UDC: 634.73:631.8
original scientific paper

Acta Agriculturae Serbica, Vol. IX, 17 (2004) 3-10

Acta Agriculturae Serbica FACULTY OF AGRONOMY • ČAČAK •

Response of bluberry to soil (SL) or soil foliar integrated (SFI) multicompound fertilizers application

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Abstract: An experiment was carried out in 2001and 2002 with blueberry (*Vaccinium corymbosum* L) cv. Bluecrop on commercial field. One year before the trial was started, plants have been already grown on sandy soil mixed with sawdsut compost in the rows. Three fertilizers treatment were applied, each in three replications. The size of mentioned single replication plot was 240 sq.m. As a source of nutrients the multicompound fertilizers NITROPHOSKA perfect 15-5-20+micro and BASFOLIAR 12-4-6 were used. During the vegetation period the soil along the plant rows was sampled simultaneously with the index plant parts. EC as well as pH were measured in the soil samples and macroelements concentration were determined in both i.e. soil and plant samples. The influence of applied fertilizers on the yield of berries was evaluated as well. The fertilizers used differenciated the plant available nutrients content in the upper soil layer and modified their concentration in an index plant leaves. Nitrogen phosphorus, potassium as apllied on SFI way influenced the plants growth and their yielding.

Key words: Blueberry, soil, foliar, fertilization

Introduction

Within last six years blueberry has been noticed as economically profitable plant for its growers. Blueberry fruits came also into demand of consumers due to high quality fresh and defrozen fruits their dietetical value as well as good taste and flavour. Therfore the area of blueberry plantations and distribution market is steadily increasing. In ranking of European countries Poland takes the first place in both area and tonnage production of these fruits (Zmarlicki 1999). Since 1995 until now an increase of growing area and

production tonnage of blueberry is evaluated in Poland by 2-3 % per annum. The growth and yielding of this plant is influenced by fertilization. An available bibliograpy of the last years points that attantion was turned out mainly on blueberry response to nitrogen application (Clark, McNew ,Maples,1999 and Clark, Young, Phillips,1999). The soil foliar integrated (SFI) fertilization of blueberry in proecological aspects has been not practically recommended as well. There is lack of date on effect of the multicompound fertilizers use too. An integrated i.e. combined soil and foliar (SFI) fertilization is aimed to acheive plant nutritional status which will assure their satisfactory growth and yielding. At the same time decreasing the soil applied fertilizer dose which is economically accepted by the grower. Supplementary foliar nutrients dressing are considered as beneficial for an environement by reducing the risk of their leaching - especially nitrogen (MacKerron, Young, 1996). The aim of this experiment was to estimate an influece of soil foliar integrated (SFI) multicompound fertilizers application on nurtitional status and yielding of blueberry plants.

Materials and methods

Since 2000, two years old seedlings of blueberry (*Vaccinium corymbosum* L.) cv. Bluecrop have been planted under commercial field conditions on sandy soil. In the plant rows, composted sawdust was incorporated into the soil before planting. The plants were planted at 3 m interrows and 1 m between them. The size of the single plot was 80 m x 3 m i.e. 240 sq.m. There were 80 plants on each plot. In 2001 and 2002 experiments with the following fertilizers i.e. solid Nitrophoska perfect 15-5-20 and liquid Basfoliar 12-4-6 were carried out. The application of the mentioned fertilizers, was as follow:

2001	[kg·ha^{-1}]	**2002**	[kg·ha^{-1}]
1. Nitrophoska	400	1. Nitrophoska	350
2. Nitrophoska	300	2 Nitrophoska	600
Basfoliar 2x 0.3%	600*		
3. Nitrophoska	400	3. Nitrophoska	500
Basfoliar 2x 0.3%	600*	Basfoliar 2x 0.3%	600*

There were three replications in each treatment. Nitrophoska basic doses were splitted in 2001 and 2002 respectively for three parts: 1. 200+100+100 and 150+100+100, 2.150+75+75 and 300+150+150, 3. 200+100+100 and 300+100+100 [kg.ha^{-1}]. Than they were broadcast and incorporoated with the soil. The first dose was applied after the blueberries leaves were well developed, the second in the time of blooming and the third one at fruits setting period. Basfoliar was sprayed two times on the leaves by 300 [l.ha^{-1}] i.e. when full

blooming and fruit setting. During vegetation the soil along the plant rows was sampled. Simultaneously the index plant parts were taken too. In the soil samples EC and pH_{KCl} were measured. P and K from the soil were extracted by Egner-Riehm and Mg by Schachtschabel and estimated by Jarrel Ash IPC. The total N in the plant samples was determined by means of Kjel Foss Automatic Analyser and P, K, Mg, Ca after the samples wet digestion by Jarrel Ash IPC. The yield of fruits was statistically evaluated by Neumann-Keuls test at alpha=0.05.

Results and discussion

The nutrients concentration in the soil were similar in the first year after all of Nitrophoska treatments. In 2002 the highest dose of Nitrophoska i.e 600 [$kg.ha^{-1}$] involved an increase of P, K, Mg in the soil. The soil reaction along the blueberry rows was similar at all of Nitrophoska applications but EC increased when 600 [$kg.ha^{-1}$] of Nitrophoska was broadcast. (tab.1,2).

Tab.1 – Effect of different fertilizers application on EC and pH and minerals content in the soil upper layer at the stage of fruits setting of blueberry cv. Bluecrop

treatment		EC [mS]	pH_{KCl}	P	K	Mg
				[$mg.100\ g^{-1}$]		
2001						
1. Nitrophoska	400 [$kg.ha^{-1}$]	0,3	4,3	5,16	7,54	3,27
2. Nitrophoska	300 [$kg.ha^{-1}$]					
Basfoliar 2x	600 [$l.ha^{-1}$]	0,3	4,3	4,78	7,75	3,97
3. Nitrophoska	400 [$kg.ha^{-1}$]					
Basfoliar 2x	600 [$l.ha^{-1}$]	0,3	4,3	4,81	7,44	4,51
2002						
1.Nitrophoska	350 [$kg.ha^{-1}$]	0,8	4,3	2,80	8,70	6,76
2. Nitrophoska	600 [$kg.ha^{-1}$]	1,1	4,3	4,16	11,10	7,07
3. Nitrophoska	500 [$kg.ha^{-1}$]					
Basfoliar 2x	600 [$l.ha^{-1}$]	0,7	4,2	3,27	7,95	6,77

Tab.2 – Effect of different fertilizers application on EC and pH and minerals content in the soil upper layer at the beginning of fruit ripening stage of blueberry cv. Bluecrop

treatment		EC [mS]	pH_{KCl}	P	K	Mg
				[mg.100 g^{-1}]		
2001						
1. Nitrophoska	400 [kg.ha^{-1}]	0,3	4,2	2,92	7,96	5,00
2. Nitrophoska	300 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	0,3	4,2	2,63	7,70	6,12
3. Nitrophoska	400 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	0,4	4,0	3,69	7,02	5,76
2002						
1.Nitrophoska	350 [kg.ha^{-1}]	0,7	4,4	3,17	6,51	4,48
2. Nitrophoska	600 [kg.ha^{-1}]	0,8	4,7	3,51	7,68	4,84
3. Nitrophoska	500 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	0,7	4,5	3,32	6,76	4,73

Tab.3 – Effect of different fertilizers application on minerals content in index leaf of blueberry cv. Bluecrop at fruit setting stage

treatment		$N_{tot.}$	P	K	Mg	Ca
		[% d.m.]				
2001						
1. Nitrophoska	400 [kg.ha^{-1}]	2,07	0,16	0,60	0,13	0,39
2. Nitrophoska	300 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	2,11	0,17	0,64	0,14	0,39
3. Nitrophoska	400 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	2,18	0,19	0,63	0,12	0,41
2002						
1.Nitrophoska	350 [kg.ha^{-1}]	2,08	0,14	0,65	0,14	0,40
2. Nitrophoska	600 [kg.ha^{-1}]	2,10	0,15	0,66	0,13	0,42
3. Nitrophoska	500 [kg.ha^{-1}]					
Basfoliar 2x	600 [l.ha^{-1}]	1,95	0,13	0,61	0,12	0,38

Nutrient demands of blueberry plants are rather slight and they must be professionally recognized as well as strictly fulfilled since this species belongs to shallow rooting ones (Pliszka 2000). Respecting this remark the obtained results revealed satisfactory response of blueberry cv. Bluecrop to soil - foliar fertilizer application. It has to be considered that plants grown in an experiment carried out, were only two/three years old. Their root system was not fully developed yet. In such case additional foliar nurtients supplying appeared as efficient for better yielding. Effciency of foliar dressing was observed within both i.e. 2001 and 2002 year at lowered but integrated nutrients supplying i.e. Nitrophoska 300 [kg.ha^{-1}] + Basfoliar or 500 [kg.ha^{-1}] + Basfoliar respectively (Fig. 1). After Basfoliar application its impact on the earliest yield of berries also appeared. This was observed at the end of 1st decade of August, 2001 as well as 2nd decade of June,2002 when 400 or 500 [kg.ha^{-1}] Nitrophoska doses were used on integrated way with Basfoliar treatment. Plants mineral status (tab.3,4) corresponded to index leaves mineral standards by (Trevett et.al., 1968 and Ścibisz, 2000) as well. (Fig.2,3).

Comparing (SFI) and (SL) fertilizers use, the total rates of nutrients applied on the field were diminished by 14.6 N,4.9 P_2O_5, 19.8 K_2O [kg.ha^{-1}] at soil - foliar integrated fertilization.

All of this results indicates that soil - foliar integrated (SFI) fertilization effects blueberry better cropping.

Tab.4 – Effect of different fertilizers application on minerals content in index leaf of blueberry cv. Bluecrop at the beginning of fruit ripening stage

treatment	$N_{tot.}$	P	K	Mg	Ca
	[% d.m.]				
2001					
1. Nitrophoska 400 [kg.ha^{-1}]	2,03	0,12	0,54	0,18	0,57
2. Nitrophoska 300 [kg.ha^{-1}] Basfoliar 2x 600 [l.ha^{-1}]	2,10	0,13	0,59	0,16	0,57
3. Nitrophoska 400 [kg.ha^{-1}] Basfoliar 2x 600 [l.ha^{-1}]	2,16	0,14	0,63	0,16	0,58
2002					
1.Nitrophoska 350 [kg.ha^{-1}]	1,91	0,13	0,52	0,14	0,50
2. Nitrophoska 600 [kg.ha^{-1}]	1,89	0,13	0,51	0,13	0,47
3. Nitrophoska 500 [kg.ha^{-1}] Basfoliar 2x 600 [l.ha^{-1}]	1,88	0,13	0,51	0,14	0,47

Fig.1 - Marketable yield of blueberry as influenced by Nitrophoska(NP) and Basfoliar(BF) application

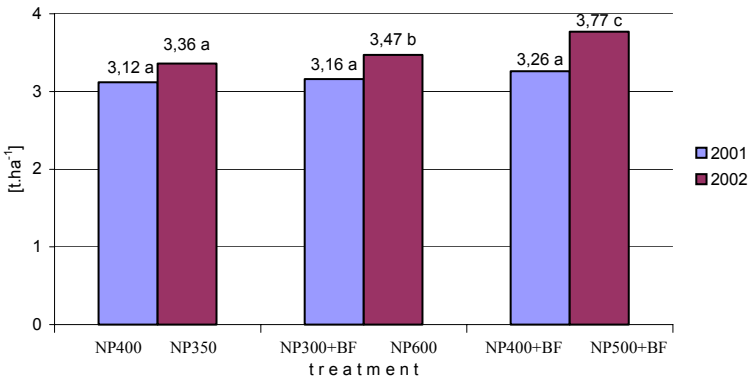


Fig. 2 - Response of blueberry cv. Bluecrop yielding as influenced by Nitrophoska (NP) and Basfoliar(BF) application (2001)

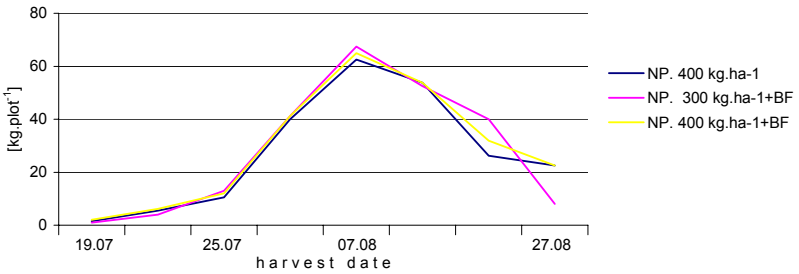
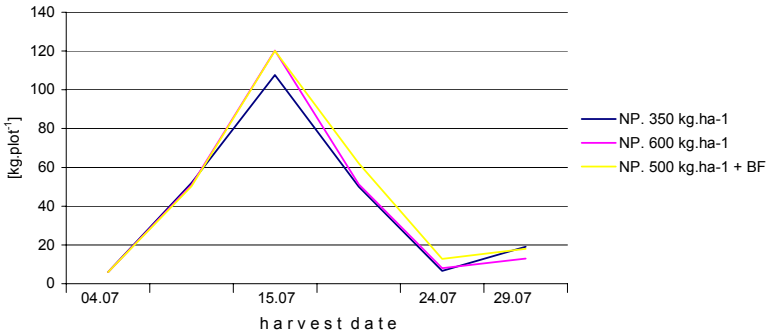


Fig.3 - Response of blueberry cv. Bluecrop yielding as influenced by Nitrophoska(NP) and Basfoliar(BF) application (2002)



Conclusions

- The yield of blueberry fruits cv. Bluecrop, increased after soil - foliar i.e. Nitrophoska perfect and Basfoliar application as compared to Nitrophoska perfect soil fertilization only. In case of soil - foliar plants nutrition the doses of Nitrophoska perfect were diminished by 100 or 150 $kg.ha^{-1}$

- In case of soil – foliar fertilization an amount of nutrients as incorporated into the agro-system was diminished by 14.6 N,4.9 P_2O_5, 19.8 K_2O [$kg.ha^{-1}$] with positive effect for blueberry yielding; proecological value of this way of plants fertilization may be taken into consideration

- After soil – foliar fertilization, when lowered doses of Nitrophoska perfect were used, plants mineral status at fruit setting and fruit maturing stages corresponded to proper macroelement index leaves standards

- There was the tendency of acceleration of fruits maturing observed most of all within the first decade of berries harvesting, when soil – foliar plants nutrition was apllied

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REAKCIJA BOROVNICE NA PRIMENU HEMIJSKI SLOZENIH FOLIJARNIH ĐUBRIVA

- originalni naučni rad -

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Rezime

Na oglednom polju tokom 2001-2002.god. obavljen je eksperiment sa borovnicom (*Vaccinium corymbosum* L.) sorte Bluecorp. Godinu dana pre početka ogleda, biljke su već gajene u redovima na peskovitom zemljištu pomešanom sa kompostom od piljevine. Primenjene su tri vrste đubriva u tri ponavljanj. Veličina eksperimentalne parcele iznosila je 240 m^2. Kao izvor hranljivih materija korišćena su đubriva sastavljena od slozenih hemijskih jedinjenja NITROPHOSKA perfekt 15-5-20 + mikroelementi i BASFOLIAR 12-4-6. U toku vegetacionog perioda, praćen je efektivni sadrzaj hranljivih elemenata i pH (u zemljištu i u biljnim delovima), kao i prinos borovnice. Đubriva su promenila sastav hranljivih elemenata u gornjem sloju zemljista, kao i u obeleženim listovima biljke. Što se tiče razvoja i prinosa borovnice najbolje se pokazala integrisana zemljišno – folijarna primena ovih đubriva.