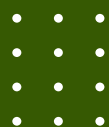


Edited by S. Stankevych, O. Mandych

MODERN TRENDS IN AGRICULTURE SCIENCE: PROBLEMS AND SOLUTIONS



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IN AGRICULTURAL SCIENCE:
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Edited by S. Stankevych, O. Mandych

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Oleksandr KUTS, Ph.D., leading of science collaboration, Director of the Institute of Vegetable Growing and melon growing of NAAS of Ukraine.

The monograph is a collection of the results of actual achievements of domestic agricultural scientists, obtained directly in real conditions. The authors are recognized experts in their fields, as well as young scientists and postgraduate students of Ukraine. Research is conceptually grouped at 7 sections: Plants protection and quarantine; vegetable growing in open and closed ground; horticulture, fruit growing, viticulture; breeding and seed production; agrochemistry and soil science; agriculture and modern agricultural technologies; management and strategies for future development. The monograph will be interesting for experts in plant breeding, economics, plant protection, selection, agrochemistry, soil science, scientific workers, teachers, graduate students and students of agricultural specialties of higher education institutions, and for all those who are interested in increasing the quantity and quality of agricultural products.

Keywords: agriculture, modern technologies, plants protection, quarantine, vegetable growing, horticulture, fruit growing, viticulture, breeding and seed production, agrochemistry, soil, management, strategies, development.

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**FORMATION OF THE YIELD AND PRODUCT QUALITY OF
BROCCOLI CABBAGES DEPENDING ON THE
CHARACTERISTICS OF THE HYBRID IN THE CONDITIONS OF
THE LEFT BANK FOREST STEPPE OF UKRAINE**

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The paper presents the results of a study on the yield and quality of products of early-ripening and medium-ripening hybrids of foreign breeding broccoli, which are grown by the seedling method on typical heavy loam chernozem on forest-like loams in the conditions of the Left Bank Forest Steppe of Ukraine.

An important indicator of the efficiency of cultivation technology is the yield level. Increasing the yield level and obtaining high-quality commercial products of broccoli is possible only with the introduction of new hybrids into production, which will be adapted to the weather and climate conditions of the growing area. It was established that the yield and quality of broccoli depended on the characteristics of the hybrids Batavia F1 (15.4 t/ha) and Batory F1 (14.6 t/ha), hybrids are characterized by high yield and good quality indicators of broccoli production.

The results of the study show that when assessing the economic efficiency of growing broccoli, the level of profitability is in the range of 59-126%. It should be noted that the level of profitability of early-ripening hybrids was somewhat higher compared to mid-ripening hybrids. The highest level of profitability was when growing the Batavia F1 hybrid and was 126%.

Key words: *broccoli cabbages, hybrid, productivity, quality, profit, profitability.*

Introduction. *Actuality.* Vegetable growing, as a branch of agriculture, is an important component of the agro-industrial complex of Ukraine. It is vegetable plants that provide the population with valuable food products, and industry is the raw material. To date, about 452 ths. ha. of cultivated land in Ukraine is occupied by vegetable crops, and the gross production is 9.7 million tons [1].

Among vegetable crops, cabbage, broccoli occupies insignificant areas (1.4 thousand hectares). However, the demand for it is constantly growing, and the cultivated areas are increasing every year. Broccoli are classified as promising crops that are suitable for industrial processing and the production of frozen semi-finished products. Broccoli is suitable for cultivation in all soil and climatic zones of Ukraine. Areas allocated for broccoli and cauliflower make up 1.2% of the total area of vegetable crops in Ukraine. The average yield of broccoli cabbage in Ukraine is 16.1 t/ha [1].

The food market of Ukraine requires an expansion of the assortment of vegetable crops, and broccoli occupies a worthy place among them. Stable production of broccoli cabbage in Ukraine is possible only under the condition of improvement and introduction of the latest approaches to the technology of its cultivation. An important condition for increasing the yield and quality of broccoli products is the selection of hybrids that are adapted to certain soil and climatic conditions. The main requirements that producers set for modern varieties and hybrids of broccoli for industrial production are as follows: high yield, dense heads (inflorescences), high quality and longness of inflorescences, suitability for the fresh market and processing, plasticity and resistance to stressful situations.

The methods and elements of the technology of growing broccoli in the conditions of the Left Bank Forest Steppe, the assortment of new hybrids, as well as those that have already proven themselves well over the years, remain insufficiently studied.

The purpose of experimental research is to study the characteristics of plant growth and development, the formation of the yield level of broccoli, which depends on the characteristics of the hybrid. To determine the economic and biological effectiveness of the technology of growing broccoli, to select hybrids of broccoli for the conditions of the Left Bank Forest-Steppe of Ukraine, in order to obtain high yields of high-quality products.

Analytical review of literature. Broccoli cabbage (*Brassica*

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cauliflorassp. Simplex Lizg.) is a type of cauliflower. It is an annual vegetable plant of the cabbage family. The plants reach a height of 70-100 cm or more. The stem is fleshy, ending in a loose inflorescence (head). Broccoli has increased repair properties. It consists in the fact that after cutting the central head in the axils of the leaves, sleeping buds quickly wake up and after 10-20 days, new inflorescences of smaller sizes are formed on their shoots, which increases the yield to 100% or more. This feature of broccoli cabbage is increasingly used by farms to obtain additional products.

Broccoli is an important food product. It has received world recognition thanks to its valuable food and medicinal properties. The annual rate of consumption of cauliflower and broccoli is 5-6 kg. Among the many crops of the cabbage family, broccoli is considered one of the tastiest. It contains vitamins of group B, vitamins E, A, PP, K, C and U. Broccoli contains more vitamin C than lemons and oranges. In addition to vitamins, broccoli contains macro and micronutrients such as potassium, calcium, magnesium, sodium, manganese, phosphorus, iron, zinc, selenium and copper. The energy value of broccoli is low and is 126 kJ/100 g. It is an important dietary food product for people of all ages [2].

In addition, broccoli plants are not very picky about growing conditions, which makes it possible to grow them in different soil and climatic conditions. Broccoli is one of the cold-resistant plants in terms of heat requirements. Its seeds germinate at a temperature of 4...5 °C, and at 18...20 °C friendly seedlings are obtained on the 3-4th day after sowing. The optimal temperature for the growth and development of broccoli is 16...20 °C.

Broccoli cabbage belongs to the first group in terms of demand for moisture - it is very demanding for both soil and air moisture. Broccoli has an increased rate of water consumption. To obtain high yields of standard quality, it is necessary to maintain humidity in the active layer of the soil at least 75–80 % RH. Broccoli plants grow and develop better when the relative humidity of the air is 80–90 % of its full saturation.

Cabbage is a light-demanding plant and belongs to plants with long daylight hours. A long day accelerates the growth of seedlings and the formation of heads. Broccoli can grow and produce high yields on different types of soil, but the best for it are light loamy soils with a high content of nutrients and a slightly acidic reaction of the soil solution [3].

About 200 varieties of broccoli are known in the world. They differ in the shape of the head. Early ripening varieties form a small, loose central head and at the same time lateral ones in the axils of the leaves. Late

varieties initially form a large and dense central head, while side heads are formed after cutting the central one. According to the duration of the growing season, varieties and hybrids of broccoli are divided into early (up to 110 days), medium-ripening (111-120 days) and late-ripening (over 120 days) [4].

The yield and qualitative biochemical indicators of broccoli depend on many factors, among which the selection of the assortment plays an important role. Improvement of varietal resources is an important condition for increasing the productivity of vegetable crops, improving the quality of products due to increasing the content of valuable nutrients. Varieties and hybrids are adapted to the climate and are resistant to the most common diseases - this is the basis of a high, environmentally safe harvest.

The range of varieties and hybrids recommended for cultivation in Ukraine and included in the State Register of plant varieties suitable for distribution in Ukraine is 32 hybrids, of which 28 hybrids are recommended for cultivation in open ground. In the register, there are missing varieties and hybrids of broccoli of domestic selection, therefore, only foreign selection is used in production. Broccoli hybrid producers are represented by the following countries: Netherlands, Japan, France, Czech Republic, Korea, Italy, Germany. The Netherlands is the leader in terms of assortment [5].

Object, subject and methods of research. The research was conducted in 2021 at the experimental field of the department of fruit and vegetable production and storage of plant products of the State Biotechnology University, which is located in the territory of the Kharkiv district, the soil and climatic conditions of the field are typical for the Left Bank Forest Steppe zone of Ukraine.

The topography of the region is dominated by undulating plains with river valleys, ravines and ravines. The topography of the area where the research was conducted is characterized as flat and undulating.

According to the weather station of KhNAU nd. a. V.V. Dokuchaev, the climate of the region where the experimental field is located is temperate-continental with unstable humidity and air temperature. The average long-term air temperature is 7.2 °C. The lowest air temperature was observed in January. According to the amount of precipitation, the territory of the experimental field belongs to the zone of insufficient moisture 529 mm of precipitation falls per year. The largest amount of precipitation – 767 mm was observed, which is 145% of the norm. The lowest amount of

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precipitation was observed - 342 mm, which is 65% of the norm [6].

The soil of the experimental field is a typical heavy loam chernozem on loess loams.

Field experiments were conducted according to generally accepted methods: according to V.F. Moiseichenko [7], G.L. Bondarenko [8], A.O. Rozhkov [9]. Soil preparation for cabbage and plant care were carried out in accordance with generally accepted recommendations. The research was conducted with early-ripening broccoli hybrids Agassi F1, Besti F1, Batavia F1 (control - Agassi F1) and medium-ripening Orantes F1, Batory F1, Larson F1 (control - Orantes F1), which are included in the State Register of Plant Varieties Suitable for Distribution in Ukraine [5].

Broccoli was grown by the seedling method. Seeds of early-ripening hybrids were sown in the third decade of March, and of medium-ripening hybrids in the second decade of April. Seedlings with three to four true leaves were planted at the age of 40-45 days. The term for planting seedlings of early-ripening hybrids is the second decade of May, and mid-ripening hybrids - the third decade of May. The method of placing plants is tape with a placement scheme - (40+100)x35 cm. Plant density - 40.8 ths. pcs./ha. Repeatability in experiments is three times. The experiment is univariate. The area of the accounting plot is 19.6 m². The placement of options is systematic. The predecessor is a carrot.

According to methods in vegetable growing, phenological observations were made, namely, the dates of sowing, emergence of seedlings, appearance of the first true leaf, diving, planting of seedlings, formation of productive organs, beginning of technical ripeness, beginning and end of harvesting were determined. The beginning of the phase was recorded when it was noted in 10% of the plants on the plot, in mass - in 75%.

Biometric measurements were taken every 15 days, on the first and sixteenth of the month. At the same time, to determine the dynamics of mass growth, the following measurements were taken: the diameter of the stem near the soil surface, the height of the plant, the number of leaves, the size of the leaf rosette, the size of the leaf plate.

Harvesting was carried out selectively as the heads formed and reached technical maturity. At the same time, the heads were weighed and divided into commercial and non-commercial products. Commercial products were divided into standard and non-standard according to the requirements of the current standard - "Fresh broccoli cabbage: technical conditions" - DSTU 8147 - 2015" [10]. The biochemical composition of the

heads was determined, namely the content of dry matter, total sugar, and ascorbic acid. Harvest accounting was carried out separately for each plot. At the same time, to determine the quality of products, the mass of the central head, the diameter of the central head, and the total mass of the side heads were determined.

Characteristics of the researched of hybrids broccoli:

Agassi F1. This is an early hybrid of broccoli. There is a harvestable hybrid for cultivation from the end of May to the beginning of September. Vegetation period - 65-75 days. It is suitable for cultivation in all regions of Ukraine. It tolerates a hot climate well. Inflorescences are not prone to negative reactions to stress factors. To ensure the conveyor, it is recommended to plant seedlings in several periods (with an interval of 7–10 days). The recommended stand density is 40-45 ths. plants per hectare. This hybrid is characterized by its resistance to heat [11].

Besti F1. This is a mid-early hybrid of broccoli. Vegetation period - 55-60 days from planting seedlings. The heads are compact, dense, weighing 1.2-1.5 kg. It is undemanding to growing conditions, tolerates adverse weather conditions and lack of nitrogen in the soil quite well. It is resistant to high temperatures. This is for growing in the spring-summer period. It is recommended to collect in May - August. Purpose: fresh market. The recommended planting density is 40-45 thousand plants/ha. It is recommended to collect in May - August. It is universal. This is an ideal form for the fresh market [12].

Batavia F1. This is an early hybrid of the Dutch company Bejo Zaden B.V. Vegetation period — 65-68 days from planting seedlings. The hybrid forms fairly marketable, dark green, elastic, dense heads weighing 1.0-1.5 kg with a fine-grained structure. The hybrid is highly productive and is in demand on the market. It is characterized by high transportability and lightness. It is resistant to fusarium wilt and cracking. It differs in its resistance to stressful growing conditions and heat resistance. It can be grown by seedling method and by direct sowing in open soil. Purpose: fresh consumption and for processing [13].

Orantes F1. This is a mid-ripe broccoli hybrid from the producer Rijk Zwaan. The vegetation period after planting seedlings is average (60-75 days). Dense is a compact inflorescence. High productivity. Uniformity and marketability of inflorescences. There is resistance to stressful conditions. Its head is quite massive, weighing up to 0.5 kg. The optimal growing time is the end of summer and autumn. There is a long period of standing in the field. It is easy to harvest. Recommended thickening - 40-45 ths. plants/ha.

It is suitable for fresh consumption and processing [11].

Batory F1. It is medium ripe. The owner is Syngenta Seeds B.V. Vegetation period — 70–75 days from planting seedlings. The heads are compact, leveled, dome-shaped, dense with a good weight of up to 1.8-2 kg. It is universal. It can be grown both indoors and outdoors. It has high resistance to high temperatures. For growing and harvesting from mid-August. Purpose: fresh market, processing. It is characterized by high qualities of transportation. The hybrid is well stored without losing its appearance (color and freshness). The recommended planting density is 35–40 ths. plants/ha [12].

Larson F1. This is a mid-season hybrid of broccoli from the producer Rijk Zwaan. There are very dense inflorescences of dark green color. Vegetation period — 70–80 days. The plant has high growth energy and a powerful root system. The hybrid is suitable for autumn harvesting. There is high resistance to stress. The recommended density is 40-45 ths. plants per hectare. Recommended for fresh market and processing [11].

Results of research

The influence of weather conditions of the growing season on the growth and development of hybrids broccoli

The land area where the research was conducted is located in the zone of medium insufficient moisture. The meteorological factors of this zone are rather unstable. According to the long-term data of the agrometeorological station located on the experimental field, the average annual precipitation is 522 mm-253 mm in acutely dry years, up to 804 mm in excessively wet years. The minimum amount of precipitation falls in February, the maximum - in June, July, August.

The average annual precipitation is distributed as follows: in winter - 16-20%, in spring - 22-25%, in summer - 35-40%. In autumn - 35-40%. The accumulation of moisture in the soil depends mainly on autumn and winter precipitation, the amount of which reaches 40% of the annual amount.

Temperature determines. All phenomena and processes in the organic and inorganic world are directly related to the temperature conditions of the environment. The air temperature determines the nature and mode of the weather. The annual course of air temperature is typical for a temperate continental climate, it is determined by a warm summer with the usual amount of moisture and not a cold winter with thaws.

In the year of the experiment, during the growing season of broccoli, hot weather was observed (Fig. 1). The highest air temperature was in the

first decade of July (26.1°C) and the first decade of August (26.2°C), which exceeded the long-term average by 5.9°C and 5.7°C, respectively. During the period of growth of vegetative mass (May-June), the temperature was optimal for the growth and development of broccoli was within 16-22 °C.

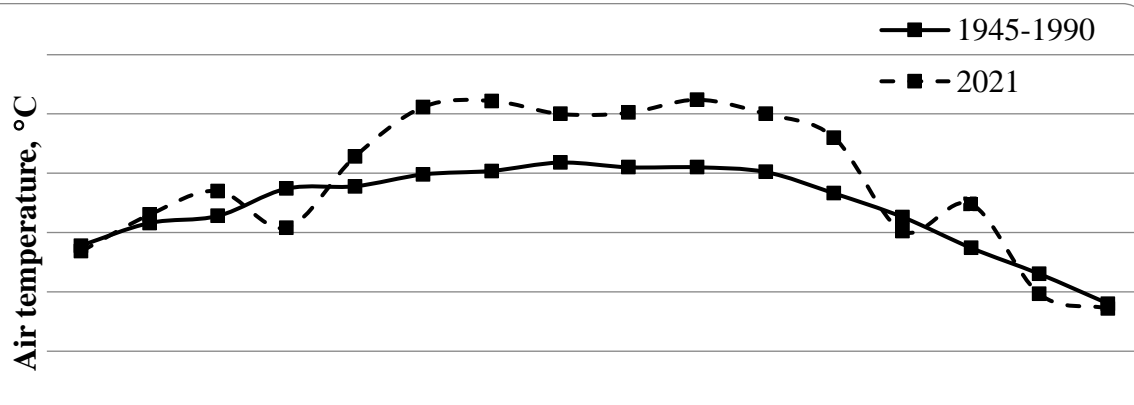


Fig. 1. Air temperature during the growing season of broccoli cabbage, °C

Mode of moisturizing. According to the amount of precipitation, the territory of the experimental field belongs to the zone of insufficient moisture. An average of 389 mm of precipitation falls per year. The largest amount of precipitation is observed in June-July.

The year 2021 was dry, and rainfall unevenness was observed over decades during the growing season (Fig. 2). Broccoli belongs to plants demanding soil moisture. Therefore, the insufficient level of moisture was compensated with the help of drip irrigation.

Hydrothermal coefficient was used to characterize moisture during the growing season of broccoli G.T. Selyaninov (GTK). This indicator has an advantage over others - it characterizes not only the profitable part of the water balance (precipitation), but also the unproductive consumption of moisture (evaporation from the surface of the soil, vegetation). It was established that the GTK in 2021 was 0.7, which characterized the weather conditions as moderately arid.

As a result of research conducted with hybrids of broccoli, it was found that plants differed in growth and development during the growing season, and the course of phenological phases in plants depended on the terms of ripeness and the hybrid, as well as on the weather conditions of the year (Table 1).

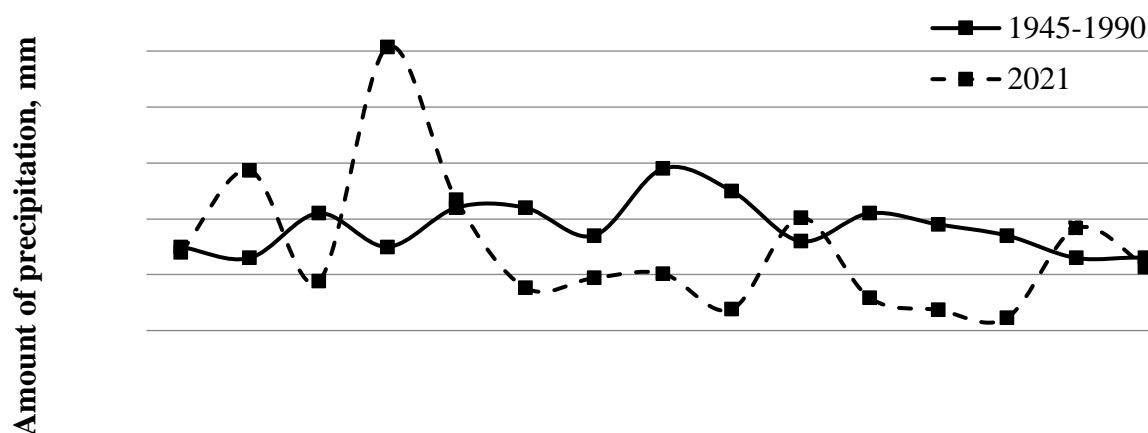


Fig. 2. The amount of precipitation during the growing season of broccoli cabbage, mm

Table 1

Dates of the onset of the phenological phases of the development of broccoli cabbage plants (2021)

Hybrid	Maturity group	Year	Planting of seedlings	Formation of productive organs		Technical maturity		The growing season
				beginning	mass	beginning	mass	
Agassi F1 (control)	ER	2021	14.05	13.07	15.07	17.07	23.07	70
Batavia F1	ER	2021	14.05	11.07	13.07	14.07	17.07	64
Besti F1	ER	2021	14.05	10.07	14.07	14.07	17.07	64
Orantes F1 (control)	MR	2021	25.05	29.07	02.08	02.08	11.08	78
Batory F1	MR	2021	25.05	05.08	10.08	11.08	15.08	82
Larson F1	MR	2021	25.05	06.08	10.08	11.08	15.08	82

During phenological observations, it was established that the growing season from planting seedlings to mass technical maturity depended on the weather conditions of the year and was within 64-70 days for the group of early-ripening hybrids. The Agassi F1 hybrid was distinguished by a longer growing season, which was 70 days. In the group of medium-ripe hybrids, the vegetation period lasted 78-82 days, the Orantes F1 hybrid had a shorter vegetation period, compared to other variants, which was 78 days.

The qualitative indicators of the formation of a marketable crop of broccoli depend on the characteristics of the hybrid

When growing rare vegetable plants, which include broccoli, it is important to obtain high-quality products. The quality of the fruits of broccoli grown in open ground, which are harvested and sold for fresh consumption and for industrial processing, is regulated by DSTU 8147 - 2015 "Fresh broccoli: Technical conditions" [10]. According to this standard, the fruits of broccoli must correspond to the shape and size, taste and smell characteristic of this botanical variety, as well as be fresh, clean, whole, healthy, without damage by pests.

Research has established that all broccoli cabbage hybrids had high product quality. It should be noted that the productivity of broccoli plants depended on the mass of the central head. In particular, the mass of the central head in the experimental variants was in the range of 180.0-236.6 g (Table 2). A greater mass of the central head was noted in the group of early-ripening plants in the hybrid Batavia F1 - 236.6 g, which was 56.6 g more than in the control variant, and in the group of medium-ripening plants Batory F1 - 214.4 g, which was 5 g more was more from control.

An important component of the technology of growing any agricultural crop, including broccoli, is the correct choice of hybrid. One of the main indicators of the effectiveness of cultivation technology is yield.

Characterizing the yield of hybrids broccoli, we can say that the lowest yield was obtained when growing the hybrid Larson F1 – 11.4 t/ha. The highest yield of marketable heads was provided by the hybrid Batavia F1 - 15.4 t/ha. Plants of the early-maturing hybrid Batavia F1 and medium-maturing hybrid Orantes F1 were distinguished by a larger diameter of the central head - 12.0 and 12.4 cm, respectively.

According to the results of dispersion analysis, the yield of broccoli during the research depended on the characteristics of the hybrid by 65-74%. In the group of early ripening plants, according to the data obtained in 2021, the hybrid Batavia F1 exceeded the control variant in yield by 3.2 tons, such a difference was significant ($SSD_{0.5}=2.82$). Among the plants of medium maturity, a significantly higher yield was obtained in the hybrid Batory F1 (14.6 t), which was 2.9 t ($SSD_{0.5}=2.06$) more than in the control variant.

Quality indicators of the yield of broccoli depending on the hybrid (2021)

Hybrid	Maturity group	Mass central heads, g	Diameter central heads, cm	Total mass of lateral heads, g	Yield, t/ha
Agassi F1 (control)	ER	180.0	11.6	118.8	12.2
Batavia F1	ER	236.6	12.0	134.1	15.4
Besti F1	ER	220.4	11.7	72.0	11.9
SSD _{0.5}	ER				2.82
The influence of the factor, %	ER				65
Orantes F1 (control)	MR	209.4	12.4	78.3	11.7
Batory F1	MR	214.4	11.5	88.5	14.6
Larson F1	MR	203.9	11.4	82.4	11.4
SSD _{0.5}	MR				2.06
The influence of the factor, %	MR				74

Biochemical composition of heads of broccoli depending on the characteristics of the hybrid

The content of the components of the chemical composition in the heads of broccoli determines their nutritional and dietary value. The content of one or another component in the product depends on the characteristics of the hybrid and the weather conditions during which it is formed. Broccoli heads contain sugars, fiber, starch, vitamins B1, B2, B6, B12, PP, E, K, C, β -carotene and mineral salts of calcium, potassium, phosphorus, magnesium, iron, and sodium.

It was established that the content of the components of the chemical composition in the heads of broccoli depends on the characteristics of the hybrid (Table 3). Within the studied hybrids, the products differed in terms of biochemical parameters. The content of dry matter is an important indicator of vegetable products, it determines the nutritional value, quality

and price. In our research, the content of dry matter in the central heads was in the range of 11.4–20.73%, depending on the hybrid, and a larger amount of them accumulated in the heads of the medium-ripe hybrid Orantes F1 - 20.73%. The total sugar content of hybrids ranged from 2.32 to 3.50%. Batavia F1 and Agassi F1 had a higher amount of ascorbic acid in the central heads.

Table 3

Biochemical composition of broccoli depending on the hybrid

Hybrid	Maturity group	Dry matter, %	Total sugar, %	Ascorbic acid, mg/100 g
Agassi F1 (control)	ER	11.4	2.40	78.9
Batavia F1	ER	12.6	3.50	80.9
Besti F1	ER	14.6	2.32	76.3
Orantes F1 (control)	MR	20.73	3.13	24.08
Batory F1	MR	16.62	3.04	25.29
Larson F1	MR	16.90	2.72	30.91

Economic indicators of the cultivation of broccoli

Economic efficiency involves achieving the maximum effect from the economic activity of enterprises with minimal expenditure of resources. The primary indicator of the effectiveness of the technology of growing vegetable products is yield. The level of productivity reflects the influence of economic and natural conditions, as well as the quality of organizational and economic activities in the cultivation of agricultural crops.

Market prices of 2021 were used when calculating the economic efficiency of growing broccoli. The cost of one liter of diesel fuel was 48 UAH. The wholesale price of production for early-ripening hybrids was 25 UAH/kg, which ensured the value of the crop in the range of 294.5-305 ths. UAH/ha. For medium-ripe hybrids, the price was 20 UAH /kg, and the cost of the crop was 228-292 ths. UAH/ha (Table 4). When calculating production costs, such indicators as wages, the cost of seeds, mineral fertilizers, plant protection products, fuel and lubricants, irrigation costs (electricity), depreciation, land lease were taken into account. For early-ripening hybrids, production costs were in the range of 139.6-170.3 ths. UAH/ha, for mid-ripening hybrids - 132.5-147.6 ths. UAH/ha.

In our research, the economic efficiency of growing broccoli products was evaluated based on the analysis of production costs and the value of the

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crop, that is, the level of profitability was determined. The vegetation period of early-ripening hybrids was shorter, compared to mid-ripening hybrids, and marketable products arrived earlier and the sales price was higher, so their profitability was in the range of 107-126%. The higher level of profitability was when growing the hybrid Batavia F1 and was 126%. In the group of medium-ripe hybrids, the profitability of growing was 59-84%, and its highest level was when growing the hybrid Batory F1 -84%.

Table 4

Economic efficiency of using a complex of technology elements for growing broccoli

Research variant	Yield, t/ha	Sales price, ths. UAH/t	Harvest value, ths. UAH/ha	Production costs, ths. UAH/ha	Net profit, ths. UAH/ha	Cost of production, ths. UAH/t	Profitability %
early ripening hybrids							
Agassi F1 (control)	12.2	25	305	147.2	157.8	12.1	107
Batavia F1	15.4	25	385	170.3	214.7	11.1	126
Besti F1	11.9	25	294.5	139.6	154.9	11.7	111
medium ripe hybrids							
Orantes F1 (control)	11.7	20	234	147.6	86.4	12.6	59
Batory F1	14.6	20	292	158.9	133.1	10.9	84
Larson F1	11.4	20	228	132.5	95.5	11.6	72

Conclusions

1. Yield and qualitative biochemical indicators of broccoli depend on many factors. Among them, the correct selection of hybrids that will be adapted to certain soil and climatic growing conditions is of great importance. Product yield is an important indicator when evaluating hybrids.

2. The duration of the growing season during the research depended on the characteristics of the hybrid and the maturity period to which it belongs, as

well as on the weather conditions during cultivation. For the group of early-ripening hybrids, this indicator was within 64-70 days. In the group of medium-ripe hybrids, the growing season lasted 78-82 days. In the year of conducting the research, the weather conditions were moderately dry (GTK=0,7).

3. According to the research results, a higher yield of marketable heads has already been ensured: in the early-ripening group - the hybrid Batavia F1 (15.4 t/ha), the yield increase compared to the control was 3.2 t/ha, or 26.2%; in the medium-ripe group - Batory F1 (14.6 t/ha), the yield increase compared to the control was 2.9 t/ha, or 24.7%.

4. According to the results of the dispersion analysis, the yield of broccoli during the research depended on the characteristics of the hybrid by 65-74%.

5. The productivity of broccoli plants depends on the mass of the central head, which in experimental variants was in the range of 180.0-236.6 g.

6. The content of the components of the chemical composition in the heads of broccoli depends on the characteristics of the hybrid. In our research, the medium-ripe hybrid Orantes F1 had a higher content of dry matter in the central heads - 20.73%. The total sugar content of hybrids ranged from 2.32 to 3.50%. Batavia F1 and Agassi F1 had a higher amount of ascorbic acid in the central heads.

7. As a result of the research, when evaluating the economic efficiency of growing broccoli products, it was established that in the group of early-ripening hybrids, the higher level of profitability was when growing the hybrid Batavia F1 and was 126%. In the group of medium-ripe hybrids, the highest level of profitability was when growing the hybrid Batory F1 -84%.

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