

## GROWTH AND FRUIT BEARING OF PRIMOCANE RASPBERRY CULTIVAR 'LYULIN' IN THE TROYAN REGION

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### Abstract

*The scientific experiment was conducted in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture in Troyan. The objective of the study was the primocane raspberry cultivar 'Lyulin'. The vegetative indicators, such as average number of shoots (1m<sup>2</sup>), average height (cm) and average thickness (mm) of shoots and also some reproductive indicators, such as average fruit weight (g), and average yield per one linear meter of intra-row area were analyzed. Fruit bearing was reported from the spring-summer harvest, intermediate (formed by additional fruit twigs between two fruit bearing) and summer-autumn harvest. The largest average number of shoots were reported in the first experimental year - 26.17 items. The average shoot height reached 118 cm in the first two years (2018 and 2019). The largest average shoot thickness (8.23 mm) was measured in 2019. The highest yield in the spring-summer harvest was gathered in 2020 (1.31 kg/1 m<sup>2</sup>), from the intermediate harvest in 2019 (0.96 kg/1m<sup>2</sup>) and from the summer-autumn harvest of the same year (2.74 kg/1 m<sup>2</sup>). The highest average fruit weight (3.25 g) was registered in the intermediate harvest (in 2019).*

**Key words:** fruit weight, cultivars, raspberries, vegetative indicators, yield.

### INTRODUCTION

Raspberry is a traditional fruit crop in the mountain and semi-mountain regions of Bulgaria, where there are suitable soil and climatic conditions for its growth. A great part of these regions are characterized by predominant clay soils, with an impermeable B horizon, with a tendency to overwetting (Hristov, 1983; Dinkova et al., 2000). Finding and applying appropriate elements of cultivation technologies are extremely important for the harvesting of plantations. Another important feature is the use of cultivars suitable for specific soil and climate conditions. Through selection, cultivars with different vegetative and reproductive potential have been created, which is manifested under conditions that correspond to the maximum degree of the genotype. The selection activity created cultivars with certain specifics in their growth and fruit bearing of raspberry plants. One of the most significant advantages of primocane cultivars is the provision of fresh fruit for a longer period of time (Boycheva, 1996; 1999; Catling and Small, 2001; Boycheva and Lazarov, 2004; Knight, 2004).

The interest in the raspberry crop is determined by the attractive fruits and the quick return on investment, through early maturity and early fruit bearing. These qualities of the crop predetermine the significant share it occupies in agricultural holdings (Stavroulakis and Gerasopoulos, 1998; Kondanova et al., 2005; Zorenc et al., 2017).

The objective of the present study was to observe the correlation dependences among some vegetative and reproductive characteristics of the primocane raspberry cultivar 'Lyulin'.

### MATERIALS AND METHODS

The scientific experiment was conducted during the period of 2018-2020 in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture in Troyan. The objective of the study was the primocane raspberry cultivar 'Lyulin'. The following indicators were observed:

- vegetative: average number of shoots per linear meter of intra-row area, average height (cm) of shoots per 1 m<sup>2</sup>, average

thickness of shoots (mm), measured at 10 cm height from the soil surface;

- reproductive: average fruit weight (g), average yield (kg) per 1 m<sup>2</sup>.

The experiment was set in six replications per one linear meter each.

The methodology for studying plant resources in fruit plants was used to report the indicators (Nedev et al., 1979). Data were processed according to the methodology of Lidanski (1988) using the software product MS Excel - 2010.

## RESULTS AND DISCUSSIONS

In the first experimental year the average number of shoots was the highest, compared to the next two years and was 26.17 items (Table 1). The average shoot height reached 118 cm and the average thickness was 7.38 mm. Regarding the reproductive indicators, the average fruit weight in the spring-summer harvest was 2.72 g, and from the summer-autumn harvest it had a lower value - 2.17 g. A significant difference was observed in terms of the obtained average yield. The spring-summer harvest was 0.43 kg and was higher than the summer-autumn harvest - 0.71 kg.

Table 1. Vegetative and reproductive indicators in 'Lyulin' cultivar for the period of 2018-2020

Indicators Harvests	Average number of shoots per 1/m <sup>2</sup>	Average height of shoots (cm)	Average shoots thickness (mm)	Average fruit weight (g)	Average yield (kg) per 1/m <sup>2</sup>
2018					
Spring-summer harvest	26.17	118	7.38	2.71	0.43
Summer-autumn harvest				2.17	0.71
2019					
Spring-summer harvest	19.5	118	8.23	2.21	0.93
Intermediate harvest				3.25	0.96
Summer-autumn harvest				2.43	2.74
2020					
Spring-summer harvest	23	91	6.84	2.64	1.31
Intermediate harvest				2.87	0.82
Summer-autumn harvest				1.93	1.44

The reported correlation dependences between the vegetative and reproductive indicators for the spring-summer harvest reported a significant correlation only for the indicators average thickness with the average height of the shoots ( $r = 0.65$ ) (Table 2). While in the summer-autumn harvest, the results show a high correlation between the average yield with

the average height of the shoots ( $r = 0.73$ ), as well as a significant correlation in the indicators of average yield with the average plant thickness ( $r = 0.67$ ) (Table 3). That is, in the primocane cultivar harvest, the average yield was directly related to the average height and average thickness of the shoots.

Table 2. Correlation dependences of vegetative and reproductive indicators from the spring-summer harvest in 2018 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	-0.1133	1		
Average thickness (mm)	-0.10356	0.653751	1	
Average yield (kg)	-0.10935	0.279603	-0.25247	1

Table 3. Correlation dependences of vegetative and reproductive indicators from the summer-autumn harvest in 2018 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	-0.1133	1		
Average thickness (mm)	-0.10356	0.653751	1	
Average yield (kg)	0.357537	0.72689	0.666838	1

In the second experimental year, a significantly lower average number of shoots was reported - 19.5 (Table 1). The average height of the plants is in the same values as from the previous year - 118 cm, but a higher average thickness was registered, which was also the highest value of the entire study period - 8.23 mm. The least average fruit weight was registered in the spring-summer fruit bearing - 2.21 g. It was the highest in the intermediate harvest - 3.25 g, as in the summer-autumn the fruit bearing was 2.43 g. A significant increase in the average yield was found. From the spring-summer harvest it was 0.930 kg, from the intermediate harvest it was 0.960 kg and from the summer-autumn harvest it was 2.74 kg.

Regarding the interrelations of vegetative and reproductive indicators, we report a high negative dependence between the average yield

and the average thickness of the shoots from the spring-summer harvest ( $r = -0.91$ ) (Table 4) In the intermediate harvest, the results show a significant correlation for the same indicators, but in a positive value ( $r = 0.57$ ) (Table 5). While in the summer-autumn harvest a correlation was found in the average yield with the average height of the shoots ( $r = 0.68$ ) (Table 6). In this fruit bearing, as from the spring-summer harvest, a negative but moderate correlation was also reported between the average yield and the average thickness of the shoots ( $r = -0.44$ ).

Table 4. Correlation dependences of vegetative and reproductive indicators from the spring-summer harvest in 2019 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	-0.45201	1		
Average thickness (mm)	-0.06873	0.306181	1	
Average yield (kg)	-0.07428	-0.47308	-0.91129	1

Table 5. Correlation dependences of vegetative and reproductive indicators from the intermediate harvest in 2019 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	-0.45201	1		
Average thickness (mm)	-0.06873	0.306181	1	
Average yield (kg)	0.111939	-0.42862	0.568981	1

Table 6. Correlation dependences of vegetative and reproductive indicators from the summer-autumn harvest in 2019 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	-0.45201	1		
Average thickness (mm)	-0.06873	0.306181	1	
Average yield (kg)	-0.14723	0.683449	-0.43619	1

In 2020, an increase in the average number of shoots was reported compared to the previous

year and their number was 23 (Table 1). The lowest values were found for the average height of the shoots - 91 cm and their average thickness - 6.84 mm for the entire study period. The average fruit weight in the spring-summer harvest was 2.64 g, the highest was again in the intermediate harvest 2.87 g and the lowest value was in the summer-autumn harvest - 1.93 g.

In the third year, an increase in the average yield from the spring-summer harvest was reported again and reached a value of 1.31 kg. The decrease was insignificant compared to the previous year for the intermediate harvest - 0.82 kg. The average yield in summer-autumn fruit bearing was 1.44 kg, which was approximately twice lower than the second experimental year.

For spring-summer fruit bearing, a moderate correlation was reported between the average height of the shoots with their average number ( $r = 0.42$ ) and significant for the average thickness of the plants with their average height ( $r = 0.64$ ) (Table 7). The relationship between the average yield and the average thickness of the shoots was moderate ( $r = 0.31$ ).

Table 7. Correlation dependences of vegetative and reproductive indicators from the spring-summer harvest in 2020 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	0.421426	1		
Average thickness (mm)	0.0187	0.636976	1	
Average yield (kg)	0.135442	-0.17462	0.312694	1

Table 8. Correlation dependences of vegetative and reproductive indicators from the intermediate harvest in 2020 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	0.421426	1		
Average thickness (mm)	0.0187	0.636976	1	
Average yield (kg)	0.23147	-0.23145	-0.35626	1

In the intermediate harvest, a moderate but negative correlation was registered in the indicators of the average yield with the average thickness of the shoots ( $r = -0.36$ ).

While in the summer-autumn fruit bearing a high negative correlation was reported between the average yield with the average thickness of the plants ( $r = -0.73$ ).

Table 9. Correlation dependences of vegetative and reproductive indicators from the summer-autumn harvest in 2020 for 'Lyulin' cultivar

	Number of shoots	Average height (cm)	Average thickness (mm)	Average yield (kg)
Number of shoots	1			
Average height (cm)	0.421426	1		
Average thickness (mm)	0.0187	0.636976	1	
Average yield (kg)	0.209606	-0.01885	-0.73345	1

## CONCLUSIONS

The average number of shoots had the highest value in the first experimental year. The best results in terms of average plant height were reported in the first two years, and their average thickness - in the second year.

The highest average fruit weight was registered in the intermediate harvest in the second year (3.25 g). An upward increase in the average yield from the spring-summer harvest was reported during each experimental year. The highest average yield was obtained from the summer-autumn harvest in the second year - 2.74 kg.

Correlation dependences show a relationship between average thickness and average shoot height in the first and third years. A high negative dependence was reported in the spring-summer harvest between the average yield with the average thickness of the shoots ( $r = -0.91$ ) in the second year.

In the summer-autumn fruit bearing in the first year there was a high correlation between the average yield with the average height of the shoots ( $r = 0.73$ ) and significant in the average yield with the average thickness of the plants ( $r = 0.67$ ). In the second year, at the same fruit

bearing, a significant correlation was reported between the average yield with the average shoot height ( $r = 0.68$ ) and high, but negative in the average yield with the average plant thickness ( $r = -0.73$ ).

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