

INFLUENCE OF THE INTENSITY OF PLANT CUTTING ON THE GROWTH AND FRUCTIFICATION OF BLUEBERRY

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Abstract

The blueberry has become a species more and more cultivated in all favourable crop areas, especially in the northern hemisphere. The interest shown in this plant is given by the nutritional and sanogenic importance of its fruits, well used as fresh fruits or processed in various forms. The crop technology of blueberry is relatively simple, but the species is very particular on the soil reaction and its drainage, as these plants are sensitive to certain specific diseases. The fructification cutting is done with different intensities to ensure a large production, quality and continuance in time. In order to test the reaction of four blueberry varieties: 'Duke', 'Draper', 'Patriot' and 'Brigitta', the plants were cut at two different intensities and it was observed that a more intensive cutting influenced the height of the bush and the total sum of growth and also the maturation of fruits was slightly anticipated. The size of fruits was favourably pushed by the intensity of cutting, however the production was lightly smaller. The fructification capacity was not significantly influenced by the cutting intensity.

Key words: fructification capacity, production, sum of total growth.

INTRODUCTION

The blueberry is the species that is becoming more and more interesting for producers and consumers. The consumption of blueberry fruits or blueberry-based products gives the human body important quantities of anthocyanins, antioxidants, phenols, organic acids etc., which are important for a balanced nutrition, especially when consuming fresh fruit or fresh juice (Mainland, C.M. and Tucker, 2002). The biochemical composition of the fruits, the storing capacity and firmness depend strongly on the variety (Cannon et al., 2002; Wang et al., 2017; Itle and NeSmith, 2016; Cătuneanu et al., 2017; Asănică, 2018; Jaakola et al., 2016; Kalt, 2006).

The consumption of blueberry fruits or blueberry-based products has beneficial effects on the human body and it can prevent certain diseases: it slows down the aging process (Armin, 2015; Kotrotsios et al., 2017), decreases the cholesterol level (Roukounakis, 2006), regulates blood sugar and has beneficial effects against diarrhoea and nausea, inhibits the proliferation of cancer cells (Wang et al., 2017), the fruits also have anti-adhesive

properties related to the streptococcus that produces dental caries etc. In order to cultivate the blueberry plants, it must be known that blueberry is a species pretentious to the soil.

Soils that ensure proper conditions for the growth and fructification of the blueberry are the best drained ones, rich in organic material of at least 2%, even slightly sandy (Cline and Bloodworth, 2016; Jackson et al., 2000, Lemaire, 1995) and with a lower pH value (4.2-5.2). Short drainage leads to a weak growth of the root system (Caruso, 2012; Sandler et al., 2004).

Plant pruning is mandatory each year, as it ensures the balance between growth and fructification (Hoza, 2000). Pruning is usually performed during the winter rest of the plants, but there are attempts to perform pruning when the crown begins to form (Banador et al., 2009).

Through pruning exhausted, weak or improperly positioned branches are eliminated but also thinning is ensured (Asănică, 2017). Plant reaction is different depending on the variety and the pruning intensity. In order to observe how blueberry plants react to pruning the present experiment was performed.

MATERIALS AND METHODS

The experiment was conducted during 2016-2018, in a 3 years old blueberry plantation, in the area of Karditsa, Greece, with 4 blueberry varieties: Duke, Draper, Patriot and Brigitta.

Two pruning variants were used:

V1 – shortening or eliminating 25% of annual growths;

V2 - shortening or eliminating 50% of annual growths.

The planting distance was set to 3 m between rows and 1,16 m between plants on each row, resulting a density of 2870 plants/ha.

The planting was made on raised beds, with mulch of black foil, on a loamy-sandy soil, using 2 kg of turf per hole, while the pH of the soil had a value of 5.5.

The plantation had an irrigation system composed of two tubes, one on each side of the row, with 2 l/h dripping capacity, set at 50 cm.

The fertilization was made with 400 kg carbamide per ha three times during the first half of the vegetative season and in order to

maintain the acid reaction three times per year 1,5 l of Nutex black was applied together with the irrigation water, a product with a pH of 4.

Parameters related to plant growth were measured like height, ramification capacity, length of annual branches, and also related to the production such as number of inflorescences, average fruit weight and production obtained.

The resulted data were statistically analyzed using the variation analysis method, with probabilities of 5%, 1% and 0,1%.

RESULTS AND DISCUSSIONS

Plant growth was influenced by the pruning intensity and the variety differently. The more intense pruning had a positive influence on plant height and the varieties had different reactions (Table 1). The analysis of the average value for the three years showed that for three out of four varieties variant V2 had higher values.

Table 1. Dynamics of the growth in height of plants for some blueberry varieties (cm)

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	102,1	103,33	104,4	103,28	Mt
	V2	120,3	141,25	142,1	134,55	***
	Average	111,2	122,29	123,25	118,91	**
Draper	V1	110,3	111,2	120,4	113,97	*
	V2	100,8	112,3	130,5	114,53	*
	Average	105,55	111,75	125,45	114,25	*
Patriot	V1	105,6	113,4	112,3	110,43	N
	V2	115,7	128,6	133,4	125,90	***
	Average	110,65	121	122,85	118,17	**
Brigitta	V1	125,4	118,2	128,4	126,90	***
	V2	135,7	141,6	160,2	145,83	***
	Average	130,55	141,6	144,3	138,82	***
DL 5%					9,81	
DL 1%					13,63	
DL 0,1%					18,97	

Positive significance: * significant, ** distinctly significant, ***very significant

Negative significance: ° significant, °° distinctly significant, °°°very significant

The statistical analysis of the differences, compared to the control variant, showed that only for the V1 of the Patriot variety the value was insignificant, while for Draper the differences for both variants were significant.

The average values per variety for the analyzed period showed that the varieties Duke and

Brigitta were more vigorous than Draper and Patriot.

In regards to the ramification capacity and the number of stems in a bush it was observed an increase in the number of stems in time, as the plants grew, but the average values did not differ much.

It could be observed that the Duke and Draper varieties had a slightly higher ramification capacity compared to Patriot and Brigitta (table 2). The statistical calculus showed that for the

variants with light pruning, Patriot and Brigitta recorded negative distinctly significant differences compared to the control.

Table 2. Dynamics of the number of stems in a bush for some blueberry varieties (stems)

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	8,5	13,5	17,3	13,10	Mt
	V2	10,5	16,4	18,2	15,03	*
	Average	9,5	14,95	17,75	14,07	N
Draper	V1	10,5	12,9	17,4	13,60	N
	V2	11,5	14,6	18,6	14,90	N
	Average	11	13,75	18	14,25	N
Patriot	V1	5,5	9,1	15,2	9,93	Oo
	V2	6,1	12,6	17,3	12,00	N
	Average	5,8	10,85	16,25	10,97	o
Brigitta	V1	5,4	8,7	15,4	9,83	oo
	V2	6,3	10,8	16,9	11,33	N
	Average	5,85	9,75	16,15	10,58	o
DL 5%					1,9	
DL 1%					2,64	
DL 0,1%					3,68	

The average length of annual branches was directly influenced by the more intense pruning, but in a different manner depending on each variety, and the differences between varieties thus showing their biological character (Table 3).

During the three experimental years, the growth was different; in 2017 were recorded lower values while in 2018 were noted higher

ones. The average values showed the varieties with a lower ramification capacity, but Patriot and Brigitta had slightly higher average growths.

Statistically, except for Duke, all variants were better than the control, the differences being distinctly significant for the moderate pruned plants and very significant for the more intense pruned ones.

Table 3. Dynamics of the average length of annual branches for some blueberry varieties (cm)

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	18,7	16,7	22,5	19,30	Mt
	V2	20,4	17,1	24,8	20,77	N
	Average	19,55	16,9	23,65	20,03	N
Draper	V1	23,4	22,1	25,3	23,60	**
	V2	25,7	26,6	29,4	27,23	***
	Average	24,55	24,35	27,35	25,42	***
Patriot	V1	21,5	22,3	25,4	23,07	**
	V2	28,6	30,8	29,9	29,77	***
	Average	25,05	26,55	27,65	26,42	***
Brigitta	V1	23,4	21,6	24,5	23,17	**
	V2	30,7	32,4	31,8	31,63	***
	Average	27,05	27	28,15	27,40	***
DL 5%					2,68	
DL 1%					3,72	
DL 0,1%					5,18	

The number of inflorescences grew from one year to the other in accordance to the plants

growth (Table 4). The number of formed inflorescences was distinct especially due to the

variety and certainly to the applied pruning. Thus, except for Duke which formed more inflorescences on the more intense pruned plants, the plants formed more inflorescences for the variants with lighter pruning due to a higher number of branches.

The average data for the three years showed that the Duke variety formed the smallest

number of inflorescences, while Patriot had the highest number. Statistically, for three varieties the V2 variant did not record differences compared to the control, while the V1 variants recorded distinctly significant differences for Draper and Brigitta and very significant differences for Patriot.

Table 4. Dynamics of the number of inflorescences for some blueberry varieties (infl.)

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	180	212	245	212,33	Mt
	V2	150	269	449	289,33	N
	Average	165	240,5	347	250,83	N
Draper	V1	226	392	432	350,00	**
	V2	192	322	355	289,67	N
	Average	209	357	393,5	319,83	*
Patriot	V1	225	468	517	403,33	***
	V2	215	416	480	370,33	**
	Average	220	442	498,5	386,83	**
Brigitta	V1	210	420	484	371,33	**
	V2	190	268	295	251,00	N
	Average	200	344	389,5	311,17	*
DL 5%					94,46	
DL 1%					131,25	
DL 0,1%					182,62	

The average fruit weight was influenced by the variety and pruning and the recorded values varied highly during the research period (Table 5). Thus, the lowest fruit weight was recorded for the Patriot variety, for V1 in 2017, with a value of only 0,96 g, while the highest value for the fruit weight was recorded for Brigitta,

V2, during the same year. The average values for the three years showed that the variants with a more intense pruning stimulated fruit growth for all varieties.

Amongst the varieties Duke and Brigitta had larger fruits, while Patriot produced smaller fruits (Table 5).

Table 5. Dynamics of the average fruit weight for some blueberry varieties

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	1,56	1,61	1,25	1,47	Mt
	V2	1,88	1,90	1,70	1,83	*
	Average	1,72	1,76	1,48	1,65	N
Draper	V1	1,25	1,30	1,02	1,19	N
	V2	1,76	1,90	1,24	1,63	N
	Average	1,51	1,60	1,13	1,41	N
Patriot	V1	1,01	0,96	1,06	1,01	Oo
	V2	1,15	1,16	1,38	1,23	N
	Average	1,08	1,06	1,22	1,12	O
Brigitta	V1	1,42	1,89	1,45	1,59	N
	V2	1,55	2,00	1,39	1,65	N
	Average	1,49	1,95	1,42	1,62	N
DL 5%					0,31	
DL 1%					0,43	
DL 0,1%					0,60	

The production capacity was different during the experimental years among the varieties and the pruning variants.

From all three years, 2017 ensured better fructification conditions, most of varieties having the largest production.

The average production per variant showed that pruning influenced the production for two varieties Duke and Patriot, the variant with more intense pruning ensured a better production.

The average value per variety showed that Patriot was more productive, with an average production of over 10 t/ha, while Duke had the lowest production of 8 t/ha.

Although the physical difference between the average values of the varieties was obvious, from a statistical point of view most variants had significant differences, except for the Patriot variant with cu more intense pruning, for which the difference was distinctly significant (Table 6).

Table 6. Dynamics of the production for some blueberry varieties (t/ha)

Variety	Variant	2016	2017	2018	Average	Significance
Duke	V1	7,43	7,17	5,81	6,80	Mt
	V2	7,12	9,92	10,17	9,07	*
	Average	7,28	8,54	7,99	7,94	N
Draper	V1	7,46	11,35	8,99	9,27	*
	V2	8,72	11,04	8,92	9,56	*
	Average	8,09	11,20	8,96	9,42	*
Patriot	V1	4,31	11,88	12,93	9,71	*
	V2	6,40	13,15	14,40	11,32	**
	Average	5,36	12,52	13,66	10,51	*
Brigitta	V1	7,93	8,49	11,99	9,47	*
	V2	7,84	10,63	9,91	9,46	*
	Average	7,89	9,56	10,95	9,47	*
DL 5%					1,86	
DL 1%					3,75	
DL 0,1%					6,39	

CONCLUSIONS

From the present paper it can be concluded that the varieties had a good response in the area of the experiment. The reaction of the varieties to pruning was distinct, which shows that the culture technology must be applied depending on the variety. Generally, a more severe pruning determined a better plant growth and a higher fruit size.

The production was influenced more by the biological characteristics of the variety than by the pruning applied.

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