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STUDY REGARDING THE SUITABILITY SOME BLACKBERRY VARIETIES ON SANDY SOILS FROM SCDCPN DĂBULENI

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Abstract

The paper represents an analysis of scientific research carried out between 2023 and 2025 on blackberry cultivation, under sandy soil conditions at SCDCPN Dăbuleni. The results obtained on 3 blackberry varieties are presented: Loch Ness, Triple Crown and Navaho. The analyzed varieties had different behavior in terms of vegetative growth, production capacity and fruit quality. The Navaho variety recorded the highest shoot growth capacity (130 cm), and the Triple Crown variety presented fruits weighing over 9 grams. In terms of fruit production, the Loch Ness variety recorded 25 tons/hectare. The amount of vitamin C recorded had values ranging between 14.96 mg% in the Loch Ness variety and 23.76 mg% in the Triple Crown variety. The carbohydrate content reached maximum values in the Loch Ness variety (11.86%).

Key words: blackberry, genotype, sandy soil

INTRODUCTION

Rubus fruticosus L is one of the 740 species of the genus *Rubus* in the *Rosaceae* family. It grows spontaneously in Europe, the Near East, North Africa and North America, in the forests of the mountainous region, in the drier plain regions or on the banks of rivers. It prefers temperate zones, occupying the subzones with medium altitude, submontane, and some species descend to the plains and meadows (Bălan V., 2001). The blackberry was introduced into culture relatively recently: in America at the beginning of the 19 th century, and in Western Europe from the second half of the 19 th century. The first blackberry plantation was established in the American state of Oregon. Here, in the period 1995-2010, 25-30 km^2 were cultivated with blackberries, obtaining 18-19 million kg of blackberries annually, which made the state of Oregon the largest blackberry producer in the world, followed by Serbia and Mexico (Lozinschii M., 2013). In Europe, the main blackberry producing countries are: Poland, Serbia, Hungary, Germany, Bulgaria, etc. The increased interest in blackberries is dictated by the biochemical composition of the fruits, the resistance of the crop to low temperatures, diseases and pests, as well as the ability to capitalize on lands with low fertility (Mladin Gh., 1992). Blackberries are one of the oldest medicinal plants, with testimonies about the use of blackberries in medicine dating back to the time of Hippocrates, 4^{th} century BC. The therapeutic qualities of blackberries are due to their composition (Mîrza A., 2016). According to the Berry Health Benefits Network, they contain 3.69 mg/g fruit of ellagic acid which, according to the American Cancer Society, is a promising compound in the treatment of cancer. (http://www.livestrong.com/article/233747-what-are-the-benefits-of-blackberry-).

The popularity of blackberries among consumers is determined not only by their pleasant appearance and delicious taste, but also by the compositional diversity of the nutraceuticals they contain. Thus, the fruits of this crop are currently appreciated and widely used for nutritional, medicinal and cosmetic purposes. Blackberries are considered an excellent source of phenolic compounds and vitamins, but also a valuable source of minerals and dietary fiber (Zia-Ul-Haq et al., 2014). The fruits can be consumed fresh or as processed products, such as jams, jellies, syrups and wines. Blackberries have been found to contain a wide range of bioactive compounds in their fruits, such as vitamin C, phenolic acids, ellagitannins, flavonoids including anthocyanins and carotenoids, which are widely available. Blackberry fruits have various pharmacological activities such as, antimicrobial, antioxidant, antidysenteric, antidiabetic and antidiarrheal (Dai et al., 2007; Bowen-Forbes et al., 2010). The fruits and their juice are also consumed for anemia. A standard infusion, which can also be applied externally as a lotion, has been reported to cure psoriasis and scaly skin conditions (Piwowarski et al., 2011). Blackberry leaves also have high levels of antioxidants, according to the findings of some authors (Buricová et al., 2011; Oszmianski et al., 2015).

MATERIALS AND METHODS

The e In 2019, within the Research and Development Station for Plant Culture on Dăbuleni Sands, an experimental batch was established with 3 blackberry varieties: *Navaho, Triple Crown* and *Loch Ness*, in order to evaluate the behavior of blackberry varieties in the pedo-climatic conditions of southern Oltenia. The experiment was established on raised beds, mulched with agrotextile, the planting distance being 3 x 2 m, irrigation and fertilization being carried out by drip and foliar. Fertilization was carried out according to the table below:

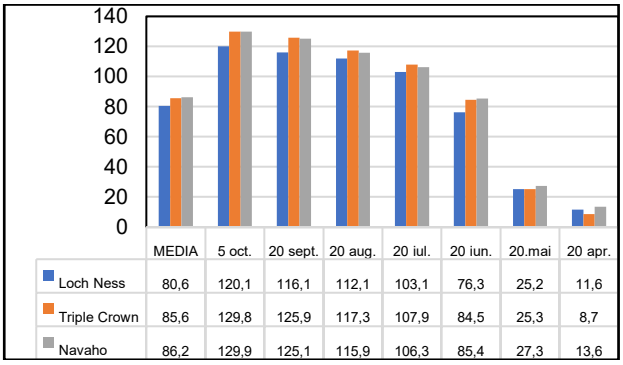
Period	Application form	Product	Quantity (kg/ha)
1-15 April	Fertigation	Mono ammonium phosphate	49
16-30 April	Fertigation	Mono ammonium phosphate	49
1-15 May	Fertigation	Mono ammonium phosphate	49
	Fertigation	Magnesium nitrate	67
16-31 May	Fertigation	Ammonium nitrate	63
1-15 June	Fertigation	Magnesium nitrate	60
	Fertigation	Ammonium nitrate	43
16-30 June	Fertigation	Magnesium nitrate	60
	Fertigation	Ammonium nitrate	43
1-15 July	Fertigation	Potassium nitrate +2%Mg	42
	Fertigation	Magnesium nitrate	35
16-31 July	Fertigation	Potassium nitrate +2%Mg	43
1-15 August	Fertigation	Potassium nitrate +2%Mg	42
16-31 August	Fertigation	Potassium nitrate +2%Mg	42
April-June every 2 weeks	Foliar (6 treatments, alternating products)	Urea with <1% biuret, conc. 0.3%	12
April-June every 2 weeks		Poly-feed 20:20:20, conc. 0,2%	8
April-June every 2 weeks		Ammonium nitrate, conc. 0,2%	8
April-June every 2 weeks		Solubor conc. 0,2%	8
Foliar (4 treatments)	Calcium chloride (conc. 0.3%)	Zinc Sulfate, 0.15%	1,5
July-August (4x foliar)			12

In order to evaluate the adaptability of these varieties to the pedoclimatic conditions of Southern Romania, the following determinations were made: shoot growth dynamics (cm), average shoot growth increment, average fruit weight (g), fruit production evaluation (t/ha), fruit diameter (mm), fruit height (mm). Shoot growth dynamics was determined by monthly measurement of shoots, and monthly growth was calculated by difference. The average fruit weight was determined by weighing a sample of 50

fruits at each harvest, and the fruit diameter and height were determined by measuring a sample of 30 fruits at each harvest. Phenological observations and biometric measurements were supplemented with determinations regarding the biochemical composition of the fruits: total dry matter (%) by the gravimetric method; soluble dry matter (%) by refractometric method; total carbohydrates (%) by Fehling Soxhlet method; vitamin C content (mg/100 g fresh matter) by iodometric method; titratable acidity (g malic acid per 100 g fresh matter) by titrimetric method. The results obtained were statistically analyzed using analysis of variance (ANOVA). Means were compared using Duncan's test at probability levels of 0.05. Different letters in the figures are significantly different according to Duncan's test (P≤0.05).

RESULTS AND DISCUSSIONS

The growth of vegetative shoots is an important characteristic for evaluating the growth vigor of blackberry plants. The average length of blackberry shoots varies depending on the particularities of the variety, the technology applied to cultivation, the conditions of the year and the density of the plants. The growth and development of the epigeal part of blackberry plants was studied and monitored throughout the vegetation period.



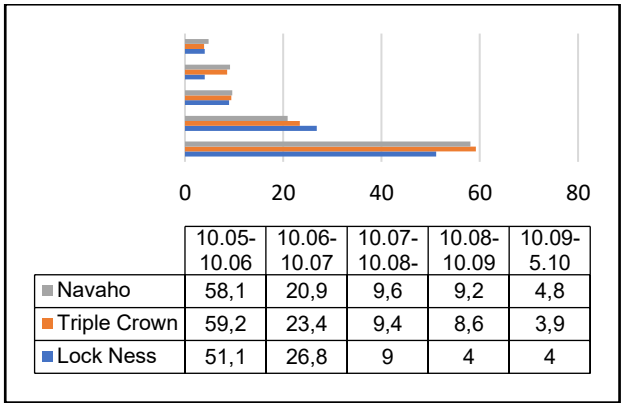
	MEDIA	5 oct.	20 sept.	20 aug.	20 iul.	20 iun.	20.mai	20 apr.
Loch Ness	80,6	120,1	116,1	112,1	103,1	76,3	25,2	11,6
Triple Crown	85,6	129,8	125,9	117,3	107,9	84,5	25,3	8,7
Navaho	86,2	129,9	125,1	115,9	106,3	85,4	27,3	13,6

Fig.1 The dynamics of annual shoots growth

The growth rate of shoots was intense during the period May - August, starting from the second decade of September, the growth rate was low and even stagnated (figure 1). The evaluation of the growth rate of shoots was carried out starting from April 20. At this time, the size of the shoots varied from one variety to another. Thus, the *Navaho* variety recorded an average shoot length of 13.6 cm, and the *Triple Crown* variety recorded an average shoot length of 8.7 cm. On 10.05, close values of the average shoot length were recorded between the three varieties studied (*Loch Ness* - 25.2 cm, *Triple Crown* - 25.3 cm and *Navaho* -27.3 cm) (figure 1).

On June 10, the lowest shoot length value was recorded for the *Loch Ness* variety (76.3 cm), and the highest for the *Navaho* variety (85.4 cm). The determinations made in July highlighted a shoot length of over 100 cm, respectively 107.9 cm for the *Triple Crown* variety and 103.1 cm for the *Loch Ness* variety. The values recorded on 10.08 were 112.1 cm for the *Loch Ness* variety, and 117.3 cm for the *Triple Crown* variety. The values of the determinations recorded in September ranged between 116.1 cm (*Loch Ness* variety) and 125.9 cm (*Triple Crown* variety).

At the end of the vegetation period (5.10), the longest length of the annual shoots was recorded for the *Navaho* variety (130 cm), and the shortest average length of the shoots was recorded for the *Loch Ness* variety (120.2 cm).



	10.05-10.06	10.06-10.07	10.07-10.08-	10.08-10.09	10.09-5.10
Navaho	58,1	20,9	9,6	9,2	4,8
Triple Crown	59,2	23,4	9,4	8,6	3,9
Lock Ness	51,1	26,8	9	4	4

Fig. 2 The average growth rate of the shoots during the studied period

The analysis of the three varieties studied shows a growth increase, ranging between +51 cm (*Loch Ness* variety) and +59.20 cm (*Triple Crown* variety) in the interval 10.05 - 10.06. During the period 10.06 - 10.07 the *Loch Ness* variety, compared to

the other varieties, reached the highest growth increase of shoots, respectively +26.80 cm, with a difference of 5.9 cm compared to the *Navaho* variety and 3.4 cm compared to the *Triple Crown* variety.
For all varieties studied, in the period 10.07 - 10.09 lower values were recorded compared to the previously monitored period, respectively 10.06 - 10.07.
The lowest values of the average shoot growth rate were recorded in the interval 10.09 – 5.10, for all studied varieties, the recorded values did not exceed 5 cm (fig.2). The average values of the shoot growth rate for the studied blackberry varieties highlighted the fact that during the entire vegetation period, the *Triple Crown* variety recorded the highest values, followed by the *Navaho* variety, and the lowest values were recorded by the *Loch Ness* variety.

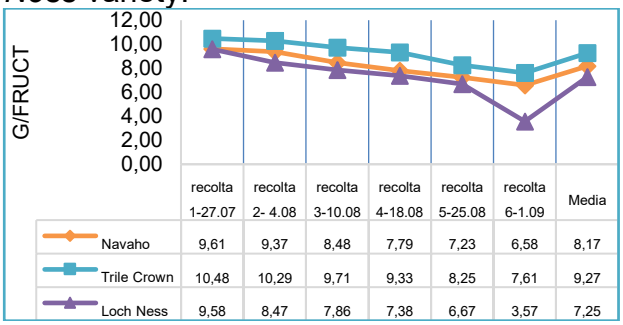


Fig. 3 The dynamics of the evolution of the fruits weight at the harvesting time

It should be noted that the fruits were harvested at 6 times, and the differences between the weight of the fruits at the first harvest and the last harvest range from 32.13% for the *Loch Ness* variety to 46.04% for the *Navaho* variety, with a difference of 37.71% for the *Triple Crown* variety (fig. 3). For fresh consumption, in the case of blackberries, marketable production is considered only that represented by fruits over 7 g/fruit. In the present case, only up to the fourth harvest can the production be sold for fresh consumption for the *Loch Ness* and *Navaho* varieties, and for *Triple Crown* the entire production can be marketed for fresh consumption.

Table 1. The fruits biometrics characteristics

Genotype	Fruit weight (g)	Fruit diameter (mm)	Fruit height (mm)
Navaho	8,17 b	22,15 b	30,88 a
Triple Crown	9,27a	27, 92 a	29,43ab
Loch Ness	7,25 b	22,69 b	27,89 b
Variation limits	7,25 – 9,27	22,13 - 24,71	27,18 – 27,92

The average fruit weight was determined by weighing a sample of 50 fruits at each harvest (6 harvests per year), and the fruit diameter and height were determined by measuring a sample of 30 fruits at each harvest.
Analyzing the data on the biometric characteristics of the fruits during the study period, it was found that the highest average fruit weight values were recorded for the *Triple Crown* variety (9.27g), followed by the *Navaho* variety (8.17g) and the *Loch Ness* variety (7.25g), with statistically significant differences presented in Table 1. The average fruit weight of the *Navaho* variety recorded during the study period, under the conditions at SCDCPN Dăbuleni, was compared with that recorded in Slovenia by Mikulik-Petkovsek (2021) and it was found that the fruits obtained at SCDCPN Dăbuleni were 1.98 g larger, this increase in weight can be attributed to the fertigation applied during the study period.
Regarding fruit diameter, the values ranged between 24.71 mm (*Triple Crown*) and 22.13 mm (*Navaho*). The *Triple Crown* variety stood out for its large fruit height, 27.92 mm. (Table 1).

Table 2. Blackberry yield to the studied genotypes

Genotype	Average production (kg/plant)			Average production (kg/ha)		
	Year 2023	Year 2024	Year 2025	Year 2023	Year 2024	Year 2025
Loch Ness	14,58 b	15,55 a	15,25 b	24,30 a	25,92 a	25,42 a
Triple Crown	11,57 b	12,13 b	10,53 b	19,28 b	20,22 b	17,55 b
Navaho	13,47 a	14,70 a	13,10 a	22,45 a	24,50 a	21,83 a

The determinations made regarding the average fruit production per hectare of the

studied blackberry varieties allowed obtaining the results shown in Table 2.
Thus, statistically significant differences were highlighted between the varieties studied, in each year analyzed. From the data presented it appears that the most productive variety over the entire study period was *Loch Ness* (25.92 t/ha), followed by *Navaho* (24.50 t/ha) and the lowest fruit production was recorded for the *Triple Crown* variety (20.22 t/ha). The fruit production obtained highlighted a good productivity of the varieties, but some of the fruits, namely the last 2 harvests, had a much more acidic taste, compared to the organoleptic characteristics at the beginning of the ripening season. We believe that this aspect is due to the pronounced heat in August, and the use of shade nets in the plantation could favorably modify this aspect.

Table 3. The fruits chemical characteristics to studied blackberry genotypes

Genotype	Total dry matter (%)	Soluble dry matter (%)	Titratable acidity (%)	C vitamin (mg/100g d.p.)	Carbohydrate (%)
Triple Crown	14,11	10,0	1,02	23,76	8,60
Loch Ness	13,53	13,8	0,64	14,96	11,86
Navaho	13,72	9,6	0,87	18,48	8,25

Biochemical characteristics of fruits are the key parameters that define fruit quality. Good fruit flavor is due to high levels of sugar and organic acids. Various fruit parameters, titratable acidity (TAc), pH and soluble dry matter content, total dry matter content (TSS) of cultivated and wild blackberry fruits were determined by Yilmaz et al. who showed lower values in cultivated genotypes (8.6%–14.1%) compared to genotypes from the spontaneous flora (12.9%–22.3%). The total dry matter content of the biotypes from the spontaneous flora was 20% higher. Milosevic et all., show that the pH averages of the biotypes from the spontaneous flora were slightly but significantly higher than the values recorded in the cultivated genotypes. At the same time, the physicochemical characteristics of the fruits of different blackberry varieties cultivated in Serbia over a period of 2 years were compared and a large variation between the investigated parameters was observed. The analysis of the biochemical properties of the fruits, namely the soluble dry matter content, the vitamin C content, the amount of carbohydrates, highlights the variability of these characteristics between varieties (table 4). Following the studies carried out, it was found that in the blackberry varieties studied, the amount of soluble dry matter (determined refractometrically) varied between 13.53% - 14.11%, the variety with the highest content being *Triple Crown*. The amount of carbohydrates recorded was between 8.25% and 11.86%, the maximum value being recorded in the *Loch Ness* variety. Regarding the vitamin C content, the values recorded were between 14.96 mg and 23.76 mg, the highest value being recorded in the *Triple Crown* variety. In the case of titratable acidity, the variation limits were between 0.64% - 1.02%, with the *Triple Crown* variety standing out with the highest value.

CONCLUSIONS

Due to the good growth capacity of the shoots, all the blackberry varieties studied require the maintenance of the support system in the plantation throughout the vegetation period.
The average fruit weight during the 6 harvests carried out, in the case of the *Triple Crown* variety, did not fall below 7 g/fruit, and the entire production of this genotype can be marketed for fresh consumption.
A production of over 25 t/ha was recorded by the *Loch Ness* variety.
The biochemical content analysis of the fruits revealed a vitamin C content of over 20mg/100g fruit, in the case of the *Triple*

Crown variety, and a soluble dry matter content of the fruits of this variety of 14.11%.

The studies carried out to date have highlighted a good adaptability of the blackberry varieties studied in pedo-climatic conditions specific to sandy soils in Southern Romania.

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