Scientific Papers. Series B, Horticulture. Vol. LXVII, No. 1, 2023
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

# CORRELATIONAL INTERCONNECTIONS BETWEEN VEGETATIVE AND REPRODUCTIVE PERFORMANCES IN RASPBERRY CULTIVAR 'TULAMEEN'

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***Abstract***

*The scientific experiment was conducted in the period 2018-2020 in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture in Bulgaria. The plantation was created in the autumn of 2016. The planting scheme of the plants is 3.00/0.50 m. The objective of the study is 'Tulameen' cultivar. Vegetative parameters were monitored: average number of shoots, average thickness and average height of shoots and reproductive: average fruit weight and yield per linear meter. The number of shoots had the highest values in the first year of the experiment (29.33), and their height (1.51 m) and thickness (7.60 mm) in the second year. The highest yield was recorded in the third year (1.48 kg/1 m$^2$). A high to very high positive correlation between shoot height and thickness was reported in all three years. In the first year, a high correlation dependence was registered between shoot height and yield (0.76) and negative in the second (-0.85) and third (-0.51) years of the experiment.*

***Key words****: cultivar, fruit weight, raspberry, vegetative indicators, yield.*

## INTRODUCTION

Raspberry production is traditional for the mountain and foot-hill regions of Bulgaria, which is directly related to a more efficient use of arable land. To be economically profitable, a correct choice of cultivars, quality planting material, suitable soil and climate conditions and intensive cultivation technologies are necessary (Georgiev et al., 2013; Serbezova, 2019; Georgiev, 2021). On the other hand, the raspberry as a fruit crop is also attractive to farmers because of its quick return on the invested financial means to create plantations, as it bears fruit already in the second year after planting, and the full fruit bearing begins in the third year.

Currently, a sustainable trend is noticed towards the use of high-yielding and adaptable cultivars, application of modern technologies for productive fruit cultivation, ensuring optimal, regular and high yields is noticed (Leposavić et al., 2013; Sønsteby et al., 2013; Domozetova, 2014). The productivity of raspberries is determined by the number of shoots per 1 linear meter and their development, as well as by the number and weight of their fruits per shrub. The study and improvement of their economic qualities and traits marks continuous progress in science.

The aim of the scientific work is to study the correlational interconnections between the vegetative and reproductive indicators in the 'Tulameen' raspberry cultivar grown in the Troyan region.

## MATERIALS AND METHODS

The scientific experiment was conducted in the 2018-2020 in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture in Troyan. The object of the study was the introduced 'Tulameen' raspberry cultivar, which was a result of crossing *Nootka* x *Glen Prosen* (http://omafra.gov.on.ca/english/crops/facts/raspvarc.htm#Jewel).

The planting scheme is 3.00/0.50 m. The plants are grown under irrigated conditions with drip irrigation. Row spacings are naturally grassed, as the necessary mowing was conducted, while the intra-row area is maintained in black fallow by tillage.

'Tulameen' is a promising large-fruited raspberry cultivar with high-quality fruits that

ripen later and over a longer period. The cultivar is distinguished by relatively firm fruits, which is why it has good transportability and is used both for processing into various products and for fresh consumption (Daubeny and Anderson, 1991; Ivanova et al., 2012; Serbezova, 2019). The planting material used was obtained by *in vitro* technology, providing healthy plant specimens with an even growth habit.

The following indicators were studied:

- average number of shoots per linear meter;
- average height of shoots (m);
- average thickness of shoots (mm), measured 10 cm from the soil surface;
- average fruit weight (g);
- average yield of 1 $m^2$ (kg).

The experiment was set in variant with six replications, each was one linear meter of the intra-row area.

The plants are planted in pits measuring 0.30/0.30/0.30 m, with the application of granulated chicken manure of 0.200 kg. The methodology for studying plant resources in fruit plants was used to report the indicators (Nedev et al., 1979). The data were processed by correlation analysis, the software product MS Excel – 2010 was used.

## RESULTS AND DISCUSSIONS

The results presented in Table 1 show that the highest average number of shoots was in the first experimental year (29.33), and in the following two years the values were in close range. Leposavić et al. (2013) in a similar experiment with 5 raspberry cultivars obtained 5.43 average number of shoots/m from 'Tulameen' in a 0.33 x 2.5 m planting scheme under the conditions of Western Serbia.

The average number of shoots for the period is 24.39. The highest values for the average height of the shoots were recorded in the second year with 1.51 m. The smallest plant height was recorded in the first and third year with very little difference between the values. Analogous results were obtained for the average thickness of the shoots. In the second experimental year, the thickness reached 7.60 mm, it was significantly smaller in the first year (6.09 mm) and in the third year (6.51 mm). Regarding the average fruit weight, the highest value was reported in the first year (2.83 g) and with close results in the following two years. The average fruit weight for the period was 2.42 g. In our previous studies (Georgiev et al., 2013), 193.98 cm height, 8.78 mm thickness of raspberry shoots and 3.54 g fruit weight of the tested cultivar were recorded. Leposavić et al. (2013) reported fruit weight (largeness) of 4.28 g and a yield per shoot 375 g, as the impact of agroecological conditions being decisive, especially in years with extreme temperatures in the studied cultivar. The highest yield was recorded in the third year (1.48 kg/1 $m^2$), and the lowest was recorded in the first year (0.80 kg/1$m^2$). For the three-year period, the average yield was 1.10 kg/1 $m^2$.

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

| Average number of shoots per 1$m^2$ | Average shoot height (m) | Average shoot thickness (mm) | Average fruit weight (g) | Yield (kg/1 $m^2$) |
|---|---|---|---|---|
| 2018 | | | | |
| 29.33 | 1.34 | 6.09 | 2.83 | 0.80 |
| 2019 | | | | |
| 22.33 | 1.51 | 7.60 | 2.24 | 1.03 |
| 2020 | | | | |
| 21.50 | 1.39 | 6.51 | 2.19 | 1.48 |
| Average value for the period 2018-2020 | | | | |
| 24.39 | 1.41 | 6.73 | 2.42 | 1.10 |

In the first year, a high correlation between shoot height and thickness (0.80) and height and yield (0.76) was observed. A significant correlation was recorded between thickness and yield (0.67) (Table 2).

Table 2. Correlation interconnections between vegetative and reproductive performances in raspberry cultivar 'Tulameen' in 2018

| | Number of shoots | Height | Thickness | Yield |
|---|---|---|---|---|
| Number of shoots | 1 | | | |
| Height | -0.19 | 1 | | |
| Thickness | -0.47 | 0.80 | 1 | |
| Yield | 0.26 | 0.76 | 0.67 | 1 |

In the following year, a very high correlation dependence between the height and the thickness of the shoots was reported (0.93). A high but negative dependence between height and yield (-0.85) and a very high negative dependence between thickness and yield (-0.95) was registered (Table 3).

Table 3. Correlational interconnections between vegetative and reproductive performances in raspberry cultivar 'Tulameen' in 2019

| | Number of shoots | Height | Thickness | Yield |
|---|---|---|---|---|
| Number of shoots | 1 | | | |
| Height | -0.37 | 1 | | |
| Thickness | -0.02 | 0.93 | 1 | |
| Yield | -0.08 | -0.85 | -0.95 | 1 |

In the third year, again a very high correlation was observed for height with shoot thickness (0.94) and significant between shoot number and yield (0.58) (Table 4).

A significant negative dependence was reported between height and yield (-0.51) and a moderate negative dependence between thickness and yield (-0.42).

Table 4. Correlational interconnections between vegetative and reproductive performances in raspberry cultivar 'Tulameen' in 2020

| | Number of shoots | Height | Thickness | Yield |
|---|---|---|---|---|
| Number of shoots | 1 | | | |
| Height | 0.03 | 1 | | |
| Thickness | 0.17 | 0.94 | 1 | |
| Yield | 0.58 | -0.51 | -0.42 | 1 |

On average for the period, a very high correlation was reported between shoot height and thickness (1.00) and a high but negative correlation between shoot number and yield (-0.82). Significant but negative correlation dependences were registered between the number of shoots with the height (-0.66) and with the thickness (-0.64) (Table 5).

Table 5. Correlational interconnections between vegetative and reproductive performances in raspberry cultivar 'Tulameen' average for 2018-2020

| | Number of shoots | Height | Thickness | Yield |
|---|---|---|---|---|
| Number of shoots | 1 | | | |
| Height | -0.66 | 1 | | |
| Thickness | -0.64 | 1.00 | 1 | |
| Yield | -0.82 | 0.11 | 0.09 | 1 |

## CONCLUSIONS

Based on the obtained results for the vegetative and reproductive characteristics of the introduced raspberry cultivar 'Tulameen', combined with the soil and climate conditions of the region, the applied agricultural techniques and the cultivar specificity, it can be assumed that the Troyan region is suitable for its cultivation.

'Tulameen' has very good shoot-forming ability. The shoots are thin, which requires the

plants to be grown on a supporting structure. A high to very high correlation between shoot height and thickness was reported. In the second and third years, a significant to high negative correlation was recorded between shoot height and yield and a moderate to very high negative correlation between thickness and yield. The cultivar is characterized by average-sized fruits.

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