

*Ana T. Selamovska*  
*Olga V. Najdenovska*

The Faculty of Agricultural Sciences and Food  
Skopje, Republic of Macedonia

## THE INFLUENCE OF THE RUNNER ORDERING OF THE PLANTS ON THEIR QUALITY, ROOTING AND YIELD OF STRAWBERRIES

**ABSTRACT:** In this work, we presented the influence of the runner ordering of the plants on their quality, percentage of root hair formation, and yield of two varieties of strawberries: Senga Sengana and Pocahontas depending on the time of planting. The runner ordering of plants and time of their planting have influence on the quality of plants, the percentage of root hair formation after the planting, and the yield. There has been established strong correlation among the diameter of the crown and the rooting when planted and the yield. Primary plants have higher quality, with bigger diameter of the crown, they take root better, and they have higher yield than secondary plants. Rosettes planted in August have higher yield than the ones planted later.

**KEY WORDS:** primary, secondary, plants, quality, root hair formation, yield

### INTRODUCTION

Depending on the method of production and the storing of the planting material, and the development of the plants, they can be classified in several categories: green, frigo, waiting bed and container. No matter the way the planting material is obtained, it needs to be of good quality, with developed root, with variety, and healthy. High quality planting material is prerequisite for obtaining high yield and high quality fruits. When evaluating the quality of the plants, besides the development of the root system, the thickness of the crown is taken into account. Plants of first and second class have been used most frequently in the production. The number of obtained high quality plants, by the plant and by the square unit is a characteristic of the cultivar (Bulatović, 1970), depending on the cultivation method (Mičić et. al., 1983, Ristevski et. al. 1986, Selamovska, 2006, Mratinić, 2000), the cultivar and runner ordering of the plants (Lootchoomun, 1999, Selamovska, 2006), the age of the plant (Popov et. al., 1963, Ristevski

et. al., 1986, Mićić et. al., 1983), the time of the planting (Ozdemir et. al., 2002, Ristevski et. al., 1986), the used agrotechniques (Paunović et. al., 1974, Mićić et. al., 2003), the protection (Ristevski et. al., 1986), etc.

For the production of plants, original plants should be used only. A small number of plants is obtained from the production plant, with poorly developed root system, smaller vegetative potential, and poor health condition. The plants with the highest quality are obtained in the first year after the planting. The first class plants have the highest quality. During ageing of the plant, its vegetative potential reduces, as well as, the quality and quantity of obtained plants.

The yield is influenced by several factors: genotype, time of planting, cultivation method, age of the plant, health condition of the plant, etc. Due to its biological characteristics, strawberry can be planted during whole year, but if speaking of high intensity production, the time of planting, on which depends the rooting and later profitability of growing strawberries, needs to be considered. When growing strawberries on an open field, the most appropriate time for planting should be determined having in mind that the plant needs to be as much developed as possible before the beginning of the winter, in order to obtain higher yield next year. If the strawberries are planted earlier, in July and August they obtain 30% higher yield. In September and October, the yield consequently decreases. The plants planted in July and in the first half of August, in the next year they provide five to ten times higher yield compared to those plants that are planted later, in the autumn or spring. When planted in the spring the yield could be left out (Hristov et al., 1967, Šoškić, 1998, Mratinić, 2000, Tešić, 1970, Stančević et al., 1986, Ozdemir et al., 2002, Pasini et al., 1982).

## MATERIAL AND METHODS

The examinations were done on the experimental strawberry plantation, located in Dolno Lisiče village near Skopje, Republic of Macedonia. The planted soil was fluvisol, with maize as a previously planted culture, low carbonate, easy to cultivate, moderately to well supplied with phosphor and potassium, but considering that it contained low content of humus and it was moderately alkaline, it was necessary to do some corrections.

To examine the influence of the runner ordering of the plants on their quality, root formation, and the yield depending on the time of planting, green plants of first and second class of two strawberry cultivars Senga Sengana and Pocahontas were planted in different time periods: every 15 days from August 15 to November 15 and in March next year. Strawberry cultivars were planted in black foil, distanced at 80 x 25 cm.

The diameter of the neck of the plant, the rooting, and the yield, in years of 2001 and 2002, were examined. For every period of plating there has been determined an average value for the required parameters.

Regarding the climate indexes (data obtained from Hydro Meteorological Institute — Skopje, measuring station Petrovec) in region of Skopje, Republic

of Macedonia, the average values of air temperature during the vegetation are favorable for growing strawberries except for the high temperatures during the summer, especially in August, which have negative impact on rooting of the plants. All the values of hydrothermal indexes indicate that the climate is semi-arid. The relative air humidity is low and unfavorable for growth of strawberries. The annual and vegetative sum of rainfalls is insufficient for development and fruitfulness of the strawberries in this region and because of that, it is necessary the strawberries to be cultivated in irrigated conditions. The results of the examination have been statistically processed, using correlative analysis, analysis of the variance, and t — test.

## RESULTS AND DISCUSSION

Data on influence of the runner ordering of the plants on the diameter of the crown, the rooting, and the yield, in different periods of the planting, are presented in Table 1.

Tab. 1. — The influence of runner ordering of the plants on diameter of crown, rooting percent and yield

Date of planting	Primary rosettes				Secondary rosettes			
	Crown diameter mm	Rooting %	Yield g/plant	Yield kg/ha	Crown diameter mm	Rooting %	Yield g/plant	Yield kg/ha
15.08	9.0	55.6	693.1	19268	7.6	55.9	591.0	16518
30.08	9.7	65.0	575.8	18694	8.1	56.2	503.0	14135
15.09	11.3	56.2	567.2	15939	8.9	41.2	410.5	8456
30.09	12.4	88.7	529.9	23501	10.2	67.2	468.6	15745
15.10	12.7	95.0	425.0	20187	10.3	78.7	486.6	19148
30.10	12.6	83.7	375.9	15731	10.6	60.0	376.0	11280
15.11	12.6	90.0	447.6	20141	11.1	91.2	397.4	18121
15.03	13.1	92.5	381.6	17649	11.0	90.0	364.3	16393
X	11.8	79.0	498.9	19706	9.7	69.6	449.6	15645
r	0.903	0.821	0.903		0.971	0.707	0.712	
LSD 0.05	2.29	24.10			1.89	23.89		
LSD 0.01	3.11	32.67			2.56	32.73		

We made comparison between primary and secondary plants related to these parameters. According to the data, the runner ordering of the plants had impact on their quality, the root formation after the planting, and their yield. Plants of the first class had higher quality, they had 17.8% bigger diameter of the crown, 12% better rooting, and 10% higher yield, more exactly 21% higher yield by square unit compared to the plants of second class, which is supported by *considerable statistical differences* (Table 2).

Tab. 2. — Comparison between primary and secondary rosettes

Parameters	Primary rosettes	Secondary rosettes	Difference between primary and secondary rosettes %	t
Diameter of the crown mm	11.8	9.7	+17.8	1.3 +
Rooting %	79.0	69.6	+12.0	1.2 +
Yield/plant g	498.9	449.6	+10.0	1.03 +
Yield kg/ha	19.706	15.645	+21.0	1.13 +

We determined positive correlation between the diameter of the crown and the root development and the yield (plants of the first class  $r = 0.872$ , plants of the second class  $r = 0.752$ ). Plants with bigger diameter of the crown had better rooting when planted, and they had higher yield. In the same period of planting, primary plants had higher values for the diameter of the crown, the rooting development, and the yield, than secondary plants. Because of the earlier organogenesis primary plants were more developed, they started to form earlier, after the planting they adapted quicker and better, and they had better rooting (S e l a m o v s k a, 2006, 2007). Related to this, when producing the planting material it is important to leave 1 to 3 plants on a plant, and in that way a smaller quantity of plants will be obtained, but with higher quality and with bigger diameter of the crown (M i ć i ć et al., 2000).

Besides the runner ordering of the plants, the diameter of the crown and root development was also influenced by the time of planting, on which there are correlative values. We determined considerable statistical differences in the diameter of the crown, rooting, and yield, between earlier and later planted plants (Table 1). Plants planted in August had smaller diameter of the crown and poorer rooting, but they had higher yield, compared to later planted plants.

Primary and secondary plants, planted on the 15<sup>th</sup> of August, in average had 17.5% smaller diameter of the crown, than plants planted on the 15<sup>th</sup> of September, 27.5% than rosettes planted on the 15<sup>th</sup> of October and 31.0% than plants planted on the 15<sup>th</sup> of March (Table 3).

Tab. 3. — Comparative values of the parameters in different planting periods

Parameters	Difference %								
	15.08/15.09			15.08/15.10			15.08/15.03		
	I	II	X	I	II	X	I	II	X
Crown diameter	-20.0	-15.0	-17.5	-29.1	-26.0	-27.5	-31.0	-31.0	-31.0
Rooting	-1.0	+26.0	+12.5	-41.0	-29.0	-35.0	-40.0	-38.0	-39.0
Yield/plant	+18.0	+31.0	+24.5	+39.0	+18.0	+28.5	+45.0	+38.0	+41.5
Yield kg/ha	+17.0	+49.0	+33.0	-5.0	-14.0	-9.5	+8.0	+1.0	+4.5

Regarding the rooting, plants planted on the 15<sup>th</sup> of August had 12.5% better rooting, than plants planted on the 15<sup>th</sup> of September, but 35% — 39% poorer rooting than plants planted on the 15<sup>th</sup> of October and 15<sup>th</sup> of March. Regarding the yield, plants planted on the 15<sup>th</sup> of August have 24.5%, 28.5% to 41.5% higher yield than the plants planted on the 15<sup>th</sup> of September, 15<sup>th</sup> of August, and 15<sup>th</sup> of March. In every period of planting, separately, primary

plants had higher values of every index compared to those of the secondary plants.

Because of the higher yield of the plants planted in summer months, higher values of the yield by square unit were expected in those months. However, it did not happen. Plants planted on the 15<sup>th</sup> of August had lower yield by square unit compared to later planted plants, from October to March. The reason for the poor yield was the extremely high air temperature. In August and September 2001, in the time of planting and after planting, there were measured extremely high air temperatures, more exactly absolute maximums of 38.7°C in August, and 32.8°C in September. In the year 2002, high midday air temperatures were measured in September with absolute maximum of 27.9°C. Extremely high air temperatures in the summer months, have caused dehydration of the plants, which had negative effect on the rooting, which have been reduced to 50%. In addition, poor rooting of the plants in August had negative effect on the total yield by square unit.

## CONCLUSION

Based on the performed experiments we conclude:

- The runner ordering of the plants has influence on their quality, rooting after plating, and yield.

- Primary plants have higher quality, bigger diameter of the crown, they form better root, and provide higher yield than secondary plants.

- The yield of the strawberries depends on the quality and runner ordering of the plants, the rooting after planting, and the time of planting. To obtain higher yield they should be planted in summer, but irrigation is required.

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## УТИЦАЈ РЕДОСЛЕДА РОЗЕТА НА КВАЛИТЕТ, УКОРЕЊАВАЊЕ И ПРИНОС ЈАГОДЕ

Олга В. Најденовска, Ана Т. Селимовска

Факултет за земјоделски науки и храна, Скопје, Р. Македонија

### Резиме

У раду је приказан утицај редоследа розета на квалитет, проценат формирања изданака и принос две сорте јагоде: зенга зенгана и покахонтас у зависности од времена садње. Редослед розета и време садње утиче на квалитет розете, проценат укорјењавања после садње и на принос. Утврђена јака корелација између пречника кореновог врата, и укорјењавања након садње и приноса. Примарне розете имају висок квалитет, са већим пречником кореновог врата, боље се укорјењавају и имају већи принос него секундарне розете. Розете засађене у августу имају већи принос у односу на розете које се саде касније.