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FIRST YEAR REACTION OF SOME EARLY HIGHBUSH BLUEBERRY VARIETIES GROWN IN CONTAINERS TO ORGANIC FERTILIZERS AND PEST CONTROL

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Abstract

In the light of current trends for enlarging the growing possibilities of blueberry plants, we were focusing in the present work on the innovative systems designed for higher productions and in the same time organically managed to accomplish the sustainable goals. Three northern highbush blueberry varieties were subject of the trial set up in early 2019: 'Early blue', 'Duke' and 'Hannah's choice'. The two years old planting material was moved under the plastic solar in containers of 65 liters with different substrate composition. A fertilization scheme using only organic commercial products was applied and the reaction of the plants was evaluated. 'Hannah's choice' was the most vigorous variety according to the total annual growths per plant. Several organic products to control pests were tested too, and the most efficient one to aphids was Chrisopa. In order to define a tailored organic technology for such a crop system, the results need further validation.

Key words*: Vaccinium corymbosum L., pots, growing substrates, organic. greenhouse.*

INTRODUCTION

Blueberries are nowadays worldwide considered as one of the healthy fruits (Lobos, 2015) and with high economic potential. Therefore, the crop catches the attention of many investors. The expansion of highbush blueberry in new areas of growing has to follow the genetic pattern of the varieties and also the environmental challenges in fully accordance with the market and consumers need.

Many countries such as Netherlands or Belgium has short harvest period and solutions for extending harvest period are expected by all the growers. In this regard, there are few solutions considering protected crops as a reliable response to this. Under the rain cover, the harvest can be delayed for about 2 to 3 weeks, but the plastic tunnels can advance 5-6 weeks prior to the open field early production (Bal, 1997).

Some economic studies were also been done in order to evaluate the opportunity of such investment (Asanica, 2018; Julian, 2011). This is not an easy decision due to a higher investment rate but became more actual in the context of land use efficiency and climate change. To better control the substrate, environmental factors and the harvest time, growing blueberries in containers (Asanica, 2019) has a high chance to foster the common goals of the future urban horticulture.

The water use efficiency inside the greenhouse and in open field is another issue to be addressed in the near future (Nicola, 2020).

Heiberg and Lunde (2006) studied the effect of growth media on highbush blueberries grown in pots and conclude that in the two years of experiment there was no significant differences between the substrate's mixtures used upon the plant height and fruit yield.

Producing blueberries in containers offers the advantage of a better pH control, drainage, organic mater and avoid the shortings of the open field crop (Kingstin et al., 2017).

In Mississippi, using high tunnels for blueberry container crops advanced blueberry production up to 5 weeks (Li and Bi, 2019) with an evident increase of market price. One interesting mention of the same authors concern the delay of the first harvest in the case of using organic fertilizers possible due to the low rate for nitrogen release.

Since more and more growers and consumers are focus on producing high quality organic fruits (Strik et al., 2016) with premium prices (DeVetter et al., 2015), we are setting up an

experiment combining more elements that we consider proper to be approached together in the near future: blueberry crop in containers, under the plastic and in organic system. The goal is to find the best solution for growing organic blueberries in the urban or peri-urban areas and in an economic range of profitability for the growers. One immediate aim is to see the optimum technological measures to foster the growths of the young blueberry plants in order to shorten the preharvest period.

MATERIALS AND METHODS

The experiment was established in 22nd of April, 2019 and designed as follows:
Size of the solar: 6 m x 18 m.
Solar cover: Ginegar Suncover Nectarin of 150 µ (87% light transmission, 35% light diffusion, 85% termicity); UV trans 300-380 nm - 45%.
Biological material: three blueberry early varieties ('Duke', 'Early blue' and 'Hannah's choice').
Blueberry pots (containers): 65 litres.
Growing substrate: different share of acid peat Kekkila FBM525 Vaccinium and pine grinded bark.
Mulch: Agrotextile under the pots.
Irrigation: drip line with stakes emitters of 6 LPH (3 stakes/pot).
Nutrition: organic fertilizers (New Logic, Bioact Veg foliar and soil application); Trianum-V (Koppert) in pot only at the planting time.
Fertilizers were applied regularly starting from the planting day (22nd of April) with Protamin (100 g/pot) in the upper part of the substrate and Trianum-V 1 g/10 plants (23rd of April, 2019) by watering. New Logic has been applied three times on substrate (3rd of May, 22nd of July and 5th of August) in a dose of 3 ml/pot/application (0.6%) and three times foliar application (15th of July, 18th of July and 23th of July) in 1% dose, respectively 2 ml/plant/application.
Bioact Veg has been used seven times for fertilize the plants on substrate with 3 ml/pot/application (11th of May, 20th of June, 29th of June, 25th of July, 13rd of August, 20th of August) and seven times as foliar sprays with 2 ml/pot/application (20th of June, 11st of July, 18th of July, 23rd of July, 22nd of August, 10th of September).
The experimental scheme is presented in the Table 1 and the module design in the Figure 1.

Table 1. Experimental variants constituted by location, substrate mixture and fertilization scheme application

Variant	Type	Substrate	Foliar fertilization	Substrate fertilization
V1	solar	Peat 90% + Pine bark 10%	New Logic	New Logic + BioactVeg
V2	solar	Peat 90% + Pine bark 10%	BioactVeg	New Logic + BioactVeg
V3	solar	Peat 75% + Pine bark 25%	New Logic	New Logic + BioactVeg
V4	solar	Peat 75% + Pine bark 25%	BioactVeg	New Logic + BioactVeg
V5	solar	Peat 50% + Pine bark 50%	New Logic	New Logic + BioactVeg
V6	solar	Peat 50% + Pine bark 50%	BioactVeg	New Logic + BioactVeg
V7	open field	Peat 90% + Pine bark 10%	New Logic	New Logic + BioactVeg
V8	open field	Peat 90% + Pine bark 10%	BioactVeg	New Logic + BioactVeg

Phyto protection: ecological products (Laser 240SC, Garex B, Prev-Am., Deffort) and natural predators (*Chrysopa*, *Chrysoperla carnea*). The insects were lunched inside the solar on 10th of August and 31st of August when the aphids were present indoor on the top of the shoots.
The predators were released in the proximity of the aphids (on the attacked shoots leaves), on the top of the pot substrate (base of the plant) and suspended in the small boxes hanging very close to the plants.

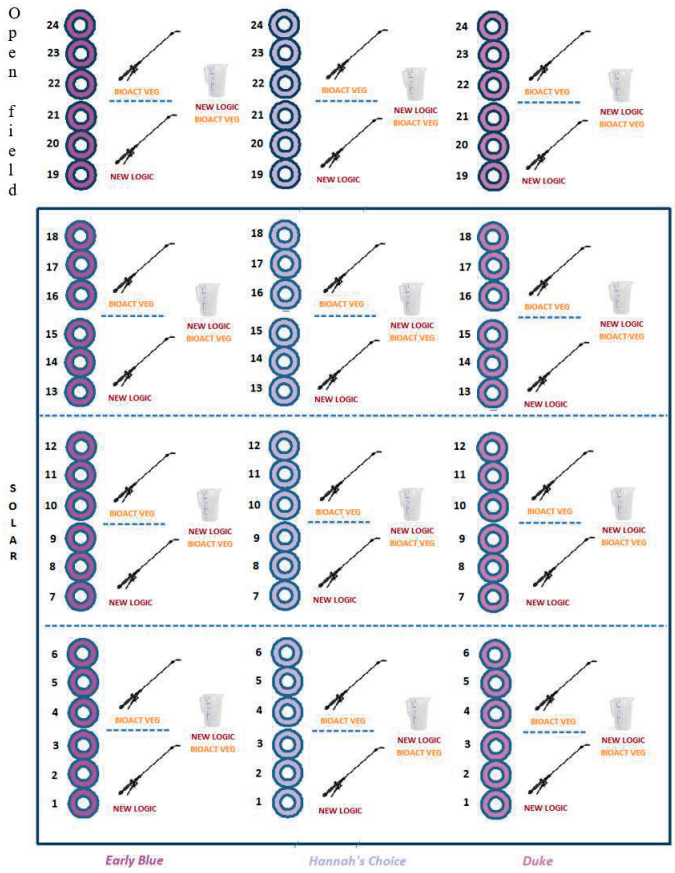


Figure 1. Experimental model for blueberry fertilization

RESULTS AND DISCUSSIONS

The matrix of factors involved in the research brings evident influences in the vegetative growths of the blueberry plants.

The Protamin and Trianum-V products applied at the beginning of poticulture assured a good start of the growing season and reduced the number of died plants after planting.

From the data gathered in 2019 and analyzed, it results that the growth vigour of 'Hannah's choice' variety is much higher that the other two varieties 'Duke' and 'Early blue'.

The total growths/plant indicates 'Hannah's choice' with the most productive vegetation volume (Figures 2 and 3).

The yearly growth sum is about two times more than 'Early blue' and four times more than 'Duke' (Figure 4).

Figure 2. Evolution of blueberry plant growths in 2019 in relation with variety and fertilization scheme applied (left - June, 2019 and right - September, 2019)

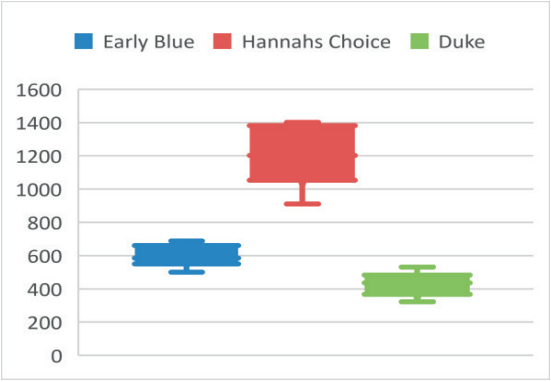
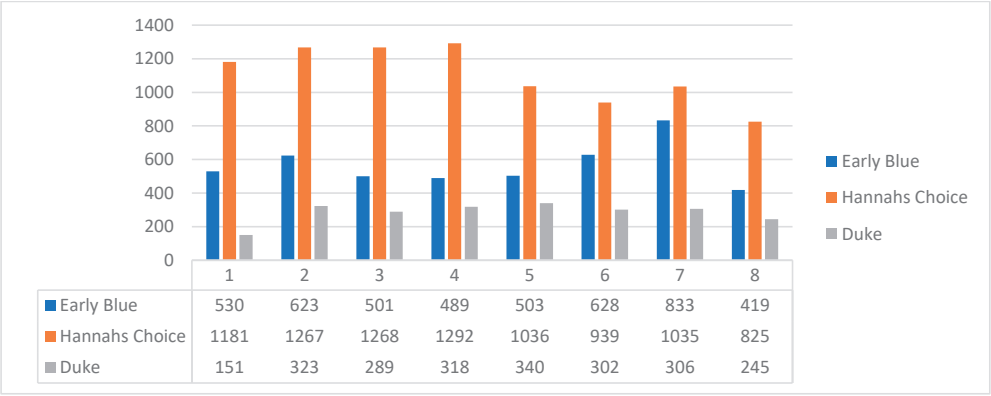


Figure 3. Vigour of blueberry varieties



	1	2	3	4	5	6	7	8
Early Blue	530	623	501	489	503	628	833	419
Hannahs Choice	1181	1267	1268	1292	1036	939	1035	825
Duke	151	323	289	318	340	302	306	245

Figure 4. Annual blueberry varieties growth sum (cm)

The tallest plants and with greater growth sum overpass 12 m of annual growths at 'Hannah's choice' and remains only at maximum 8.3 m at 'Early blue' and 3.4 m at 'Duke'.

The variability in growths is of 467 cm for 'Hannah's choice', 414 cm at 'Early blue' and 172 cm at 'Duke'.

The growing conditions have more impact in the total values of plant growths also for Hannah's choice mainly. The plastic cover enhanced the total growths with 25% (Figure 5). For the other two variants these conditions were not effective in due time.

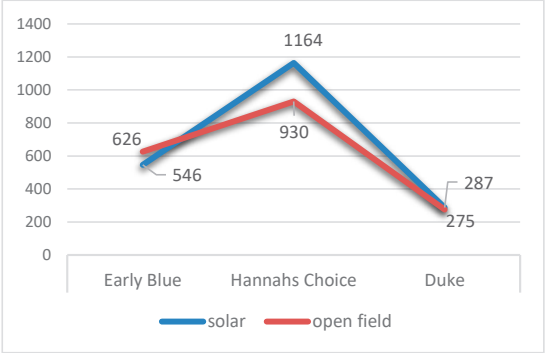


Figure 5. Plants growth under the plastic and open field

In terms of substrate and fertilization scheme applied upon the plant heigh, it was remarked that independent of blueberry variety (Figure 6), the presence of 90% of peat and 10% pine bark plus application of Bioact Veg sprays and New Logic and Bioact Veg applied directly in the substrate contributed to a better growth of the plants.

In contrast, the equal parts of the peat and pine bark in the pots and the fertilization with New logic foliar plus both products in the substrate generated lower growths at the end of the 2019 season.

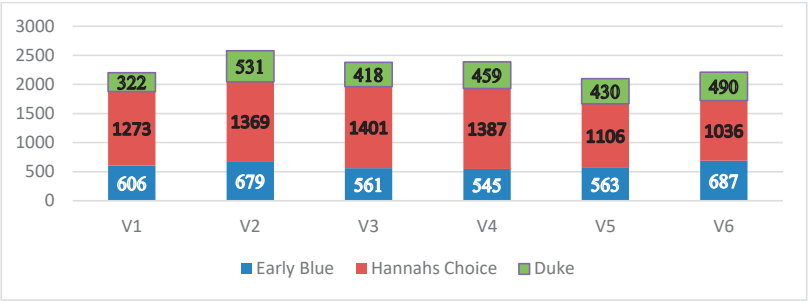


Figure 6. The influence of substrate and fertilization in the total growth of the blueberry varieties

Each variety reacted different at the fertilization and substrate composition (Figure 7). We can observe the similar trendline at the 'Duke' and 'Early Blue' varieties and while 'Hannah's choice' behaved better in a rich peat substrate and indoor.

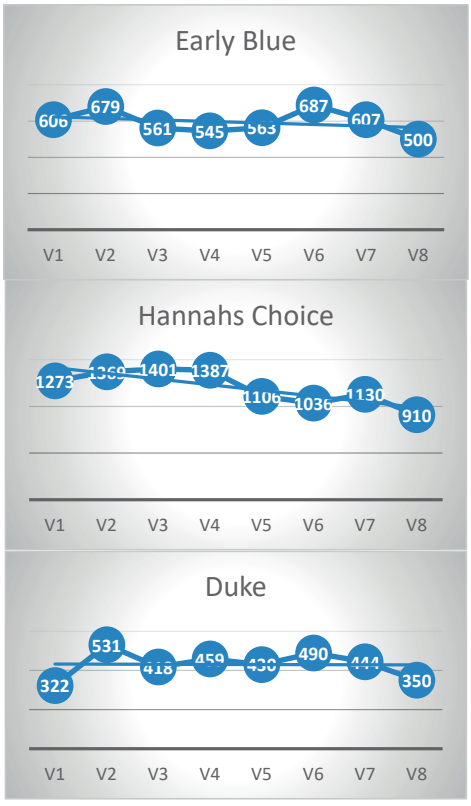


Figure 7. Variety growths according to the fertilization and substrate variant

Except 'Hannah's choice' where New logic increased the plant height, Bioact Veg had the same influence on the "Early blue' and 'Duke' growth (Figure 8).

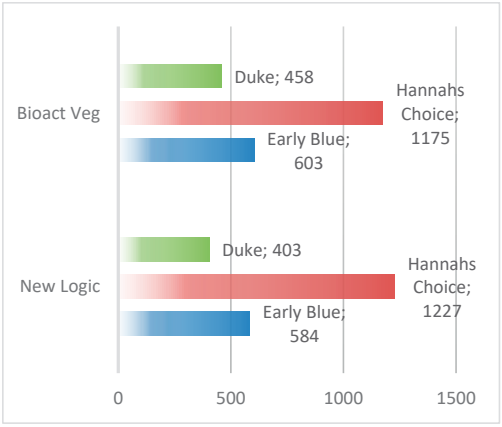


Figure 8. Influence of product fertilization on the total plant height (2019)

During the growing season, inside and in open field plants were not affected by diseases. The only key problem were aphids.

In August, the young shoots were severe attacked by the insects and couple of products were tested in this regard to assess the efficacity of them (Table 2).

Table 2. Efficacity of some organic products in the blueberry pest control

Product	Date of application	Dose	Efficacity
Laser 240 SC	May, 28 2019	6 ml/10 l water	Very good
GAREX B	July, 17 2019	10 ml/10 l water	Medium
PREV-AM	July, 18 2019	60 ml ml/10 l water	Medium
DEFFORT	July, 25 2019	30 ml/10 l water	Medium
GAREX B	July, 30 2019	60 ml/10 l water	Medium
DEFFORT + PREV-AM	July, 31 2019	25 ml DEF + 60 ml PREV/ 10 l water	
Chyisopa	August, 10 2019	*Chrysoperla carnea*	Excellent
PREV-AM + DEFFORT	August, 26 2019	PREV-AM 40 ml + DEF 30 ml/10 l water	
PREV-AM + LASER	August, 29 2019	PREV-AM 40 ml + LASER 5 ml/10 l water	
Chrisopa	August, 31 2019	*Chrysoperla carnea*	Very good

At the beginning, Laser was very efficient in combat the aphids but soon after another wave of aphids attacked the blueberry shoots and the repetition of the spray with Laser this time was not efficient as first application.
The other products such as Garex B, Prev-Am, Deffort had more repellent effect rather to fight against the aphids.
The natural predators *Chrysoperla carnea* proved a high efficiency and eliminated the aphids. At the second lunch in the end of August, 2019 the number of predators decreased and therefore to continue fight against aphids it was necessary to release more adults.

CONCLUSIONS

The fertilization strategy has to follow the environmental conditions and variety need.
Most vigorous variety was 'Hannah's choice' which grew higher.
Under the plastic, during one season for 2 out of three young blueberry varieties the influence was not enough expressed in terms of total growths.
More peat in the substrate proved to be in favour of supporting vegetative grows for the blueberry plants.
To protect the vegetative growths of the blueberry plants, two methods proved their efficiency: Laser spraying one time and *Chrysopa* as a natural predator product against aphids.

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