plants is considered a positive trait, as it enhances carbon assimilation and photosynthetic activity, thereby improving fruit set and increasing overall productivity (Table 2).

As shown in Table 2, four new hybrid combinations demonstrated high potential in terms of yield. However, it is important to obtain not only high yield but also high-quality produce.

Table 2

Yield and its quality in greenhouse melon accessions under spring cultivation (2025)

№	Accessions	Marketable yield (kg/m²)		% of standard	Early yield as % of marketable yield	Brix %	Taste evaluation (score)
		kg/m²	early yield				
ст	Kichkintoy	4.62	0	100	0	10.0	4.0
1	L-160 xKichkin	4.15	2.58	89	62	10.0	4.2
2	Zarkhal x L-20-17	7.37	3.9	159	53	11.5	4.5
3	Zarkhal x L-20-22	7.71	1.265	166	16	10.5	4.5
4	L-9 x L-20-17	6.50	2.75	140	42	11.0	3.8
5	L-7 x Zarkhal	3.69	2.118	80	57	9.5	3.8
6	Ananas x L-22-20	6.76	0	146	0	11.5	4.0
7	L-9 x Galiya	5.02	2.392	108	47	11.0	4.0
8	L-22-17 x Galiya	6.24	2.748	135	52	11.0	4.5
9	Dave x L-9	6.36	2.65	137	49	9.5	4.5
10	L-22-17 x Ananas	5.42	0	117	0	10.0	4.3

The average fruit weight among all melon accessions ranged from 0.937 to 1.442 kg. In terms of soluble solids content (measured using a refractometer), the following hybrids were distinguished: F_1 Zarkhal × L-22-20 (10.5%), F_1 Zarkhal × L-20-17 (11.5%), and F_1 Ananas × L-20-22 (11.5%), while the lowest value was recorded in the standard variety Kichkintoy (10.0%). During the period of mass harvesting, a sensory evaluation of melon fruits was conducted using a 5-point scale.

Table 3

Agronomically valuable traits of F_1 greenhouse melon hybrids

№	Accessions	Fruit characteristics				Fruit weight (kg)	Powdery mildew	Fusarium wilt
		(length width,	flesh thic	flesh color	flesh texture			

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		cm)	knes s (cm)				infe ctio n	infe ctio n
st	Kichkintoy	15x13. 5	3.0	light green	soft	1.065	1	0
1	L-160 xKichkin	15.5x1 3	3.0	cream	firm	1.155	1.5	0
2	Zarkhal x L-20-17	17x14	3.5	cream	soft	1.442	0	0
3	Zarkhal x L-20-22	13x13	3.0	cream	medium	1.177	0	0
4	L-9 x L-20-17	14x11	2.5	cream	medium	0.937	0	0
5	L-7 x Zarkhal	14x13	3.0	white	soft	1.068	2.5	0
6	Ananas x L-22-20	13x11	3.0	cream	firm	1.190	0	0
7	L-9 x Galiya	16x12	3.0	cream	firm	1.080	0	0
8	L-22-17 x Galiya	12x10	3.0	white	medium	1.046	1	0
9	Dave x L-9	15x13	3.0	cream	soft	1.340	1.5	0
10	L-22-17 x Ananas	20x13	3.0	cream	medium	1.355	2.5	0

In terms of taste quality and external appearance, all 10 new melon accessions—L-160 × Kichkintoy, L-9 × L-22-17, L-7 × Zarkhal, Zarkhal × L-22-17, E Zarkhal × L-22-20, Ananas × L-20-22, L-9 × Galiya, L-22-17 × Galiya, Dove × L-9, and L-22-17 × Ananas—showed excellent performance, with sensory evaluation scores ranging from 4.5 to 5.0 points, while the standard variety Kichkintoy scored 4.0 points.

Table 3 presents the characteristics of agronomically valuable traits of the new greenhouse melon accessions. As shown in Table 3, the fruit flesh of greenhouse melons was predominantly white, soft in texture, with flesh thickness ranging from 2.5 to 3.5 cm.

All accessions exhibited resistance to powdery mildew, while the hybrids F_1 Zarhal × L-22-20, F_1 L-9 × L-22-17, F_1 Ananas × L-22-20, and F_1 L-9 × Galiya also demonstrated resistance to Fusarium wilt. The remaining accessions showed susceptibility to Fusarium wilt at levels of 10–25%, whereas the open-field variety Kichkintoy exhibited up to 10% infection with powdery mildew.

Resistance to diseases is an important indicator of the перспективность (prospects) of any variety or hybrid, especially against the most common melon diseases such as powdery mildew and Fusarium wilt.





L-22-17 x Galiya Dave x L-9 Zarkhal x L-20-22 L-7 x Zarhal L-160 x Kichkintoy





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L-9 x L-20-17 Zarkhal x L-20-17 Ananas x L-22-20 Dave x L-9 L-22-17 x Ananas

Conclusions. The new local melon hybrids F_1 Zarkhal × L-22-20, F_1 L-9 × L-22-17, F_1 Ananas × L-22-20, and F_1 L-9 × Galiya showed relative resistance to powdery mildew and Fusarium wilt, and were distinguished by high yield, attractive appearance, and superior taste quality. These hybrids are considered highly promising for cultivation under protected (greenhouse) conditions**.**

In 2025, these hybrids are planned to be submitted to the State Patent Agency**.**

At present, these promising accessions are undergoing ecological testing in the Tashkent region**.**

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