

Ecological Plasticity and Stability of Melon under Dynamic Climatic Conditions

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Agrobiological assessment of melon was conducted in 2023–2024 at the experimental field of the Department of Vegetable Growing of Uman National University. Morphological, physicochemical, qualitative indicators, productivity indicators, and indicators of ecological plasticity and stability of 10 cultivars ('Ananas', 'Medova Kazka', 'Dubivka', 'Kolhospnysa', 'Prestyge', 'Karamel', 'Rannya 133', 'Cantaloupa', 'Titovka', 'Torpeda') and 7 hybrids of common melon (Carriere F₁, Valencia F₁, Blanco F₁, Maziane F₁, Bizan F₁, 'Retato Degli ortolani', 'Amal F₁') were studied. The fruit mass values ranged from 0.8 to 2.2 kg. The highest fruit mass value was reached by 'Prestyge' cultivar (2.2 kg). The highest yields were obtained by the varieties 'Medova Kazka' (63.0 t·ha⁻¹), 'Ananas' (62.3 t·ha⁻¹), 'Prestyge' (62.1 t·ha⁻¹), 'Rannya 133' (61.7 t·ha⁻¹) and the 'Carriere F₁' hybrid (61.7 t·ha⁻¹). The most stable cultivars were 'Ananas', 'Torpeda', 'Cantaloupa' and 'Carriere F₁', 'Bizan F₁', 'Maziane F₁' hybrids. The most environmentally plastic cultivars were 'Medova Kazka' and 'Carriere F₁', 'Bizan F₁' hybrids. The most adaptive (by CAA coefficient) were 'Medova Kazka', 'Ananas', 'Prestyge', 'Rannya 133' and the 'Carriere F₁', 'Maziane F₁' hybrids. According to most of the physicochemical characteristics, the cultivars 'Medova Kazka', 'Titovka', 'Carriere F₁' and 'Amal F₁' hybrids performed the best. As a result of this study, varieties and hybrids of common melon were identified that are most adapted to the climatic conditions of the Right-Bank Forest-Steppe of Ukraine.

Keywords: yield, stability, plasticity, adaptability, fruit quality

1 Introduction

Melon is one of the most common melon vegetable crops. Melon fruits are consumed mainly fresh, and are also used as raw materials for the processing industry. Common melon belongs to the genus *Cucumis*, family Cucurbitaceae. Melon has a diploid set, which contains 24 chromosomes. The global area of melon cultivation is 1.07 million hectares, and the gross production is 28.6 million tons, of which the lion's share or 387.06 thousand hectares is occupied by land in China, where the gross production is 14.07 million tons. The second place in terms of production is occupied by Turkey, where in 2023 1.6 million tons were grown, on an area of 66.8 thousand hectares. India is in third place, where the gross production is 1.478 million. The global melon cultivation area is 1.07 million hectares, and the gross production is 28.6 million tons, of which the lion's

share or 387.06 thousand hectares is occupied by land in China, where the gross production is 14.07 million tons. The second place in terms of production is occupied by Turkey, where in 2023 they grew 1.6 million tons, on an area of 66.8 thousand hectares. India is in third place, where the gross production is 1.478 million tons, and the cultivation area is 75 thousand hectares. China and Turkey together produce more than 50% of the world's melon production. In Europe, the leaders in melon production are: Spain, Italy, France. In Spain in 2023, 652.6 thousand tons were grown on an area of 19.2 thousand hectares. In Italy, with an area of 23.5 thousand ha, 607.3 thousand tons were harvested. In France, 271.9 thousand tons were harvested, on an area of 14 thousand hectares. Most varieties are recommended for distribution in the soil-climatic zones of the Forest-Steppe (34%), and Steppe (33%). In

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the Polissya zone, 22% of varieties are recommended for cultivation (Burkovetskyi, 2024).

Phytocomponents contained in melon include carotenes, apocarotenoids, ascorbic acid, flavonoids, terpenoids, chromone derivatives, β -carotene, carbohydrates, amino acids, fatty acids, phospholipids and various minerals. Melon seeds contain a high level of proteins, so they are often used in diets. The recommended intake of melon is 100–300 g per day, or 30 kg per person per year. The seeds contain 26.26–39.96% of protein, 26.56–55% bof fat, 49.5 mg·100 g⁻¹ of iron, 18.58 mg·100 g⁻¹ of copper, 22.09 mg·100 g⁻¹ of zinc and 12.2 mcg·100 g⁻¹ of selenium. It contains essential amino acids: arginine, histidine, isoleucine, leucine, tryptophan, tyrosine, methionine and phenylalanine. Melon seeds contain saturated (21.2%), monounsaturated (16.1%) and polyunsaturated (62.7%) fatty acids, of which linoleic acid accounts for 62.42% (Enujiugha et al., 2023).

Ground melon seeds are used to make flour, a thickener for soups, and as an additive to baby food. Melon seeds are also used to make fermented seasoning, as well as oil, which is used for food purposes. The dry matter content in melon fruits is 1.5–13%, the sugar content is 7–21%, and depending on the variety and growing conditions, the pectin content varies within 3.8–4.5% (Silva et al., 2020).

To obtain a consistently high yield of melon, it is necessary to introduce high-yielding varieties and hybrids, studying their level of realization of the biological potential laid down by selection. Due to global warming, climate change and an increase in average daily temperatures, there is a need to introduce new varieties and hybrids resistant to high temperatures (Suliman, 2024). Changes in the length of daylight hours and air temperature affect the flowering process of the crop (Ren et al., 2025).

The study of varietal and genetic properties contributes to the improvement of melon resistance to diseases (Kaur et al., 2025, Cui et al., 2022), as well as abiotic stresses such as salinity, nutrient deficiency and excessive high temperature (Lopez-Zaplana et al., 2022). One of the indicators characterizing the genotypic and varietal variability of melon is the content of dry soluble substances (Andrade et al., 2021). In addition to this indicator, the antioxidant activity of melon is also being studied (da Silva, et al., 2025). At the current stage of melon breeding, scientists pay attention to the weight of the fruit and the content of dry soluble substances (Yu, et al., 2025).

2 Material and Methods

2.1 Research Conditions

Experimental studies were carried out in 2023–2024 at the experimental field of the Department of Vegetable Growing of Uman National University (Uman, with geographical coordinates 48° 46' N, 30° 14' E). The soil of the experimental field is podzolized heavy loamy black soil with a humus horizon 40–45 cm thick and a humus content of 1.5%; pH (saline) – 6.65; hydrolytic acidity – 2.6 mg. eq·100 g⁻¹, soil saturation with bases 90–95%, the indicator of the sum of absorbed bases – 24.6 mg·eq·100 g⁻¹.

According to the data in Figure 1, it can be seen that the temperature regime during the growing season in 2024 was the most moisture-rich and favorable for growing melons. According to «Uman» weather station, this year was characterized by a uniform distribution of precipitation, which ensured a higher yield.

The investigation studied the adaptive capacity of varieties and hybrids according to the following scheme: cultivars – ‘Titovka’ st, ‘Ananas’, ‘Medova Kazka’,

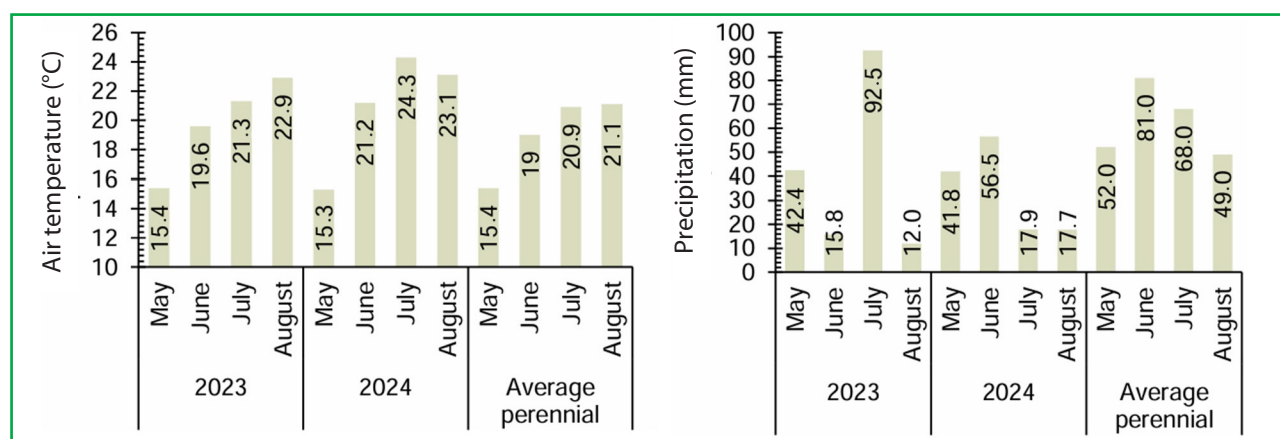


Figure 1 Climatic map for the growing season of common melon varieties and hybrids for 2023–2024 (according to data from «Uman» weather station)

'Dubivka', 'Prestyge', 'Karamel', 'Rannia 133', 'Cantaloupa', 'Kolhospyntsa', 'Torpeda', hybrids – 'Amal F₁' st, 'Carriere F₁', 'Valencia', 'Blanco F₁', 'Maziane F₁', 'Bizan F₁', 'Retato Degli ortolani'. The placement of variants in the experiment is systematic. 'Titovka' cultivars and 'Amal F₁' hybrid were taken as the standard, they are recommended for the growing zone of the Forest-Steppe of Ukraine.

The studies were carried out under conditions that ensure satisfactory growth and development of plants and sufficient detection of characteristic features of the variety, such as fruit weight, typical color. The size of the accounting plot was 40 m², so that the removal of plants or their parts for measurements and calculations would not harm the surveys during the growing cycle. The description of morphological identification features of the variety was carried out by visual assessment and by measurements and calculations depending on the type of detection of features.

For measurements, 20 marker plants were used. The plant placement scheme was 1.4 × 1.4 m (5.1 thousand plants/ha).

2.2 Research Methods

Genetic and statistical processing of the results.

A large number of methods are used to assess adaptability. Most of them are based on the method of regression analysis, and is also based on the principles of combining and transforming the effects of the environment and the interaction of the genotype with growing conditions. The coefficient of linear regression of yield of a variety shows its reaction to changes in growing conditions. The higher the value of the coefficient ($bi > 1$), the better the response of the variety. In the case of $bi < 1$, the variety reacts weakly to changes in environmental conditions. Under the condition that $bi = 1$, there is a complete correspondence of the change in the yield of the variety in accordance with the change in growing conditions. Nonlinear deviations from the regression line (σ^2d – stability). The lower the stability coefficient, the more stable the variety.

Coefficient of adaptability (CA). To determine the adaptive capacity, the coefficient of adaptability of the variety (CA) was used.

The absolute average coefficient of adaptability (CAA) is calculated for the variety according to the formula:

$$CAA = \frac{(XiA) \times 100 \times (Xm)}{100} \quad (1)$$

where: XiA – average yield of the variety over years of testing; Xm – multi-year average variety yield

The coefficient of variation is a relative value used to characterize the dispersion (variability) of a feature. It is the ratio of SD mean square deviation to the arithmetic mean, expressed as a percentage:

$$CV = \frac{SD}{\bar{X}} \quad (2)$$

Coefficient of variation on the following ratio scale:

CV < 10% – variation is weak; CV 11–25% – variation is average; CV > 25% – variation is significant.

In the experiments, phenotypic, genotypic and ecological variability of varieties was determined according to the following formulas:

Genetic variance:

$$\sigma_G^2 = \frac{CM_p - CM_e}{r} \quad (3)$$

Environmental variance:

$$\sigma_A^2 = CM_e \quad (4)$$

Phenotypic variance:

$$\sigma_F^2 = \sigma_G^2 + \sigma_A^2 \quad (5)$$

Coefficient of genotypic variation:

$$\frac{\sqrt{\sigma_G^2}}{\bar{X}} \times 100 \quad (6)$$

Coefficient of phenotypic variation:

$$\frac{\sqrt{\sigma_F^2}}{\bar{X}} \times 100 \quad (7)$$

Coefficient of ecological variation:

$$\frac{\sqrt{\sigma_A^2}}{\bar{X}} \times 100 \quad (8)$$

where: CM_p – generalized root mean square value of the population trait; CM_e – generalized root mean square error; r – number of repetitions

2.3 Physicochemical Traits Measurement

The mature fruits of various genotypes were harvested. The flesh was separated and homogenized after the rind was removed. In a nutshell, a measured quantity of flesh fruit (5.00 g) was sliced, and the juice was taken from the fruits by pulping and compressing. For 10 min, the samples were centrifuged at 8000 rpm, and the clear supernatant was taken for physicochemical analysis.

Total phenolic content (TPC) measurement The total phenolics in juice were determined using the Folin-Ciocalteu reagent, as reported in our earlier paper (Lateef, Mustafa, Tahir, 2021), with some modifications. Three replications were used to get the mean value of each genotype. The results were expressed as the equivalent of μg gallic acid (GAE) per gram of flesh fresh weight using the following formula (9):

$$\text{TPC } (\mu\text{GAE}\cdot\text{g}^{-1}\text{ FW}) = \frac{\text{volume of juice (mL)}}{\text{fresh weight of flesh (g)}} \times \text{concentration from standard curve of gallic acid } (\mu\text{g}\cdot\text{mL}^{-1}) \quad (9)$$

Total flavonoid content (TFC) estimation The TFC in each extract was calculated using our earlier paper (Lateef, Mustafa, Tahir, 2021) with some modifications. Each juice's total flavonoid concentration was reported as μg quercetin (QE) per gram of fresh flesh matter using the following formula (10):

$$\frac{\text{volume of juice (mL)}}{\text{fresh weight of flesh (g)}} \times \text{concentration from standard curve of quercetin } (\mu\text{g}\cdot\text{mL}^{-1}) \quad (10)$$

2.4 Antioxidant Activity (AC) Evaluation by DPPH (Lateef, Mustafa, Tahir, 2021)

The antioxidant capacity of the flesh juice was estimated using the 1-diphenyl-2-picrylhydrazyl (DPPH) radical-scavenging method outlined in our article (Lateef et al. 2021), with some enhancements. Three replications were used to create each genotype's mean value. The antioxidant potential of various juices was quantified as Trolox equivalents per gram of fresh flesh weight using the following equation (11):

$$\frac{\text{volume of juice (mL)}}{\text{fresh weight of flesh (g)}} \times \text{concentration from standard curve of Trolox } (\mu\text{g}\cdot\text{mL}^{-1}) \quad (11)$$

Each number in this experiment is the average of three measurements.

Soluble sugar content (SSC) measurement Soluble sugar content was determined using the method given by Lateef et al. (2021). Three replications have been used to determine the average value of each genotype. The soluble sugar concentration was given as $\mu\text{g}\cdot\text{g}^{-1}$ of fresh flesh weight using the following formula (12):

$$\text{SSC } (\mu\text{g}\cdot\text{g}^{-1}\text{ FW}) = \frac{\text{volume of juice (mL)}}{\text{fresh weight of flesh (g)}} \times \text{concentration from standard curve of glucose } (\mu\text{g}\cdot\text{mL}^{-1}) \quad (12)$$

Ascorbic acid content (ASC) determination The ASC was defined as $\mu\text{g}\cdot\text{g}^{-1}$ of fresh flesh weight. Three replications have been used to calculate the average value of each genotype.

Quantification of carotenoid content (CAC) The carotenoid concentrations were expressed as μg per gram of fresh flesh weight and estimated by this formula (13):

$$\text{CAC } (\mu\text{g}\cdot\text{g}^{-1}) = \frac{(\text{absorbance reading} \times \text{total volume of juice (mL)} \times 10,000)}{(\text{carotene extension coefficient in methanol} \times \text{fresh weight of flesh (g)})} \quad (13)$$

Three replications have been used to calculate the average value of each genotype.

2.5 pH Measurement

Juice was collected and homogenized from known weights of flesh melons, and a known volume of deionized water was added to each juice sample. The pH was obtained after calibrating the pH meter (Hanna Instruments, Romania) for pH 4 and 7 with standard solutions. Furthermore, three readings were taken from each juice genotype, and such values from triplicate samples were used to calculate the mean.

2.6 Measurement of Total Soluble Solids (TSS)

The TSS in the juice was determined using a handheld refractometer. TSS was expressed as Brix unit. Three replications have been used to calculate the average value of each genotype.

2.7 Statistical Data Analysis

The results were statistically processed using the arithmetic mean ($\bar{x}$) and standard deviation (SD) calculated using Microsoft Excel 2019. Correlations were calculated using Statistica 12 software. The Chaddock scale was used to qualitatively assess the correlation coefficients.

3 Results and Discussion

One of the key characteristics of a variety is fruit weight. The studies used regionalized and promising varieties and hybrids with fruits of different weights and shapes, which are becoming increasingly popular on the market.

The results showed that the largest fruits by weight were observed in the cultivars 'Prestyle', 'Kolhosprnytsa' and 'Medova Kazka' (Figure 2). During the study, the fruit weight ranged from 0.8 kg ('Cantaloupa') to 2.2 kg ('Prestyle').

The following cultivars were noted for their average or relatively small weight: 'Cantaloupa' – 0.9 kg,

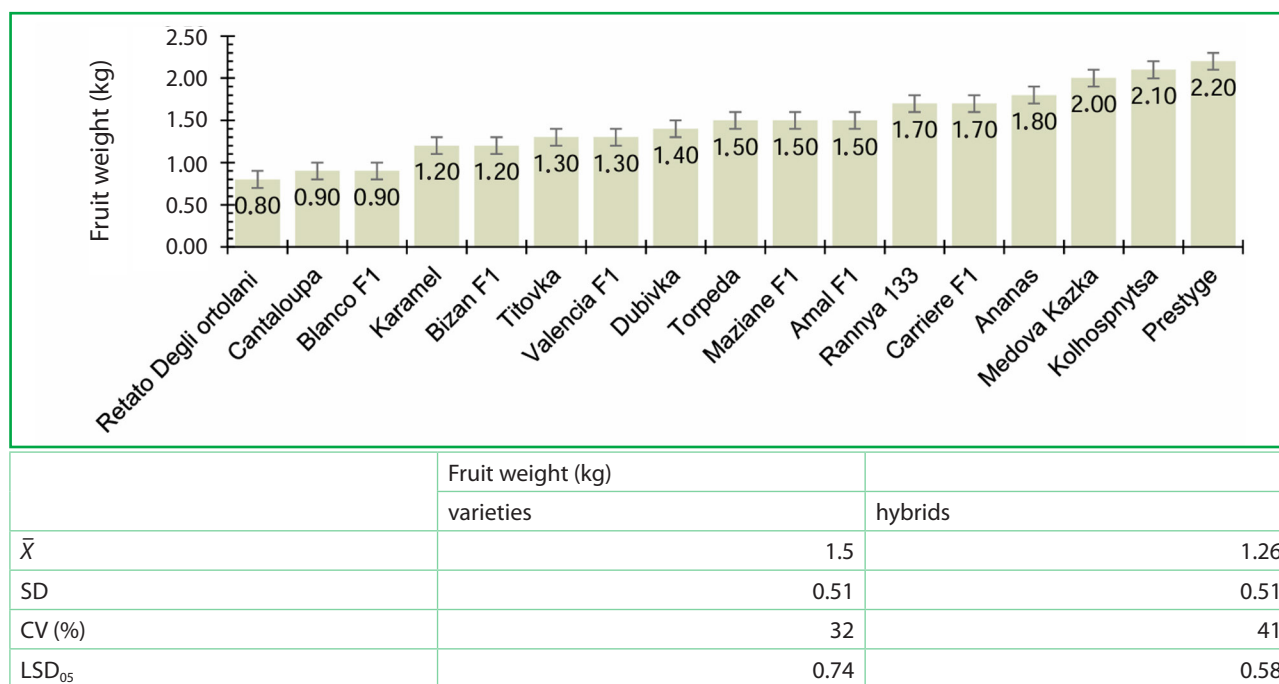


Figure 2 Dynamics of fruit mass formation of different melon varieties and hybrids, 2023–2024

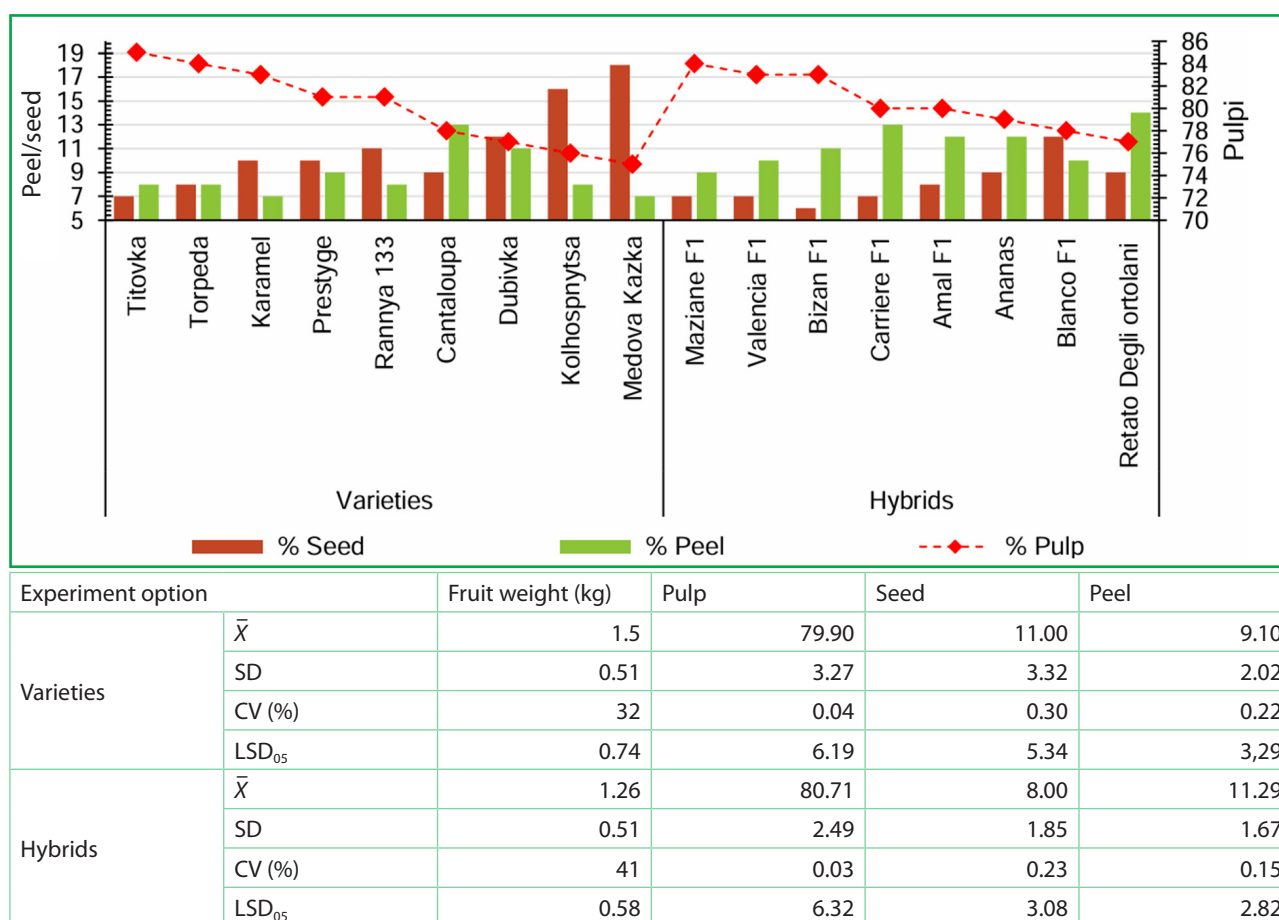


Figure 3 The proportion of pulp, peel and seeds in the fruit structure depending on varietal characteristics, 2023–2024

‘Karamel’ – 1.2 kg, ‘Titovka’ – 1.3 kg. Among the studied hybrids, a significant diversity in fruit weight was found. The largest fruits were observed in the hybrids ‘Carriere F₁’, ‘Maziane F₁’ and ‘Amal F₁’, the average weight of which was 2.1 kg, 1.7 kg and 1.6 kg, respectively.

In contrast, other hybrids were characterized by significantly smaller fruit sizes. In particular, the average weight of ‘Retato Degli Ortolani’ was only 0.8 kg, ‘Blanco F₁’ – 0.9 kg, and ‘Bizan F₁’ – 1.2 kg. Such a difference in indicators indicates a wide range of characteristics of the studied hybrids, which is associated with their genetic characteristics and adaptive properties.

Analyzing the structure of the melon fruit (Figure 3), it was noted that the highest percentage of pulp was formed by the cultivars ‘Titovka’, ‘Torpeda’, ‘Karamel’, ‘Prestyge’, and the hybrids ‘Maziane F₁’, ‘Valencia F₁’ and ‘Bizan F₁’. These varieties have the highest yield of consumer melon product. The greatest peel thickness was noted in the cultivars ‘Cantalupa’, ‘Ananas’, ‘Dubivka’ and the hybrids ‘Retato Degli ortolani F₁’, ‘Carriere F₁’ and ‘Amal F₁’. The higher this indicator, the better the fruits tolerate transportation over long distances, and the shelf life of the fruits in storage increases.

The highest seed content in the fruit structure was noted in the cultivars ‘Medova Kazka’, ‘Kolhospyntsa’, ‘Dubivka’ and the hybrid ‘Blanco F₁’. This indicator is an important criterion in the selection and seed production of vegetable crops.

Crop yield is a key indicator that determines the efficiency of cultivation and the correct choice of variety. With high-quality production technology, the potential of the variety can be best realized and the highest yield can be ensured. Research results indicate that melon has a fairly high yield, which is guaranteed by favorable climatic conditions and high-quality cultivation technology. According to the research results, the maximum average yield among all studied varieties was found in 2024 (Figure 4). This result is largely due to the optimal weather conditions of the growing season, which contributed to the intensive growth and development of plants, effective fruit formation, and the full realization of the genetic potential of melon varieties and hybrids.

Particularly favorable factors for melon productivity and yield are: optimal temperature regime, timely and sufficient rainfall, sufficient daylight hours and intensity of sunlight. Analysis of yield variability

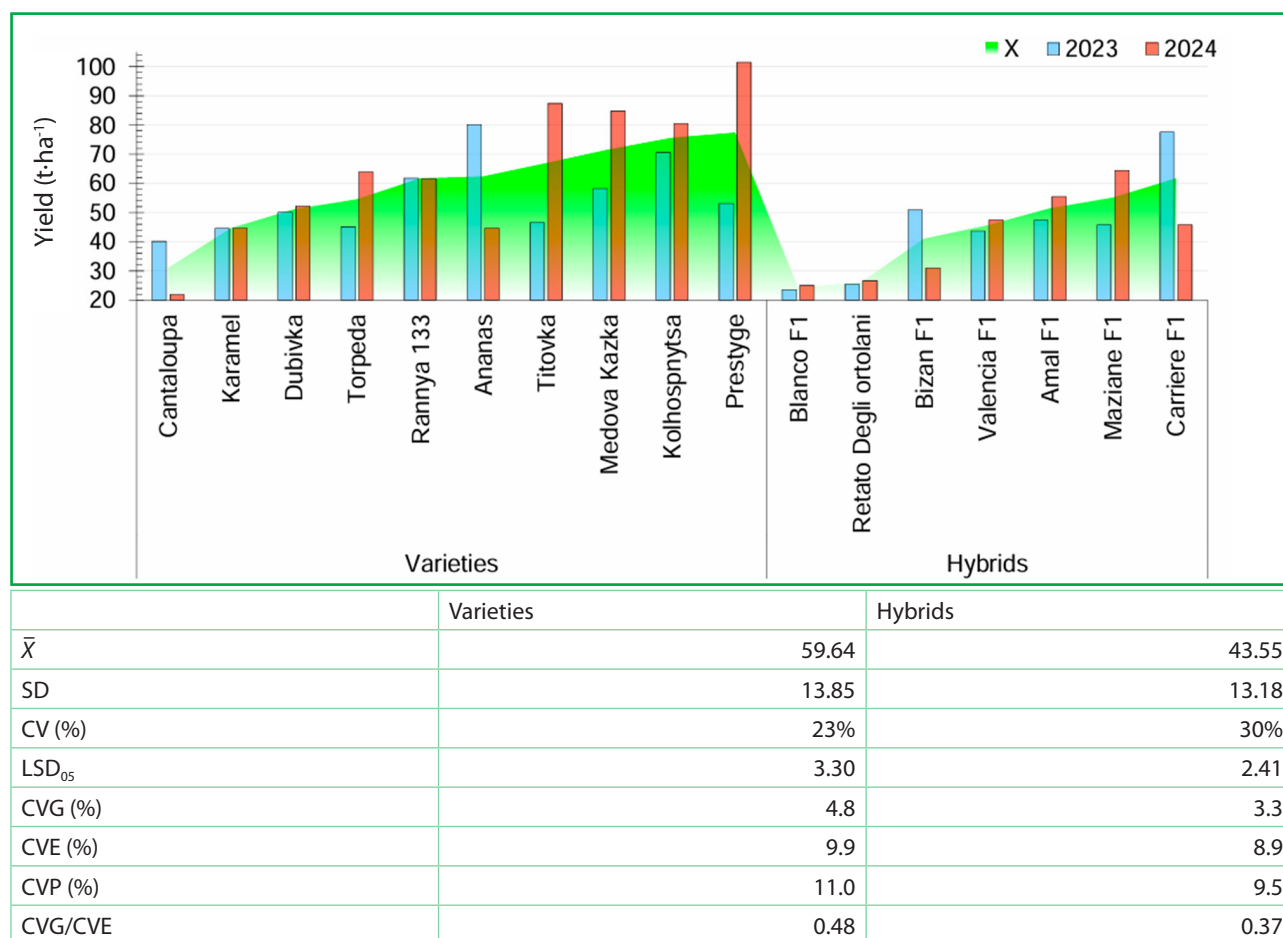


Figure 4 Dynamics of yield formation of varieties and hybrids of common melon, 2023–2024

allowed us to differentiate melon varieties into three clear groups based on the level of stability: Highly stable varieties (coefficient of variation < 10%): 'Rannia 133', 'Medova Kazka', 'Kolhospnysa', 'Dubivka', 'Karamel'. These cultivars demonstrate minimal yield fluctuations, which indicates their ability to maintain stable productivity regardless of external conditions. The cultivars with moderate stability (coefficient of variation 11–25%): 'Titovka' (st), 'Prestyge', 'Torpeda'. This group is characterized by medium fluctuations in yield, which may be associated with sensitivity to certain environmental factors. Unstable cultivars (coefficient of variation > 25%): 'Ananas', 'Cantaloupa'. These varieties exhibit significant yield dependence on external conditions, which requires a particularly careful approach to their cultivation.

Among the studied varieties, the highest yields were the cultivars 'Medova Kazka' (63.0 t·ha⁻¹), 'Ananas' (62.3 t·ha⁻¹), 'Prestyge' (62.1 t·ha⁻¹) and 'Rannia 133' (61.7 t·ha⁻¹), which exceeded the yield of the control variant (by 7.9–9.2 t·ha⁻¹). The lowest yields were observed in the cultivars 'Karamel' (44.6 t·ha⁻¹) and 'Cantaloupa' (30.9 t·ha⁻¹). The low yield is due to the lower fruit weight. Among the hybrids, the lowest yields were observed in the hybrids 'Retato Degli ortolani F₁' (26.0 t·ha⁻¹) and 'Blanco F₁' (24.3 t·ha⁻¹).

Genetic and statistical analysis of the yield of melon varieties and hybrids showed that the most stable

(σ^2d) were the cultivars 'Ananas', 'Torpeda', 'Cantaloupa', and 'Prestyge' (Figure 5).

It was found that the cultivars 'Karamel' and 'Cantaloupa' had plasticity indices $bi < 1$ and stability $\sigma^2d > 0$, which shows the best result under adverse conditions, but they were unstable. The cultivars 'Rannia 133' and 'Kolhospnysa' had plasticity indices $bi > 1$ and stability $\sigma^2d = 0$, therefore they had the best result under favorable growing conditions, stable. The cultivars 'Titovka', 'Ananas', 'Medova Kazka', 'Dubivka', 'Prestyge', 'Torpeda' were distinguished by plasticity indices $bi > 1$ and stability $\sigma^2d > 0$, and showed the best result under favorable growing conditions.

It is commonly known that to obtain high productivity, a CVG/CVE ratio close to unity or greater than unity is required, since in these cases, genetic variation is greater than environmental variation, indicating that the conditions meet the requirements of the crop. Analysis of the compliance of growing conditions with the requirements of the melon crop in the Forest-Steppe conditions indicated that the growing conditions meet the requirements of the crop insufficiently – CVG/CVE = 0.48 for varieties and 0.37 for hybrids.

The coefficient of absolute adaptability of varieties and hybrids CAA showed that the cultivars 'Medova Kazka', 'Ananas', 'Prestyge' and 'Rannia 133' were the most adaptable to the conditions of the Forest-Steppe

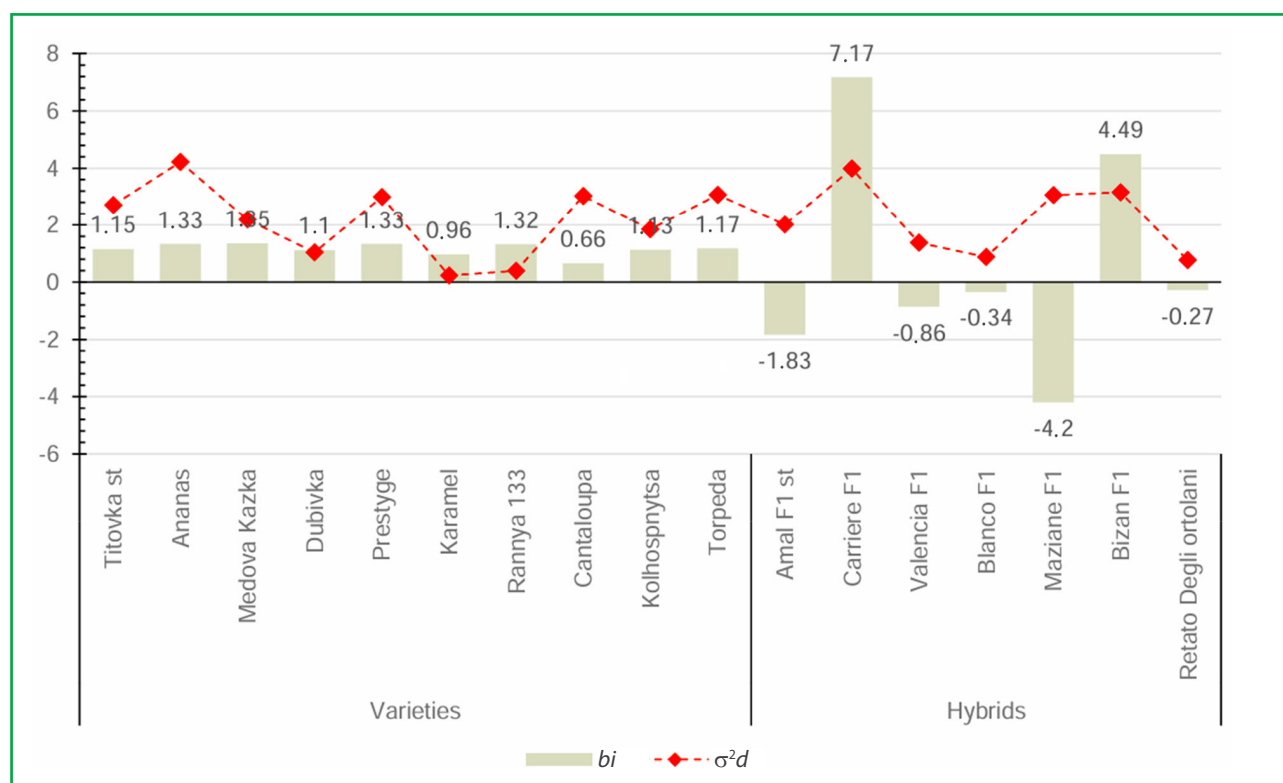


Figure 5 Parameters of plasticity and stability of melon varieties and hybrids

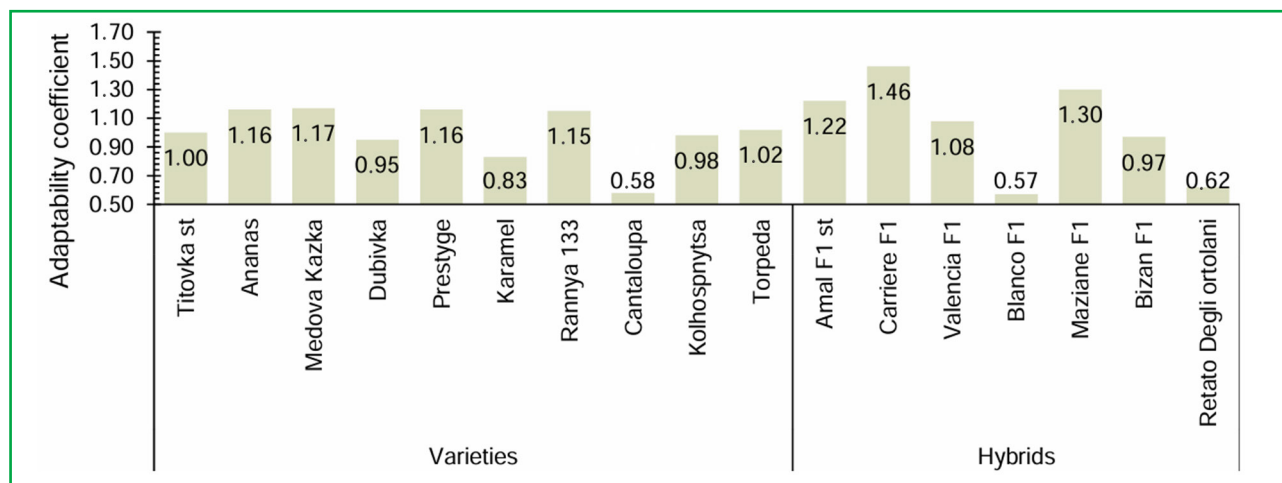


Figure 6 Absolute adaptability coefficient of cantaloupe varieties and hybrids

(Figure 6). The most adaptable among melon hybrids were the hybrids 'Carriere F₁', 'Maziane F₁' and 'Amal F₁'.

Statistical calculations have shown that increasing the mass of one fruit significantly increases the overall

yield of melon. This trait can be a reliable criterion for selecting high-yielding varieties or hybrids in breeding work.

3.1 Coefficient of Determination

The coefficient of determination $r^2 = 0.5984$ – 0.9738 indicates that from 59.84 to 97.38% of the variation in yield is explained by changes in fruit weight. The correlation coefficient ($r = 0.7736$ – 0.9868) also indicates a strong and close positive linear relationship between average fruit weight and yield (Figure 7).

3.2 Physicochemical Characteristics of Fruits of Melon Varieties and Hybrids

The highest moisture content of fruits was in the cultivars 'Cantalupa' and 'Medova Kazka' and hybrids 'Carriere F₁', 'Maziane F₁', 'Bizan F₁', 'Valencia F₁'. The data on the total phenol content ranged from 5.48 in 'Medova Kazka' to

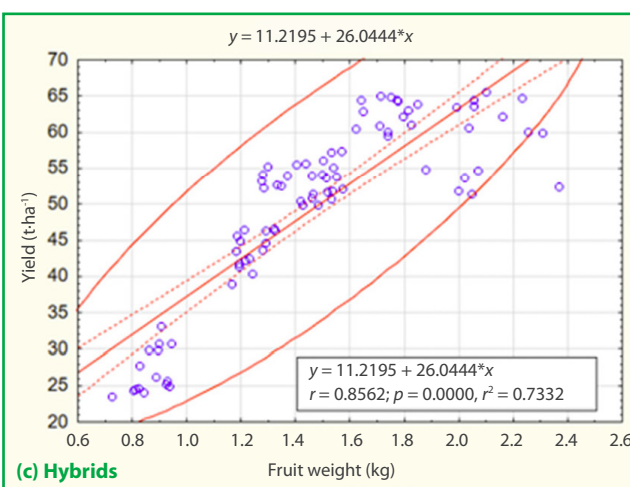
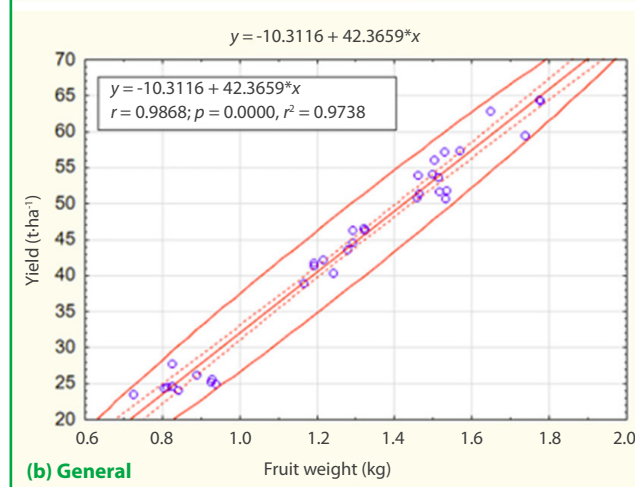
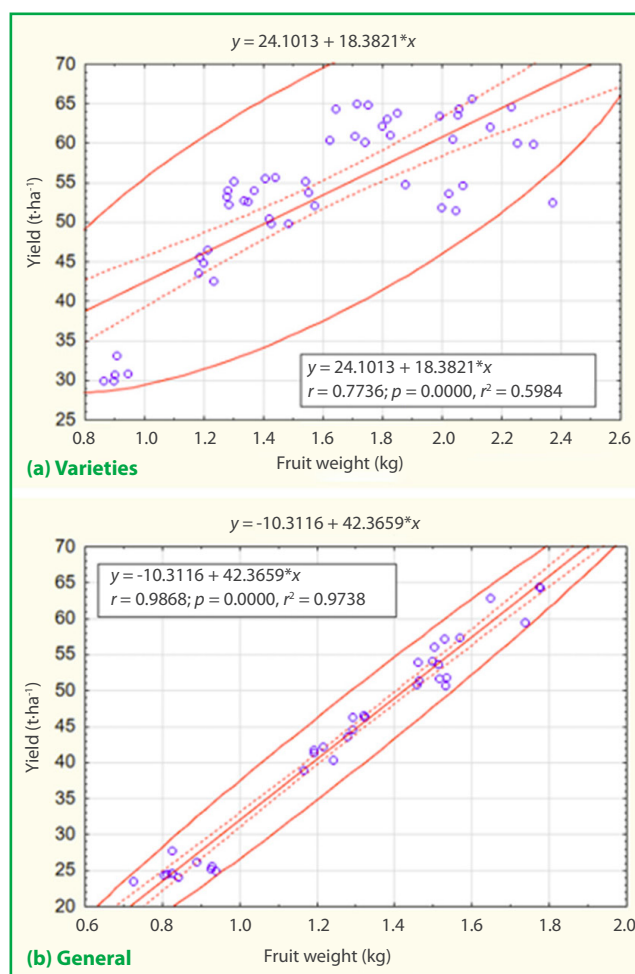


Figure 7 Statistical dependence of the yield of melon varieties and hybrids on the weight of the fruit

32.2 in 'Dubivka'. The indicator of the total flavonoid content varied significantly. The highest flavonoid content was observed in cultivars 'Titovka' (6.4), 'Dubivka' (6.14) and 'Kolhospnysa' (6.02). The antioxidant activity of melon varieties and hybrids ranged from 12.76 to 65.1 (Table 1).

A significant influence of the variety on the nature of the soluble sugar content was noted. The highest content was found in the hybrids 'Carriere F₁' and 'Amal F₁'. The low content of soluble sugar was found in the varieties 'Karamel', 'Torpeda' and the hybrid 'Valencia F₁'. The soluble sugar content in all variants of the experiment ranged from 42 to 227.8. The highest content was found in the hybrids 'Carriere F₁' and 'Amal F₁'. The lowest content was found in the cultivars 'Torpedo', 'Karamel' and 'Prestyge'.

The best ascorbic acid indicators were shown by the 'Amal F₁' hybrid and the 'Titovka' and 'Prestyge' cultivars. As indicated in the table, the best carotenoid content was shown by 'Medova Kazka', 'Dubivka', 'Titovka' cultivars and the 'Amal F₁', 'Maziane F₁', 'Carriere F₁' hybrids.

Low carotenoid content was shown by the cultivars 'Rannia 133', 'Cantalupa' and 'Kolhospnysa', and the hybrids 'Valencia F₁', 'Bizan F₁' and 'Blanco F₁'. Analyzing the pH

index, it was noted that the highest values were observed in the hybrid 'Amal F₁' and the varieties 'Prestyge' and 'Torpeda'.

'Dubivka' cultivar and 'Valencia F₁', 'Amal F₁' hybrids had the highest content of soluble solids. 'Kolhospnysa' and 'Retato degli ortolani' cultivars had the lowest values. In terms of TTA, 'Dubivka' variety and the 'Amal F₁' hybrid outperformed the other variants in the experiment, since their value was greater than 1. 'Karamel', 'Rannia 133' and 'Ananas' cultivars had the lowest TTA values.

The genetic diversity of common melon includes many varieties and hybrids, both local and those that are gaining popularity in the vegetable market. Therefore, it is important to study the quality indicators of fruits of different varieties and hybrids of common melon, as well as to analyze the adaptability of the variety to a particular climatic zone, since in dynamic climatic conditions there can be a large variation in the quality and yield characteristics of a variety or hybrid.

Mannozi reported that the moisture content of freshly harvested melon fruits was 92%, in our studies, the hybrids 'Carriere F₁' and 'Maziane F₁' exceeded this figure (Mannozi et al., 2021). 'Cantalupa' cultivar and the hybrids 'Valencia

Table 1 Comparison of the values of physicochemical characteristics of melon (*Cucumis melo* L.) fruits

Experiment option		Fruit moisture	Phenol content	Flavonoid content	Antioxidant activity	Soluble sugar content	Ascorbic acid content	Carotenoid content	pH	Soluble solids (Brix)	Total titratable acidity (TTA%)
Varieties	Ananas	89.2	7.6	2.5	48.8	193.8	19.4	0.93	5.22	6.2	0.62
	Medova Kazka	90.9	5.5	3.4	21.6	121.6	22.8	1.69	5.04	9.8	0.89
	Dubivka	89.4	12.2	6.1	35.8	135.6	26.7	154	4.76	10.2	1.15
	Kolhospnysa	88.1	15.4	6.0	12.8	112.6	12.8	0.78	4.93	5.8	0.78
	Prestyge	89.7	11.5	3.4	38.4	78.4	31.8	0.88	5.87	7.3	0.84
	Karamel	83.8	10.2	1.2	31.2	42.0	12.4	0.95	5.43	5.9	0.42
	Rannia 133	89.4	7.5	1.1	22.8	117.0	10.2	0.36	5.12	8.4	0.57
	Cantalupa	92.0	18.8	4.1	21.8	153.6	18.8	0.59	5.24	9.5	0.92
	Titovka	88.0	9.2	6.4	27.6	134.1	32.5	1.37	4.37	7.6	0.78
	Torpeda	89.6	16.8	5.6	16.2	43.8	19.4	1.11	5.77	8.4	0.69
	LSD ₀₅	6.2	12.4	3.1	16.8	72.5	12.0	0.64	0.73	2.5	0.31
Hybrids	Carriere F ₁	95.0	13.5	2.2	22.6	227.8	12.4	1.25	4.34	9.3	0.77
	Valencia F ₁	92.2	14.1	3.5	65.1	43.7	24.5	0.63	5.18	10.4	0.83
	Blanco F ₁	88.9	9.1	5.9	61.4	145.8	9.9	0.75	4.75	8.7	0.74
	Maziane F ₁	93.2	16.8	4.3	14.5	164.8	11.2	1.39	5.28	9.4	0.64
	Bizan F ₁	92.7	18.3	5.5	18.9	145.0	23.4	0.74	5.50	8.3	0.85
	Retato Degli ortolani	89.1	12.1	4.6	23.8	87.0	23.9	0.96	5.47	5.9	0.77
	Amal F ₁	89.8	12.3	3.0	22.9	224.6	41.5	2.23	5.89	10.1	1.06
	LSD ₀₅	5.3	4.8	2.1	32.3	102.8	17.0	0.85	0.82	2.3	0.20

F₁, 'Bizan F₁' had the same percentage of fruit moisture (92%), the remaining variants had lower moisture values, which ranged from 83.82 to 90.86.

Akhtar et al. (2022) reported that the phenolic content of melon fruits was 4.1. Our values were slightly higher, ranging from 5.48 to 18.8 (Akhtar et al., 2022). Hussain reported that the flavonoid content was 79.16 mg QE-100 g⁻¹ (Hussain et al., 2024). In our studies, the flavonoid content ranged from 1.12 to 6.24.

Antioxidant activity (DPPH). Islam and Sultana indicate that the antioxidant activity of melon was in the range of 2.89 to 10.59 (Islam & Sultana, 2020). Miller reported that the antioxidant activity of Piel del Sapo melon pulp was 26.68 (Miller et al., 2020). In our studies, the antioxidant activity was slightly higher, ranging from 16.2 to 65.1. The soluble sugar content of the fruits was 227.8 mg·g⁻¹ and was higher than in the studies of Singh, who reported a sugar content of 83.3 (Singh et al., 2022). The carotenoid content ranged from 0.63 to 1.69 and was slightly lower than in the studies of Singh, Jayaprakasha (Singh, Jayaprakasha et al., 2021), and approximately equal to the values studied by de Oliveira, in which the carotenoid content was 1.54 (de Oliveira et al., 2021). The ascorbic acid content ranged from 9.90 to 41.5 and was higher than in the studies of Zhao (Zhao et al., 2025), and approximately equal to the content reported by Manchali (Manchali et al., 2021). The pH ranged from 4.34 to 5.89, and was slightly lower than in studies (Imen, et al., 2023) in which the pH in the fruits was 5.5–6.6, and lower than in studies (Barbosa Junior et al., 2024) in which the pH was 6.5. The total dissolved solids (TSS) content ranged from 5.8 to 10.4 and was lower than in the Diaz-Alvarado studies, where the TSS index showed from 10.55 to 13.0 (Diaz-Alvarado & Monge-Perez, 2017).

The total titratable acidity (TTA) in our study ranged from 0.42 to 1.15%, which was approximately equal to the values of Aziz (Aziz & Tahir, 2022).

4 Conclusions

The weight of melon fruits varied significantly depending on the variety and hybrid. The cultivars 'Prestyge', 'Kolhospnysa' and 'Medova Kazka', as well as the hybrids 'Carriere F₁', 'Maziane F₁' and 'Amal F₁', demonstrated the highest fruit weight. The cultivars 'Cantalupa', 'Karamel', 'Titovka' and the hybrids 'Retato Degli Ortolani', 'Blanco F₁' and 'Bizan F₁' had the lowest fruit weight.

The structure of the fruits demonstrated varietal specificity. The highest pulp yield was obtained from the cultivars 'Titovka', 'Torpeda', 'Karamel', 'Prestyge' and the hybrids 'Maziane F₁', 'Valencia F₁', 'Bizan F₁'. The thickest peel was obtained from the cultivars 'Cantalupa', 'Ananas', 'Dubivka', as well as from the hybrids 'Retato Degli Ortolani',

'Carriere F₁', 'Amal F₁', which increases the transportability and keeping quality of the fruits.

The yield depended on the variety, weather conditions and growing technology. The highest yield was shown by the cultivars 'Medova Kazka', 'Ananas', 'Prestyge' and 'Rannia 133'. On the other hand, 'Karamel', 'Cantalupa' and the hybrids 'Retato Degli Ortolani F₁', 'Blanco F₁' had the lowest indicators.

The stability of yield allowed classifying varieties into three groups: highly stable: 'Rannia 133', 'Medova Kazka', 'Kolhospnysa', 'Dubivka', 'Karamel'; moderately stable: 'Titovka', 'Prestyge', 'Torpeda'; unstable: 'Ananas', 'Cantalupa'.

Genetic and statistical analysis showed that the cultivars 'Rannia 133', 'Kolhospnysa' had high plasticity and stability, and the cultivars 'Karamel', 'Cantalupa' – only plasticity, without stability. The cultivars 'Medova Kazka', 'Ananas', 'Prestyge', 'Rannia 133' and the hybrids 'Carriere F₁', 'Maziane F₁', 'Amal F₁' turned out to be the most adaptable to the conditions of the Forest-Steppe.

Physicochemical parameters of fruits varied significantly depending on the variety and hybrid:

- Moisture content was the highest in hybrids 'Carriere F₁', 'Maziane F₁' and 'Cantalupa' cultivar.
- Phenols: the highest level in 'Dubivka' cultivar.
- Flavonoids: highest in 'Titovka', 'Dubivka', 'Kolhospnysa' cultivars.
- Antioxidant activity ranged from 16.2 to 65.1, which exceeds the literature data.
- Soluble sugars: the highest content in hybrids 'Carriere F₁', 'Amal F₁'; the lowest – in cultivars 'Karamel', 'Torpeda'.
- Ascorbic acid: the highest content in 'Amal F₁', 'Titovka', 'Prestyge'.
- Carotenoids: leaders – 'Medova Kazka', 'Dubivka', 'Titovka', 'Amal F₁', 'Maziane F₁', 'Carriere F₁'.
- pH: the highest in 'Amal F₁', 'Prestyge', 'Torpeda'.
- TSS (total soluble solids): the highest values are 'Dubivka', 'Amal F₁', 'Valencia F₁'.
- TTA (total titratable acidity): the highest values are 'Dubivka' and 'Amal F₁'.

Comparison with literary sources shows that in many cases the content of beneficial substances (phenols, antioxidants, ascorbic acid, sugars) in the studied samples exceeded the values given in the works of other authors, which indicates the high biochemical potential of individual melon varieties and hybrids.

These findings imply that the above-mentioned melon varieties and hybrids can be used to improve melon varieties and hybrids by breeding for fruit quality and adaptive variability.

In the perspective of expanding the assortment and distribution area of common melon in different climatic conditions, we recommend paying attention to varieties with a high coefficient of adaptability to dynamic climatic conditions, namely the cultivars 'Medova Kazka', 'Ananas', 'Prestyge', 'Rannya 133' and hybrids 'Carriere F₁', 'Maziane F₁'.

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Conflict of interest

The authors declare that there is no conflict of interest.

Author contributions

Oleksii Burkovetskyi: Data curation, Formal analysis, Investigation, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. Nataliia Yatsenko: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing. Viacheslav Yatsenko: Conceptualization, Data curation, Methodology, Software, Writing – review & editing. Oleh Lazarev: Conceptualization, Writing – original draft, Writing – review & editing.

AI and AI-assisted technologies use declaration

No generative AI tools/AI-assisted technologies were used during the preparation of the manuscript.

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