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GROWTH AND DEVELOPMENT OF BLUEBERRY VARIETIES PLANTS INTRODUCED IN THE CLIMATIC CONDITIONS OF TASHKENT REGION

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Abstract: The duration of the growing season of blueberry varieties, which are introduced into the conditions of the central climate of Uzbekistan, is in the range of 213-221 days. In this case, the shortest period is 213 days in the Toro and Darrou varieties, the longest period is 220-221 days in the Patriot and Legasi varieties, and the duration of the growing season of the remaining varieties is in the range of 215-218 days.

Keywords: Blueberry, soil, climate, variety, harvest, introduction, seedling, fruit, vegetation period, day, leaf

Introduction

New types of fruits suitable for the climatic conditions of Uzbekistan are being introduced, they are studied on a scientific basis and applied to production. In the new development strategy of the Republic of Uzbekistan for 2022-2026, it is important to “increase the income of peasants and farmers by at least 2 times through intensive development of agriculture on a scientific basis, bring the annual growth of agriculture to at least 5%” defined as strategic tasks.

Blueberry (Vaccinium uliginosum) is a leaf-weaving bush plant belonging to the genus Vaccinium of the Veresca family, today it is an important raw material of the processing industry due to its unique biochemical composition, unparalleled taste qualities, and culinary value and it is becoming the most popular among berries. Currently, it is widespread mainly in the temperate and cold climate regions of the Northern Hemisphere.

The distribution area of the Blueberry plant covers vast expanses, starting from Iceland and Great Britain to the Far East and Japan. Today, it can be found in large-scale cultivation in Spain, Italy, Turkey, and the countries of the Balkan Peninsula, as well as in North America from Alaska to Newfoundland (southern California). Due to its good adaptability nature, extensive scientific and practical work has been initiated for its introduction and industrial cultivation outside these

regions.

The Republic of Uzbekistan is one such country, and in recent years, private entrepreneurs and farms have been trying to introduce and grow blueberries on an industrial basis. However, due to the newness of this plant for the climate of our country and its special demand for soil acidity, there are several shortcomings in the cultivation of blueberry in these farms. This requires conducting deeper scientific research on the introduction of this plant to the climatic conditions of our republic.

Based on the above-mentioned points, during 2020-2022, in the experimental field of the Information and Consulting Center (Extension center) under the Tashkent State Agrarian University, blueberry was selected in the Aurora, Chandler, Duke, Patriot, Toro, Legasi, Darrow and Bluecrop varieties introduced to Uzbekistan. Scientific studies were carried out on the growth and development of plants, the periods and duration of phenological phases in them, and the monitoring of morpho-biological changes during the vegetation period.

Figure 1. An experimental nursery where phenological and biometric indicators of blueberry varieties introduced to Uzbekistan were studied.

In this experiment, 5 plants of each of the introduced cultivars Aurora, Chandler, Duke, Patriot, Toro, Legacy, Darrow, and Bluecrop were planted, and their annual growth height, dates of the beginning and end of the vegetative phases during the growing season, growth phenological observations such as duration of growth, determination of biometric indicators such as total growth length of plants, nature of branching, leaf coverage, leaf shape and size were performed.

Under natural conditions, the wild ancestors of the blueberry and its close relative, the blueberry plant, grow in the temperate forest glades of North America. These regions are

distinguished by the presence of a thick snow cover in winter, a somewhat late arrival of spring, and mild and rainy summer and autumn seasons. In the conditions of our republic, there is less snow cover and spring is a little earlier, that is, the period when the average daily temperature is higher than 10 ℃ begins early.

In contrast to its natural habitats, the early spring in Uzbekistan also affected the awakening of the blueberry. Our experiments on the study of the transition period of phenological phases in the introduced varieties of blueberry showed that bud initiation in these varieties differed by about 15-20 days from the regions where the varieties were obtained by selection.

Our observations showed that Duke, Patriot, Aurora and Bluecrop varieties had the earliest bud initiation in blueberry plants. In these varieties, the tips of the buds first began to split on March 5-6. The Chandler variety was distinguished by the late onset of vegetative buds. In this variety, the first sprouting buds were recorded from the second half of March. In the rest of the varieties (Toro, Legasi and Darrow), buds began to grow in the second ten days of March - from March 10-12. The inter-varietal difference in the date of bud initiation was 2-10 days (see Table 1).

Table 1.

Duration and transition of phenological phases in blueberry varieties (Tashkent region), 2020-2021

Varieties	Phenological phases, date						
	Bulging of buds	First leaf spelling	Start blooming	End of flowering	Ripening of fruits	Full ripening	leaf shedding period
Avrora	07/III	16/III	27/III	12/IV	01/VII	15/VII	08/X
Chandler	15/III	25/III	05/IV	15/IV	04/VII	20/VII	15/X
Duke	05/III	15/III	25/III	05/IV	30/V	10/VI	05/X
Patriot	06/III	14/III	24/III	03/IV	08/VI	19/VI	12/X
Toro	12/III	24/III	03/IV	12/IV	06/VI	25/VI	10/X
Legasi	08/III	19/III	08/IV	16/IV	10/VI	29/VI	13/X
Darrou	10/III	22/III	30/III	09/IV	06/VII	22/VII	08/X
Bluecrop	05/III	16/III	24/III	06/IV	30/V	09/VI	08/X

The information in the above table shows that the date of the first leaves in the plants of blueberry varieties also depends on the budding period. The beginning of the first leaves and the buds' swelling were noted in Duke, Patriot, Aurora, and Bluecrop varieties. The first fully formed leaves of plants of this variety were observed on March 14-16. A very late onset of leaf formation was noted in Chandler and Toro varieties, and this period corresponded to March 24-25. The full formation of the first leaves in Legasi and Darrow cultivars occurred on March 19 and 22, respectively. In general, the intervarietal difference in the date of full formation of the first leaves was 1-9 days.

Blueberry varieties were also differentiated by the flowering period of the plants. The earliest flowering was recorded in Duke, Patriot, Aurora and Bluecrop varieties. In these varieties, the first flowers opened on March 24-27. The latest flowering was recorded in Chandler, Toro and Legacy varieties, and this period corresponded to April 3-8. The beginning of the flowering phase of the Darrow variety coincided with March 30. In general, the intervarietal difference in the flowering phase was 1-14 days.

It should be noted separately that the ripening of blueberry varieties did not depend on the duration of the transition period of the previous phases, but on the biological characteristics of the varieties, i.e. early or late ripening of the varieties, and was differentiated accordingly. In this case, the first ripening of fruits was noted in Duke and Bluecrop varieties, that is, fruits with the color and shape characteristic of the variety were observed on May 30. Aurora, Chandler and Darrow varieties were distinguished by the very late onset of fruit ripening.

The first ripening fruits were observed in the first ten days of July (July 1-6). Patriot, Toro, and Legasi varieties differed in that they started ripening in the middle periods. In these varieties, the first ripening fruits corresponded to July 6-10. In general, the intervarietal difference in the phase of ripening of fruits was 2-38 days.

The phase of full ripening was related to the phase of ripening of fruits. The beginning of this phase, as well as its end, were the first recorded in the Duke and Bluecrop varieties, the fruits were fully ripened on June 9-10. The varieties Aurora, Chandler, and Darrow were distinguished by the very late ripening of fruits. In these varieties, the full ripening of fruits was observed in the second half of July (July 15-22). Patriot, Toro, and Legasi varieties were distinguished by their full ripening in the middle periods. In these varieties, the fruit fully ripened in the second half of June, that is, June 19-29. In general, the intervarietal difference in the phase of fruit ripening was 1-43 days.

Depending on the ripening period information given above, blueberry varieties introduced to the central climatic region of Uzbekistan can be conditionally divided into the following groups according to the ripening period:

a) *early ripening varieties (the first ten days of June) - Duke, Bluecrop;*

b) *mid-ripening varieties (second half of June) - Patriot, Toro, Legasi;*

c) *late ripening varieties (second half of July) - Aurora, Chandler, Darrow.*

The duration of the vegetation period of blueberry varieties introduced to the conditions of the central climate of Uzbekistan was between 213 - 221 days. The shortest period was 213 days in Toro and Darrow varieties. The longest period was 220-221 days in Patriot and Legasi varieties. The duration of the vegetation period of the remaining varieties was between 215 - 218 days. It can be seen that the length of the growing season was almost very close (the maximum difference was 8 days), it did not depend on whether they ripened early or late.

Cold temperatures during winter dormancy are very important for blueberry. Dormancy period for bud differentiation and formation of fruit derivatives of blueberry species is required on average 700-800 hours in its natural distribution areas, and at least 300 hours for common blueberry species and definitely, temperature T < -45 °F. In order to determine the sum of such temperatures under the conditions of our republic, we conducted an analysis in the experimental years (2020-2022). To do this, first of all, you need to convert the temperature from Faringeyt to Celsius. According to the sources, the Faringeyt temperature is converted to Celsius according to the following formula.

(See formula 3.3)

$$T_{(°C)} = \frac{(T_{(°F)} - 32)}{1.8} \qquad (3.3)$$

According to this formula, we can transfer the temperature T < -45 °F, which most varieties of blueberry require during the rest period, to Celsius:

$$T_{(°C)} = \frac{(T_{(°F)} - 32)}{1.8} = \frac{-45 - 32}{1,8} = \frac{-13}{1,8} = -7,2\ ℃$$

It can be seen that a temperature lower than -7 ℃ is necessary for the good wintering of common blueberry varieties and the normal development of shoots in them, and the total sum of hours with this temperature should be 300 hours on average. To calculate the duration of such a period, the night and day temperature fluctuations of December 2022 and January-February 2023 were taken.

The data of Figure 2 below shows that the temperature below -7 ℃, which is required for good wintering of blueberry varieties, was observed mainly during the winter night hours in the conditions of the central climate of Uzbekistan. Only in January 2023, for 1-2 days, an average temperature below -7 ℃ was observed during the day. Adding up these temperature times, their sum totaled an average of 301 hours. This shows that in the central climate of our republic, there are favorable conditions for the wintering of ordinary blueberry varieties (see Fig. 2).

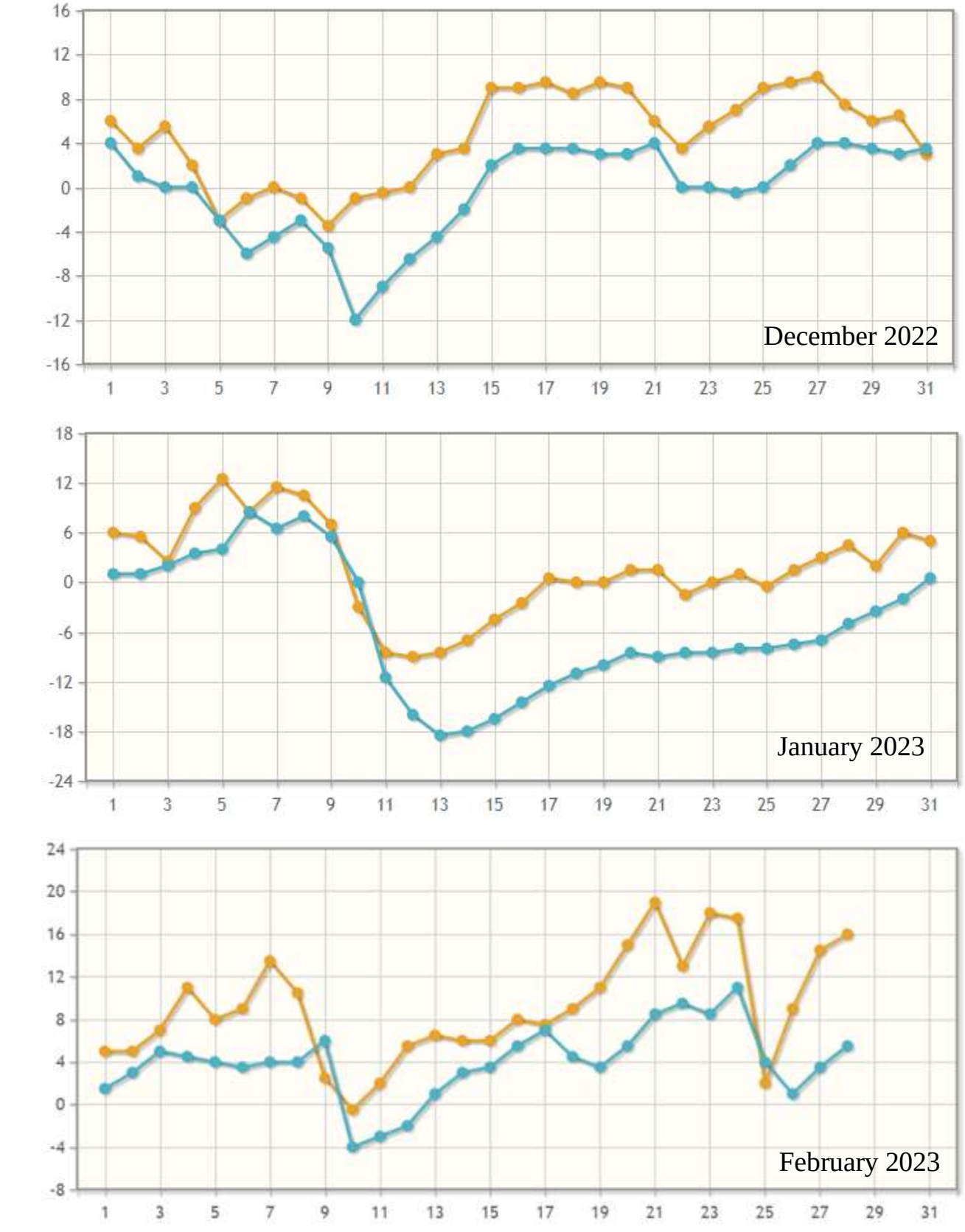


Figure 2. Night and day temperature fluctuations of the research area during the winter rest period, 2022-2023.

In our further observations, indicators of biometric development were also determined in these varieties of blueberry plant introduced to our country. In this experiment, the height of mother plants, first-order branches and fruiting branches, leaf coverage and leaf parameters (length, width and index) were measured in blueberry cultivars. Biometric measurements determined in the third year after transplanting showed that the height of mother bushes of blueberry varieties exceeded at least 75 cm at the age of three. The tallest plants were observed in Darrow and Bluecrop varieties. The average height of plants in these varieties reached 115 and 110 cm, respectively. The lowest plants were observed in Patriot and Toro varieties. The average height of plants in these varieties was 75 and 80 cm, respectively. The average height of the remaining varieties, such as Aurora, Chandler, Duke and Legasi, was in the range of 85-100 cm.

The diameter of the main body of Blueberry plants was in the range of 16.5-23.8 mm. Darrow and Duke varieties stood out with the thickest body. In these varieties, the main body diameter was in the range of 21.07-23.84 mm. The thinnest body was found in Aurora and Toro varieties. In these varieties, the main body diameter was 16.53-16.73 mm. The main body diameter of the remaining varieties differed in the average range of 17.45-19.8 mm.

There was no strong difference between varieties in the number of first-order skeletal branches. In the studied varieties, the first order skeletal branches were formed from 2-3 pieces.

The varieties were differentiated according to the diameter of the first order mother branches. The strongest and strongest branches were found in Duke and Darrow varieties. The diameter of the first-order skeletal branches formed in plants of these varieties reached 18.84-20.04 mm in three-year-old plants. The thinnest first order mother branches were found in Aurora and Toro varieties (see Table 2).

Table 2.

Analysis of biometric indicators in three-year-old plants of blueberry varieties, 2022 year

№	Blueberry varieties	Plant height, cm	Body diameter, mm	Order 1 number of mother branches, PCs	Order 1 branches diameter, mm	Number of harvest kings in a branch, pieces
1	Avrora	85±2	16,73±1,2	2±0,5	14,62±1,5	5±1,0
2	Chandler	90±3	19,8±1,7	3±1,0	17,50±1,6	9±2,0
3	Dyuk	100±3	23,84±2,0	3±1,0	18,84±1,7	4±1,5
4	Patriot	75±1	18,47±1,3	2±1,0	15,17±1,4	7±2,0
5	Toro	80±2	16,53±1,2	2±1,0	14,47±,2	3±0,5
6	Legasi	90±3	17,45±1,1	2±0,5	16,84±1,2	3±0,5

7	Darrou	115±3	21,07±1,7	3±1,5	20,04±2,1	5±1,0
8	Blyukrop	110±2	19,19±1,9	2±0,5	15,55±1,2	4±0,5
	ЭКФ$_{05}$	*3,0*	*0,5*	*0,1*	*0,4*	*0,2*
	Sx	*0,52*	*0,09*	*0,02*	*0,07*	*0,03*

The data of table 2 above shows that the diameter of the first-order skeletal branches formed in the rest of the varieties differed by an average of 15.5-18.5 mm in the third year after planting.

The number of branches formed on a one-year branch differed by 3-9 units depending on the biological characteristics of the varieties, i.e., branch productivity and vertical growth. The Chandler variety stood out as the variety that formed the most crop branches. In this variety, the number of branches formed on annual branches reached 9 pieces on average. The lowest yield was found in Toro and Legasi varieties, in which the average number of branches was 3. In the rest of the varieties, the number of branches formed on annual branches was around 4-7 pieces.

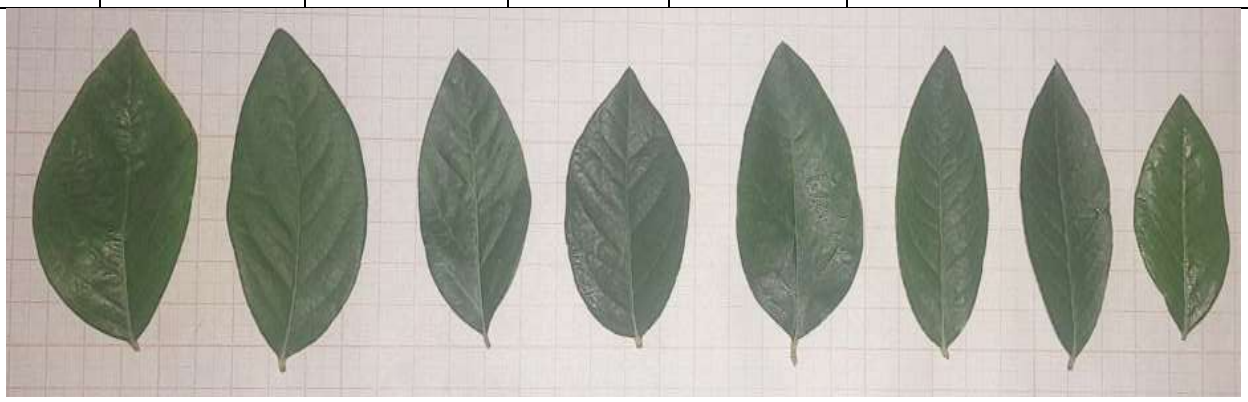
Determining the leaf sizes of the studied varieties showed that the Duke variety stood out with the largest of its leaves. The average length of the leaves of this variety was 7.1 cm and 2.5 cm wide. The smallest leaves were identified in the Aurora and Darrou varieties, with the average length of the leaf of these varieties being between 3.1 and 2.9 cm, respectively, and the leaf width between 1.4 and 1.3 cm. The size of the remaining varieties was in the range of 4.0-6.1 cm in length and 2.0-3.5 cm in width (See Figure 3 and Table 3)

Table 3

Dimensions and description of the leaf of the studied varieties of blueberry, 2020-2022

№	Blueberry varieties	Leaf length, sm	Leaf width, sm	Leaf index	Color and shape of the Leaf
1	Aurora	3,1±0,7	1,5±0,3	2,1	green, dark red in autumn, oblong-oval in shape
2	Chandler	6,0±1,1	3,5 ±0,7	1,7	dark green, red in autumn, oval in shape
3	Duke	7,1±1,1	2,5 ±0,4	2,8	beautiful dark green, yellow in autumn, oblong oval in shape
4	Patriot	5,1±0,8	3,0±0,6	1,7	dark green, Crimson in autumn, ovoid
5	Toro	5,0±0,7	1,5 ±0,2	3,3	dark green, bright red in autumn, oblong-heart-shaped
6	Legasi	6,1±1,0	3,1±0,7	2,0	bluish green, orange – raspberry in autumn, oblong-oval in shape
7	Darrou	2,9±0,2	1,3±0,1	2,2	dark green, orange-reddish in autumn, elliptical in shape

8	Bluecrop	4,0±0,3	2,0±0,1	2,0	bright green, lilac or yellowish-red, oval shape in autumn
	EKF_{05}	*0,2*	*0,1*	*0,1*	-
	Sx	*0,03*	*0,01*	*0,01*	-



1 2 3 4 5 6 7 8

Figure 3. Morphological differentiation of leaves of studied blueberry varieties:

1 –Duke, 2 – Bluecrop, 3 – Toro, 4 – Chandler, 5 – Darrou, 6 – Aurora,

7 – Legasi, 8 –Patriot

Figure 3: The data above shows that the leaf index of the studied blueberry varieties has become dependent on whether they are large or small. The leaf index, the ratio of length to width, had the largest number in the Torro and Duke varieties and was equal to 3.3 and 2.8, respectively. The leaf index of the remaining varieties was in the range of 1.7-2.2.

Table data shows that the color of the leaves during the growing season and at the time of their development corresponded to the biological characteristics of the variety, that is, the description given by the moderators. They were all almost dark green, the edges formed an entire (unshaven or toothless) leaf, in autumn it was observed that it entered the yellow, orange, lilac, red and Crimson tones characteristic of the variety. Only the leaf color of the Lega and Bluecrop varieties in the growing season was distinguished by its uniqueness. In them, during the growing season, the color of the leaves became bright green.

Conclusion

The duration of the growing season of blueberry varieties, introduced into the conditions of the central climate of Uzbekistan, was in the range of 213-221 days. The shortest period was 213 days in the Toro and Darrou varieties. The longest period was 220-221 days in Patriot and Lega varieties. The duration of the growing season of the remaining varieties was in the range of 215-218 days. It can be seen that the duration of the growing season is almost in very close indicators (the difference is a maximum of 8 days), which did not depend on their early or late ripening

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