

*Kalayda Katerina,
Tokar Anastasiya,
Slobodyanik Galina,
Uman national university of horticulture, Uman, Ukraine
Voitsekhivskiy Volodymyr,
Zahliada Andrii,
Iliashenko Andrii,
Tkachuk Svitlana,
Nesterova Natalia,
National university of life and environmental sciences of Ukraine, Kiev
Muliarchuk Oksana,
HEI «Podillia State University», Kamianets-Podilskiy, Ukraine
Balitska Liudmila,
Yushkevich Marina,
Symonenko Natalia,
Ukrainian institute for plant varieties examination, Kiev*

QUALITY, BIOLOGICAL VALUE AND PRODUCTIVITY OF SWEET PEPPER OF EARLY VARIETIES AS THE BASIS OF COMPETITIVENESS

Abstract.

A comprehensive rating assessment of sweet pepper of the early ripeness group of widespread and prospects of varieties and hybrids was carried out. The most competitive varieties of sweet pepper were determined based on a complex of economic, commodity science and biochemical indicators: Scrivia, Denis F₁, Krasnyi Rytsar F₁, Telestar F₁, Aden and Danai. The obtained results make it possible to expand knowledge and optimize the process of selecting the optimal assortment for specialized enterprises.

Ключові слова: перець солодкий, група стиглості, ранні, сорт, гібрид, якість, конкурентоспроможність.

Introduction.

Sweet pepper culture is the oldest and most popular culture in the world. It began to be grown more than 5000 years ago in South America. Hot pepper is a widespread vegetable crop in the world. Most of it is grown in the countries of Southeast Asia - 72.3% and Africa - 19.0%, and much less in the countries of Europe - 4.6% - and America - 4%. The world commercial production of pepper is more than 28 million tons, for which more than 1.8-1.9 million hectares of land are used. The leading producer of pepper in the world is China, where more than 50% of the world's gross harvest (more than 15 million tons) is grown with a yield of more than 26 tons/ha. In Ukraine, according to data from 2018-2021, 163.6 thousand tons of sweet pepper fruits were grown annually, with an average yield of 10.2-11.4 tons/ha, although this is one of the key crops in vegetable production. The Kherson region is traditionally the leader in pepper production in Ukraine, Dnipropetrovsk and Odesa regions produce almost three times less, all of them together provide half of the total volume of sweet pepper in Ukraine and are the main suppliers to other regions of the country and exports, their share of gross production in the country is more than 52% [2, 7, 12].

The sweet pepper market is quite dynamic, and only the factor of unstable product quality is an obstacle to the exit of our country to other markets. It is the quality of products that is the main factor that the consumer is guided by when choosing one or another

product. Currently, high quality will not be able to ensure the full success of the product on the market, other indicators must also be taken into account: economic, functional, organoleptic, physiological, economic, etc. Therefore, the assessment of economic and botanical varieties of sweet pepper according to a set of indicators is an important stage in the selection of the assortment for planning cultivation in certain soil and climatic conditions [1, 4, 5, 7, 14, 15].

The competitiveness of a certain variety can be assessed only in comparison with a competing analogue product. To do this, you need to have different characteristics of all varieties. Therefore, the problem of determining the complex economic and commodity characteristics of sweet pepper fruits is relevant [6, 11].

Among the works devoted to determining the competitiveness of goods, the leading place is occupied by the researches of some scientists [6-8, 10, 11], but one cannot use one method due to the great variety of goods.

Current methods of determining competitiveness are flawed because there are no baseline varieties against which to compare existing or newly introduced varieties. The economic component of competitiveness also differs, which depends on the agricultural technology used by the producer, prices for fuel and lubricants, protective equipment and other factors that determine the cost of production [6, 7, 8, 10, 11].

The purpose of the study is to determine the resource potential of sweet pepper assortment of early varieties in the conditions of Ukraine on the basis of a

complex economic, commodity science and food evaluation.

Research materials and methods.

The calculation of the competitiveness of sweet pepper was carried out on the basis of the methodology of Professor V.A. Koltunov [6,7,8] according to economic and functional indicators. This technique is not limited to a certain number of varieties and involves a comprehensive assessment of the main indicators on a ranking scale. For this purpose, the ranking of the possible values of the competitiveness indicators was carried out and the general assessment was calculated on the basis of the collected and systematized information materials. The research was carried out according to generally accepted methods in vegetable production [3, 8, 13].

Results and discussion.

The genetic potential of sweet pepper plants is quite high for all areas of Ukraine. The state register of plant varieties suitable for distribution in Ukraine is updated every year with new domestic and introduced varieties. Currently, the registered varieties of domestic breeding are the leaders of the Institute of Vegetable and Melon Growing of the National Academy of Agrarian Sciences of Ukraine and the private enterprise "Agrosvit", as well as many introduced hybrids.

Pepper fruit is a multi-seeded berry, which is more often called a pod. By the way, the Latin name of pepper *Capsicum* comes from the word *canca* (box, bag) and is associated with the shape of the fruit. Fruits of different varieties and hybrids have different shapes (from round, flat-round to cylindrical and conical), weight (from 5 to 450 g) and color (from green, white and yellow to orange, red and purple). In Ukraine, the assortment of sweet pepper includes more than 115 varieties and hybrids with red and 34 - yellow fruits.

According to the duration of the growing season (number of days from full sprouting to technical ripeness), all pepper varieties and hybrids are divided into early (less than 100 days), early ripe (100-120 days), medium-ripened (121-135 days) and medium-late and late (more than 135 days). Among the varieties with red fruit color: 19 early-ripening, 19 medium-early, 32 medium-ripening, 2 medium-late; varieties with yellow fruits - 7 early, 6 mid-early, 8 mid-ripening and 3 late-mid; 40 varieties suitable for growing in closed soil. The number of varieties changes every year, so this time we did not find 10 varieties in the list, but it contains varieties that are recommended from year to year and for quite a long time, but this does not mean that they have advantages in terms of a set of indicators. For most varieties, only partial economic and commercial characteristics are given, and for some - completely absent. Indicators of economic suitability are limited by the average weight of fruits, chemical composition, marketable yield, early production, wall thickness and tasting evaluation are sometimes given, the direction of use is limited by two phrases: "universal purpose" and "fresh consumption". Of the varieties registered for 2023, more than 24 do not have even a minimal description or only partial data on yield or chemical composition are given, there is no information on organoleptic evaluation at all, nor is dormancy studied, only for half of them the recommended growing area is indicated. There are also inconsistencies in the definition of the ripeness group of varieties, or it is not specified at all, therefore, for some varieties, the ripeness group, economic and merchandising properties were established on the basis of generalized literature data.

On the basis of the State Register, a grouping of sweet pepper varieties of the early ripeness group, suitable for distribution in Ukraine as of 2022-2023, was carried out (Table 1).

Table 1

Grouping of sweet pepper varieties as of 2022-2023

Ripeness group	Growing area		
	Polissya	Forest Steppe	Step
Early	9	10	11

The fundamental difference between varieties of the early ripeness group in productivity, biometric characteristics, nutritional value, according to the data of variety testing generalized for Ukraine (Table 2). There is no fundamental difference between varieties grown in different soil and climate zones. When

analyzing the chemical composition of the assortment of early-ripening pepper fruits, it was noted that there is a difference depending on the sample. The averaged data of the qualification examination of the main indicators of the chemical composition of sweet pepper are shown in Table 2.

Table 2

Comparative economic and commodity evaluation of sweet red pepper varieties of the early ripeness group

Soil and climate zone	Marketable yield, t/ha	Average fruit weight, g	The average thickness of the fruit walls, mm	Chemical composition			
				dry matter, %	total sugar, %	vitamin C, mg/100 g	nitrates, mg/kg
Step	49,9	132,9	6,2	7,5	5,6	149,2	65
Forest Steppe	54	135,7	6,4	7,6	5,5	146,8	69
Polissya	52,4	121,7	5,8	7,3	5,3	153,8	74
Average	52,1	130,1	6,1	7,5	5,5	149,9	69

The average data of the examination of the main indicators of sweet pepper indicate a yield in the range of 49.9-54.0 t/ha, the average weight of the fruit is 121.7-135.7 g. The following indicators were obtained by cultivation zones: in the Steppe, the average yield is 52, 1 t/ha, and fluctuates within, Steppe – 49.9 t/ha, Forest Steppe – 54.0, Polissya – 52.4 t/ha. The fruits of different pepper varieties differ in size, shape and color.

An important indicator for consumers and the processing industry is the thickness of the walls. This indicator, depending on the zone, is 5.8-6.4 mm. Pepper fruits are characterized by two stages of ripeness - technical and biological. In the stage of technical ripeness, the fruits meet the requirements of technical processing, are well transported and have the ability to ripen. With the onset of biological ripeness, the amount of nutrients in the fruit increases compared to the technical one, the color changes to red or yellow, the best culinary and organoleptic conditions are achieved.

According to literature data, the fruits of sweet pepper have large differences in chemical composition. So, dry substances in pepper fruits are from 7.3 to 7.6%, of which 27.0–53.7% are sugars, 1.8–9.3% are starch, 9.7–24.1% are fiber, 4.0–13.1% – pectin substances, vitamin C – 149.2–153.8 mg/100 g of raw substance. The maximum content of both sugars and ascorbic acid is observed in fruits of biological ripeness.

The average nitrate content by soil and climatic zones is 69 mg/100 g of raw material. The difference between the zones is insignificant and the products are safe. The average performance between the samples was different, the more promising according to this indicator are the samples: Aden, Atlant, Barbie F₁,

Danai, Denis F₁, Gypsy F₁, Red Knight F₁, Lungi F₁, Monanta, Pritavit F₁, Raphaela F₁, Samander, Scrivia and Slavi F₁ (Table 3).

According to the tasting evaluation, all varieties of sweet pepper have high organoleptic indicators - 4-5 points, but there is no information on how they change during storage, which requires further research. Better indicators were noted in the following varieties: Aden, Atlant, Danai, Denis F₁, Dimentio F₁, Monanta and Telestar F₁.

Among such a variety of fruits of varieties of sweet red pepper, it is impossible to clearly single out the best varieties, since some varieties can provide a high yield, but are characterized by low consumption properties, which makes them unattractive to the consumer, or, on the contrary, have a low yield with high nutritional and biological value, which is disadvantageous for manufacturer. Therefore, such an integral indicator as the competitiveness of a variety should be considered only through the prism of additivity.

According to the conducted research, no variety meets the desired criteria, most varieties have good taste qualities (Table 3). It is impossible for breeders to achieve 100% assessment of all indicators, but it is necessary to strive for 60-80%, that is, a competitiveness coefficient of 0.6-0.8, and varieties with low indicators should not be included in the State Register.

From the group of early-ripening varieties of sweet pepper, it is worth noting the large-fruited and thick-walled varieties Scrivia, Denis F₁ and Krasnyi Rytsar F₁ (Kk=0.65 - 0.70).

Table 3

Rating evaluation of sweet red pepper fruits of common early ripening varieties and hybrids

Variety or hybrid	Estimated rank scores of indicators						Σ points	Coefficient of competitiveness	Rating of variety or hybrid
	commodity harvest	average fruit weight	the average thickness of the fruit walls	a comprehensive indicator of the content of nutrients	tasting assessment	the production cost of a unit of production			
Aden	5	3	3	5	5	5	26	0,60	5
Amulet	4	3	3	5	4	4	23	0,54	8
Atlant	5	5	3	3	5	4	25	0,59	6
Barbie F ₁	5	4	3	5	4	4	25	0,59	6
Danay	5	3	3	5	5	5	26	0,60	5
Denis F ₁	5	5	4	5	5	4	28	0,66	2
Gypsy F ₁	5	3	2	3	4	4	21	0,49	10
Dimentio F ₁	4	3	3	5	5	4	24	0,55	7
Zlahoda F ₁	4	3	3	5	4	4	23	0,54	8
Quadri F ₁	4	3	2	4	4	4	21	0,49	10
Red Knight F ₁	5	5	4	4	4	5	27	0,65	3
Lungi F ₁	5	3	2	4	4	4	22	0,51	9
Monanta	5	3	2	1	5	5	21	0,49	10
Prytavit F ₁	5	4	3	5	4	4	25	0,59	6
Raphaela F ₁	5	3	2	5	4	4	23	0,54	8
Samander	5	3	2	5	4	4	23	0,54	8
Scrivia	5	5	5	5	4	5	29	0,70	1
Slavi F ₁	5	3	2	5	4	4	23	0,54	8
Telestar F ₁	4	5	4	5	5	4	27	0,64	4

As a result of a comprehensive rating evaluation of early ripening pepper fruits, the most promising samples were identified (in descending order of competitiveness): Scrivia, Denis F₁, Red Knight F₁, Telestar F₁, Aden, Danai, Atlant, Barbie F₁, Prytavit F₁, Dimentio F₁, Amulet, Rafaela F₁, Samander, Slavi F₁, Zlagoda F₁, Lungi F₁, Gypsy F₁, Quadri F₁ and Monanta.

Conclusions and suggestions.

Sweet pepper fruits of early varieties are valuable food products with high biological value for fresh consumption and for processing. According to a complex of economic, functional and economic indicators, the highest competitiveness has the following varieties: Scrivia, Denis F₁, Krasnyi Rysar F₁, Telestar F₁, Aden and Danai. When assessing competitiveness, all indicators should be considered comprehensively, because economic, merchandising and economic characteristics are closely dependent on each other. Therefore, it is advisable to reduce the list of varieties and hybrids of sweet pepper at the expense of low-value uncompetitive varieties, which will lead to the expansion of planting areas and an increase in the yield of high-value, competitive varieties both on the domestic and international markets. The economic and commercial assessment of new varieties and hybrids should be transferred to research institutions and varieties that do not have a full assessment of their economic, consumer and biological value should not be included in the Register.

List of references:

1. Войцехівський В.І., Гопчак В.О. Стабільність деяких показників хімічного складу плодів перцю різних сортів та гібридів вирощених в Україні. *Наук. Вісн. Національного аграрного університету*. 2008. 118. 84-89.
2. Городний Н.М. Плодоовощные ресурсы и их медико-биологическая оценка / Н.М. Городний, М.Я. Городняя, В.В. Волкодав, И.Т. Матасар, А.В. Быкин. К.: ООО "Алефа", 2002. 468.
3. Данильян О.Г., Дзьобань О.П. Методологія наукових досліджень: Підручник. Х.: «Право», 2019. 386.
4. Завадська О.В., Войцехівський В.І. Порівняльна характеристика якості плодів перцю солодкого із закритого ґрунту. *Електронний вісник НАУ*. 2006. 6.
5. Куракса Н.П. Параметри адаптивності перцю солодкого. *Овочівництво і баштанництво*. 2014. 60. 155-166.
6. Колтунов В.А., Метельська Н.С., Бровенко Т.В. Господарська і товарознавча оцінка яблук зимових сортів. *Харчова наука і технологія*. 2014. 4. 76-81.
7. Колтунов В.А., Гіджеліцький В.М., Мазур В.А. Ресурсний потенціал сортаменту і конкурентоспроможність осінніх плодів груші України. *Товарознавчий вісник*. 2013. 6. 164-176.
8. Колтунов В.А. Якість плодовоовочевої продукції та технологія її зберігання. У 2 ч. Ч. I: Якість і збереженість картоплі та овочів: монографія К.: Київ. нац. торг.-екон. ун-т, 2004. 568.
9. Методика дослідної справи в овочівництві і баштанництві; За редакцією Г.Л. Бондаренка, К.І. Яковенка. Х.: Основа, 2001. 369.
10. Осика В.А., Бабіч О.В. Якість та конкурентоспроможність винограду, що реалізується на ринку України. *Сучасні проблеми товарознавства: зб. наук. пр.* К.: КНАУ, 2001. 18-26.
11. Сидоренко О.В. Товарознавчі складові ринкознавства: навч. посібн. К.: ВЦ КНТЕУ, 2001. 241.
12. Сич З.Д., Сич І.М. Гармонія овочевої краси та користі. К.: Арістей, 2005. 192.
13. France J., Thornley J.H.M. Mathematical Models in Agriculture: Quantitative Methods for the Plant, Animal and Ecological Sciences. CABI, 2007. 906.
14. Voytsekhivskyy V.I. Nutrient value of the sweet pepper grown in conditions of the Ukraine. *European society for new methods in agriculture research XXXIV Annual ESNA Meeting. IASI-ROMANIA, (10-14September)*. 2006. 73.
15. Voitsekhivskiy V., Denisyuk V., Slobodyanik G. et. al. Variety features of nitrate accumulation in fruits of sweet pepper. *International Scientific Periodical Journal "Modern Scientific Researches"*. Belarus. 2021. 15(1). 134-137.