

**INFLUENTA SUBSTRATULUI DE PLANTARE ASUPRA NATURII SI INTENSITATII CORELATIILOR DINTRE UNELE CARACTERISTICI DE CRESTERE, FRUCTIFICARE SI CALITATEA PRODUCTIEI DE FRUCTE LA SAPTE SOIURI DE AFIN IN PRIMII CINCI ANI DE RODIRE**  
**THE INFLUENCE OF PLANTING SUBSTRATE ON THE NATURE AND INTENSITY OF CORRELATIONS BETWEEN SOME GROWTH, FRUCTIFICATION AND FRUIT QUALITY CHARACTERISTICS OF SEVEN Highbush BLUEBERRY VARIETIES IN THE FIRST FIVE YEARS OF FRUITING**

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**Abstract**

For a good growth, the highbush blueberry (*Vaccinium corymbosum*) needs special soil conditions with high organic matter content, good water permeability, and low pH values ranging from 4.8 up to 5.5. To create such conditions on an alluvial soil with low humus content, poorly gleyed, an experiment was organized on the 3<sup>rd</sup> terrace of the `Doamnei River`, at Maracineni – Arges. The experiment had the following scheme: A Factor - cultivar, with seven graduations: a<sub>1</sub>- Simultan, a<sub>2</sub>-Delicia, a<sub>3</sub>-Lax, a<sub>4</sub>-Compact, a<sub>5</sub>-Augusta, a<sub>6</sub>-Azur a<sub>7</sub>-Blueray; B Factor - planting substrate, with 3 graduations: b<sub>1</sub>-5 kg peat+5kg manure; b<sub>2</sub>= 10 kg coniferous litter; b<sub>3</sub>= 5kg peat+5 kg manure+40 g sulphur powder; C Factor- experimental year, with 5 graduations (2005-2009). To emphasize the effects of applying such materials on some fruiting characteristics of seven highbush blueberry cultivars, some investigations were carried out at the Research Institute for Fruit Growing Pitesti-Maracineni during 2005-2009 period. Of all correlations calculated, the percentage of significant correlations recorded a value of 100% for all graduations of A,B,C experimental factors and for indicators of plant growth and fructification but for physical and chemical fruit quality indicators, the lower values were recorded. For all three groups of related indicators (growth, fructification, fruit quality), the highest percentage of significant correlations occurred: for the Delicia variety, followed by the Simultan variety, and the on the last two positions the Compact and Lax varieties were located; in the case of b<sub>1</sub> planting substrate, and on the second places b<sub>2</sub> and b<sub>3</sub> planting substrates were placed; for the C factor, in the case of second research year, followed chronologically by the third, fourth and fifth year. On average on the experimental factors graduations the highest percentage of significant correlations occurred between: height and diameter of the plant (growth indicators); between the number of the flower buds and flower clusters per bush (fructification indicators); between fruit and calyx cavity size (physical fruit quality indicators); and between dry matter and the other chemical indicators (chemical fruit quality indicators).

**1. Introduction**

The highbush blueberry is characterized by large berries with intensive dark blue color, high firmness and a pleasant sweet taste. The berries are considered to be one of the most valuable fruit due to their low caloric value (Skupien, 2006) and high antioxidant activity (Prior *et al.* 1998, Mainland *et al.* 2002). For this reason, this crop is extensively cultivated in the USA and more recently have become a popular commercial crop in many European countries. In Romania, high bush blueberry was introduced for the first time in 1968 at the Research Institute for Fruit Growing Pitesti-Maracineni (Botez *et al.*, 1984). For optimal growth and productivity high bush blueberry needs well drained acid soils (pH<sub>H2O</sub> 4.8-5.5) with high content of organic matter. In Romania such soils are found on restricted areas. To extend the highbush blueberry culture on large areas with different soils, the pH adjustment and additional organic matter before planting is necessary (Korkak, 1988; Finn *et al.*, 1993). The effects of three planting substrates on the growth, fructification and fruit quality characteristics of seven highbush blueberry cultivars were presented in previous works (Ancu, 2010, Iancu, 2010, 2010 a). The aim of this paper is to present the influence of application of these materials on the nature and intensity of correlations between indicators used for characterization of these effects.

**2. Material and methods**

The experiment was located on the 3<sup>rd</sup> terrace of the `Doamnei River`. Some data about this experiment were presented in other paper published in these proceedings (Iancu *et al.* 2010). A subdivided plot design with factorial arrangement 7x3x3 was applied after the following scheme: A Factor - cultivar, with seven graduations: a<sub>1</sub>- Simultan, a<sub>2</sub>-Delicia, a<sub>3</sub>-Lax, a<sub>4</sub>-Compact, a<sub>5</sub>-Augusta, a<sub>6</sub>-Azur a<sub>7</sub>-Blueray; B Factor - the substrate applied at planting, with 3 graduations: b<sub>1</sub>-5 kg peat+5kg manure; b<sub>2</sub>= 10 kg coniferous litter; b<sub>3</sub>= 5kg peat+5 kg manure+40 g sulphur powder; Factor C-the studying year, with

5 graduations: c1 = 2005; c2=2006; c3=2007; c4=2008, c5=2009. For quantifying the effects of the experimental factors above mentioned on the growth, fructification and fruit quality some indicators were used. There were calculated correlations both between indicators of the same group of indicators (growth, fructification, fruit, quality) and between indicators from these different groups. Only linear correlations using Microsoft office 2003 Excel were calculated. To highlight the strength of correlations specific of each graduation of experimental factors (A,B,C) or of used indicators, the percentage of significant correlations from total number of calculated correlations was registered. When this percentage of significant correlations registered the same value, the separation strength of correlations by averaging the absolute values of significant correlation coefficients was done.

### 3. Results and discussions

#### 1. The influence of experimental factors graduations on the nature and intensity of growth indicators.

For each of the seven studied varieties, the percentage of significant correlations from total number of calculated correlations between the six growth characteristics (P) was 100%. The average values of the absolute values of the significant correlation coefficients for Azur variety (0,803), followed by Delicia variety (0.790), Simultan variety (0.776), Compact variety (0.773), Blueray variety (0.770), Lax variety (0.757) Augusta variety (0.723) were recorded. For each of the tree planting substrates, the same values of P coefficient (100% from total number of calculated correlations) were registered. The average value of the absolute values of significant correlation coefficients for the b1 planting substrate (0.702), followed by b3 planting substrate (0,652) was registered. On the last place, the b2 planting substrate coefficient (0.604) was situated.

For all the seven varieties studied and the three planting substrates, the same percentage of significant correlations between the six growth characteristics (100% from the total number of calculated correlation). for each of the five research years was registered. The average values of absolute values of the significant correlation coefficients (CC1) in the first year (0.752), followed by second year (0.696) fourth year (0.681), third year (0.668) were registered. The value of this type of correlation coefficient from fifth year (0.538) on the last place was situated..

The number of cases in which, each of the six correlation between growth characteristics, for all experimental factors graduations (CN%), was the same (100%). In exchange, the highest average value of absolute values of significant correlation coefficients for all experimental factors graduations (CC-2) for the height and diameter of the bush (0.926) and the lowest average value for the number of shoots and the average length of shoot per bush (0.329) were recorded (Table 1).

#### 2. The influence of experimental factors graduations on the nature and intensity of fructification indicators.

For each of the seven varieties studied, the percentage of significant correlations from the total number of calculated correlations between the four fructification characteristics (P) was 100%. The average value of the absolute values of correlation coefficients between, the four fructification characteristics (C.C-1) highest for the Delicia variety (0.785) and lowest one for Lax variety (0.633) was recorded. For the b1 and b3 planting substrates the same values of P (75%) were recorded, and for the b2 planting substrate the value of this coefficient was 50%. In exchange, for the b2 planting substrate the value of C.C-1coefficient was 0.954, for b3 one 0.840, and for b1 planting substrate the value of this coefficient was only 0.776.

For the second, third and fourth year of research the value of P was 100% and for the fifth year the value of this coefficient was 75%. But among the for research years the highest value of CC 1 coefficient (0.739) in the fifth year and the lowest one (0.529) in the second year, was recorded.

For all experimental factors graduations for two from the four calculated correlations between the fructification indicators the values of P coefficient were 100% and for the other two they registered the value of 86% and respectively 79% (table 2).

#### 3. The influence of the experimental factors graduations on the nature and intensity of some fruit quality characteristics.

##### 3.1. The correlations between the physical characteristics of fruit quality

On average for the three planting substrates and three research years the value of P coefficient in brackets for the three varieties (Simultan, Delicia, and Blueray) was 100%, and for the other studied four varieties the value of this coefficient was 60%. On average for the seven varieties and three research years the value of P coefficient for the b1 planting substrate was 100%, and for the b2 and b3 ones its value was 80%.

On average on the A,B,C experimental factors graduations, for each of the three research years the value of P coefficient was 80%.

On average for the A,B,C experimental factors graduations from the five calculated correlations, the value of P coefficient was 100% and for the two its value represented 69% and respectively 23%(table 3).

### **3.2. The correlations between the chemical characteristics of fruit quality**

#### **3.2.1. The influence of variety on the nature and intensity of correlations between analyzed chemical components.**

On average for the three planting substrates and four research years, the value of P coefficient for the Augusta variety (71%), for the Delicia and Lax varieties (57%), for the Simultan and Azur varieties (54%), and for the Compact and Blueray varieties (46%) were registered. For all seven studied varieties, the highest number of significant correlations from the total of 49 calculated correlations for each of the eight analyzed chemical component, for the dry matter chemical component (70%) and the lowest for the content of potassium was registered (37%) (table 4).

#### **3.2.2. The influence of planting substrate (b1, b2, b3) and the research year (C2-C5) on the nature and intensity of correlations between analyzed chemical components.**

The values of P coefficient for b2 planting substrate (75% from the total of 28 calculated correlations), 71% for b1 planting substrate and 68% for the b3 planting substrate were recorded.

On average for the seven studied varieties and three planting substrates the values of P coefficient for the third research year (89% from the total of 28 calculated correlations), 82% for the second research year and 68% for the fourth research year were registered (Table 5).

#### **4. The influence of experimental factors (A,B,C) on the nature and intensity of correlations between growth and fructification indicators.**

Among the analyzed growth indicators it was considered that the total length of annual shoots indicator is the most representative for characterizing of plant vigor. For this reason for the correlations presented in table 6 among the growth indicators only this indicator was used. The value of P coefficient for five from seven studied varieties, Simultan, Delicia, Lax, Augusta and Blueray (100%) and for the varieties Lax and Azur (80%) were registered. The values of P coefficient for b1 and b3 planting substrates (100% from the total number of calculated correlations) and 80% for b2 planting substrate were registered.

The values for the CC-1 coefficient for b1 planting substrate (0.656) and for b3 planting substrate (0.760) were recorded. In the third, fourth and fifth research year, the value of P coefficient was 100% from the total number of calculated correlations and in the second year its value was only 20% (table 6).

#### **5. Influence of the experimental factors on the nature and intensity of correlations between total length of annual shoots per bush and fruit physical and chemical indicators**

##### **5.1. The correlations between the total length of annual shoots per bush and fruit physical indicators**

The values of P coefficient for the Blueray variety (100% from the total number of calculated correlations), for Simultan, Delicia, Lax, Augusta, Azur (75%) and for Compact variety (50%) were recorded.

The values of P coefficient for b1 and b3 planting substrates (100% from the total number of calculated correlations) and 75% for the b2 planting substrate were registered.

The values of P coefficient for the fourth research year (75%) for the fifth year (50%) and zero for the third research year, were recorded (table 7).

##### **5.2. The correlations between the total length of annual shoots per bush and fruit chemical indicators**

For the seven studied varieties the value of P coefficient varied from zero (Simultan variety) to 62 % (Azur and Lax varieties). This shows small values and great variability of this coefficient. The values for b3 planting substrate (62%), for b1 planting substrate (50%) and for b2 planting substrate (25%) were registered (table 8).

#### **6. The influence of variety on the nature and intensity of correlations between fructification indicators and some physical and chemical fruit quality indicators**

On average for the three planting substrates and for the four research years, the values of P coefficient from the total 27 calculated correlations between the tree fructification indicators and the nine indicators related to fruit quality for the Augusta variety (52%), Delicia variety (48%), Blueray variety (44%), Azur variety 37%, Compact variety (30%) and Lax variety (26%) were recorded.

For all seven studied varieties from the total of 63 calculated correlations for each of the three fructification indicators and the nine indicators related to fruit quality the value of P coefficient for number of fruit per bush (46%), yield (41%) and average fruit weight (27) were recorded.

For all seven studied varieties, from the total of 21 calculated correlations for each of 9 indicators related to fruit quality and the three fructification indicators, the highest value of P coefficient for the ash content (86%) and the lowest value for the potassium content (19%) were recorded (table 9).

#### **7. The influence of planting substrates (b1, b2,b3) and of research years (C2-C5) on the nature and intensity of correlations between some fructification indicators and fruit quality indicators.**

On average for the seven studied varieties and the three research years, the values of P coefficient from the total number of calculated correlations between fructification indicators and those

related to fruit quality, for the planting substrates b1 and b3 (44%) and for b2 planting substrate (7%) were registered.

On average for the seven studied varieties and for the three planting substrates the values of P coefficient for the second research year (52%) and for the third and fourth research year (41%) were registered (table 10).

#### 4. Conclusions

The percent of significant correlations from total number of calculated correlations for all experimental factors graduations for the growth and fructification indicators (100%) and for indicators related to fruit quality (less than 100%) values were recorded.

For all tree groups of studied indicators (growth, fructification and fruit quality) from the total number of calculated correlations, the highest value of significant correlations was registered:

-for the Delicia variety followed by the Simultan variety and on the last two places the Compact and Azur varieties were situated;

-for the planting substrate b1 and on the second place the b2 and b3 planting substrates were situated;

- in case of the second research year followed in a chronological order by the third, fourth and fifth research year.

On average for the experimental factors graduations the highest percent of significant correlations between the following indicators were registered:

- between the height and the diameter of the bush (growth indicators);  
- between the number of flower buds and number of flower clusters per bush (fructification indicators);

- between the average weight of a berry and calyx cavity (physical fruit quality indicators);  
- between the content of ash and the other chemical components (chemical fruit quality indicators).

#### 5. References

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Table 1. The influence of experimental factors (A,B,C) on the nature and intensity of correlations between some growth indicators

*)	A experimental factor graduations						B experimental factor graduations						C experimental factor graduations					CN%	C.C-2
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	b3	c1	c2	c3	c4	c5			
1	0,868 ***	0,920 ***	0,845 ***	0,956 ***	0,905 ***	0,941 ***	0,876 ***	0,938 ***	0,817 ***	0,950 ***	0,995 ***	0,981 ***	0,994 ***	0,971 ***		100	0,926		
2	0,948 ***	0,898 ***	0,935 ***	0,909 ***	0,962 ***	0,940 ***	0,890 ***	0,872 ***	0,806 ***	0,828 ***	0,873 ***	0,877 ***	0,722 ***	0,701 ***	0,682 ***	100	0,856		
3	0,914 ***	0,964 ***	0,842 ***	0,886 ***	0,609 ***	0,866 ***	0,925 ***	0,822 ***	0,787 ***	0,734 ***	0,952 ***	0,960 ***	0,850 ***	0,960 ***	0,555 ***	100	0,842		
4	-0,450 **	-0,348 *	-0,300 *	-0,296 *	-0,329 *	-0,337 *	-0,402 **	0,344 **	0,238 *	0,237 *	0,416 **	0,314 *	0,283 *	0,324 *	-	100	0,329		
5	0,899 ***	0,913 ***	0,862 ***	0,818 ***	0,811 ***	0,930 ***	0,987 ***	0,464 ***	0,371 ***	0,521 ***	0,517 ***	0,432 ***	0,430 ***	0,642 ***	0,642 ***	100	0,683		
6	0,576 ***	0,697 ***	0,694 ***	0,614 ***	0,736 ***	0,715 ***	0,531 ***	0,774 ***	0,569 ***	0,643 ***	0,759 ***	0,610 ***	0,731 ***	0,486 ***	0,486 ***	100	0,629		
P%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100				
C.C-1	0,776	0,790	0,757	0,733	0,723	0,803	0,77	0,702	0,604	0,652	0,752	0,696	0,668	0,681	0,538				

\*)1= height of bush (cm)/ diameter of bush (cm), 2= height of bush (cm) / volume of bush (m<sup>3</sup>), 3= diameter of bush (cm)/ volume of bush (m<sup>3</sup>), 4= the number of shoots per bush / the average length of annual shoots (cm), 5= the number of shoots per bush / the total length of annual shoots (cm), 6= the average length of annual shoots (cm)/ the total length of annual shoots (cm)

P% the percentage of significant correlations for each experimental factors graduation;

CN % the number of cases in which the correlation was significant for all experimental factors graduations %;

CC-1= the average correlation coefficient - 1 (absolute value) for each experimental factors graduations;

**Table 2. The influence of experimental factors (A,B,C) on the nature and intensity of correlations between some fructification indicators**

*)	A experimental factor graduations							B experimental factor graduations					C experimental factor graduations					CN%	C.C-2	
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	b4	b5	c1	c2	c3	c4	c5			
1	0.980	0.983	0.985	0.986	0.984	0.984	0.979	0.983	0.984	0.982	0.982	0.982	0.982	0.982	0.982	0.982	0.982	0.982	100	0.978
2	0.614	0.562	0.356	0.325	0.396	0.325	0.391	0.192	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	79	0.394
3	0.494	0.708	0.356	0.325	0.396	0.325	0.500	0.411	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	86	0.421
4	0.863	0.887	0.835	0.963	0.975	0.949	0.968	0.933	0.925	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	100	0.882
P%	100	100	100	100	100	100	100	75	50	75	100	100	100	100	100	100	100	100		
C.C.1	0.738	0.785	0.633	0.650	0.688	0.646	0.710	0.776	0.954	0.849	0.678	0.529	0.559	0.739						

\*)1= The number of flower buds/bush / The number of flower clusters/bush, 2= The number of flower buds/bush / Average mass of a berry(g);

3= Average weight of a berry(g) / Berry yield /bush (g), 4= Number of fruits/bush / Berry yield /bush (g).

P/; CN%; CC-1; CC-2; The same significations as in table 1.

**Table 3. The influence of experimental factors (A,B,C) on the nature and intensity of correlations between some physical indicators quality**

	A experimental factor graduations							B experimental factor graduations					C experimental factor graduations					C.C-2
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	b4	b5	c1	c2	c3	c4	c5	
1	0.408	0.546	0.769	0.450	0.963	0.833	0.907	0.777	0.794	0.861	0.745	0.762	0.361	100	0.706			
2	0.831	0.549	0.749	0.892	0.847	0.786	0.721	0.631	0.638	0.425	0.408	0.415	0.566	100	0.651			
3	-0.561	-0.389	NS	NS	NS	NS	-0.457	-0.257	NS	NS	NS	NS	NS	31	0.416			
4	0.633	0.415	0.810	0.733	0.742	0.891	0.631	0.564	0.626	0.407	0.414	0.362	0.455	100	0.591			
5	-0.493	-0.409	NS	NS	NS	NS	-0.471	-0.493	-0.452	-0.254	0.264	0.289	0.255	69	0.376			
P%	100	100	60	60	60	60	100	100	80	80	80	80	80					
C.C.1	0.585	0.461	0.776	0.691	0.717	0.836	0.637	0.542	0.627	0.489	0.457	0.457	0.409					

\*)1= Size index (cm) / shape index (cm), 2= Size index (cm) / calyx cavity (cm), 3= Size index (cm) / Firmness (N/cm<sup>2</sup>), 4= / Shape index (cm) / Calyx cavity (cm), 5= Shape index (cm) / firmness (N/cm<sup>2</sup>)

P/; CN%; CC-1; CC-2; The same significations as in table 1.

**Table 4. The influence of the variety on the nature and intensity of the correlations between same fruit chemical components**

Simultan variety							
Ghemical component	pH	Phosphorus	Potassium	Total sugar	Titration acidity	Dry weight	Ash (%)
%Brix	NS	0,400*	NS	0,879***	NS	0,962***	0,952***
pH	-	NS	NS	NS	0,419*	NS	0,464**
Phosphorus	-	-	0,513***	NS	NS	0,538**	0,524**
Potassium	-	-	-	0,426*	NS	NS	0,668**
Total sugar	-	-	-	-	NS	0,391*	0,425*
Titration acidity	-	-	-	-	-	NS	0,876***
Dry weight	-	-	-	-	-	-	0,583***
P%	54						
Delicia variety							
%Brix	NS	0,502**	NS	0,505**	NS	0,887***	0,583***
pH	-	0,467**	NS	NS	0,575***	NS	0,477**
Phosphorus	-	-	0,379*	NS	-0,450**	NS	0,488**
Potassium	-	-	-	0,463**	NS	NS	0,682***
Total sugar	-	-	-	-	NS	0,390*	0,742***
Titration acidity	-	-	-	-	-	-	0,420*
Dry weight	-	-	-	-	-	-	0,564***
P%	57						
LAX variety							
%Brix	NS	0,329*	NS	0,680***	NS	0,927***	0,474**
pH	-	0,382*	NS	NS	0,592***	NS	0,416*
Phosphorus	-	-	0,360*	0,288*	-0,396*	0,542**	0,438**
Potassium	-	-	-	0,366*	NS	NS	NS
Total sugar	-	-	-	-	NS	NS	NS
Titration acidity	-	-	-	-	-	0,546**	0,415*
Dry weight	-	-	-	-	-	-	0,385*
P%	57						
COMPACT variety							
%Brix	NS	0,438*	NS	0,497**	NS	0,856***	0,647***
pH	-	NS	NS	NS	0,397*	-0,472**	NS
Phosphorus	-	-	NS	0,619***	-0,358*	NS	0,578***
Potassium	-	-	-	NS	NS	NS	0,354*
Total sugar	-	-	-	-	-0,372*	0,662***	NS
Titration acidity	-	-	-	-	-	NS	NS
Dry weight	-	-	-	-	-	-	0,499**
P%	46						
AUGUSTA variety							
%Brix	0,454*	0,717***	0,529**	0,525**	0,777**	0,635***	0,569***
pH	-	0,427**	NS	NS	0,469**	NS	0,503**
Phosphorus	-	-	0,640***	0,404**	-0,358*	0,549***	0,739***
Potassium	-	-	-	0,490**	NS	NS	0,426*
Total sugar	-	-	-	-	NS	0,416*	NS
Titration acidity	-	-	-	-	-	0,372*	0,372*
Dry weight	-	-	-	-	-	-	NS
P%	71						
AZUR variety							
%Brix	NS	NS	0,349*	0,710***	0,609***	0,879***	0,762***
pH	-	0,610**	NS	0,381*	0,388*	NS	0,608***
Phosphorus	-	-	0,374*	NS	NS	0,392*	0,502**
Potassium	-	-	-	NS	NS	0,377*	NS
Total sugar	-	-	-	-	0,682***	NS	NS
Titration acidity	-	-	-	-	-	0,377*	NS
Dry weight	-	-	-	-	-	-	0,438*
P%	57						
BLUERAY variety							
%Brix	0,390*	0,492**	0,349*	0,774***	0,373*	0,753***	0,604***
pH	-	NS	0,421*	NS	0,477**	NS	NS
Phosphorus	-	-	NS	NS	NS	NS	0,354*
Potassium	-	-	-	NS	NS	NS	NS
Total sugar	-	-	-	-	NS	NS	0,552**
Titration acidity	-	-	-	-	-	NS	0,534**
Dry weight	-	-	-	-	-	-	0,643***
P%	46						

**Table 5. The influence of planting substrate (b1,b2,b3) and of the research year (c2,c3,c4) on the nature and intensity of correlations between some chemical fruit components**

<b>b1</b>							
Chemical component	pH	Phosphorus	Potassium	Total sugar	Titration acidity	Dry weight	Ash (%)
%Brix	0,244*	0,355**	NS	0,824***	NS	0,623***	0,702***
pH		NS	0,603***	0,372*	0,390*	NS	0,308*
Phosphorus			0,317*	NS	NS	0,620***	0,480**
Potassium				0,280*	NS	0,450***	0,332**
Total sugar					NS	0,683***	0,664***
Titration acidity						0,739***	0,586***
Dry weight							0,771***
P%	71						
<b>b2</b>							
%Brix	0,330*	0,323***	0,286*	0,657***	NS	0,463***	0,566***
pH		NS	0,520***	0,626***	0,364**	NS	0,308*
Phosphorus			0,419***	NS	NS	0,439***	0,509***
Potassium				0,605***	NS	-0,397**	0,342**
Total sugar					-0,452**	0,293*	NS
Titration acidity						0,356**	0,878***
Dry weight							0,605***
P%	75						
<b>b3</b>							
%Brix	0,450***	0,333***	NS	0,667***	NS	0,840***	0,605***
pH		NS	0,356**	0,455***	0,310*	NS	0,394**
Phosphorus			0,253*	NS	NS	0,548***	0,471***
Potassium				0,356**	NS	0,321*	0,267*
Total sugar					NS	NS	0,552***
Titration acidity						0,469***	0,566***
Dry weight							0,757***
P%	68						
<b>c2</b>							
%Brix	0,288*	0,304*	0,455***	0,488***	NS	0,732***	0,703***
pH		NS	0,255*	0,529***	0,550***	NS	0,343**
Phosphorus			0,796***	0,588***	NS	0,361**	0,582***
Potassium				0,725***	0,284*	0,438***	0,771***
Total sugar					NS	0,458***	0,800***
Titration acidity						0,510***	0,540***
Dry weight							0,459***
P%	86						
<b>c3</b>							
%Brix	0,534***	0,321*	0,541***	0,550***	NS	0,599***	0,588***
pH		0,333*	0,392**	0,505***	0,351**	0,281*	0,438**
Phosphorus			0,274*	0,510***	-0,317*	0,555***	0,380**
Potassium				0,631***	NS	0,623***	0,543***
Total sugar					NS	0,542***	0,539***
Titration acidity						0,613***	0,419***
Dry weight						-	0,396**
P%	89						
<b>c4</b>							
%Brix	0,271*	0,373**	NS	0,662***	NS	0,604***	0,524***
pH		NS	NS	0,400**	0,298*	NS	0,264*
Phosphorus			0,441***	NS	-0,266*	0,408***	0,373**
Potassium				0,298*	0,382**	0,251*	0,441***
Total sugar					NS	NS	NS
Titration acidity						0,446***	0,662***
Dry weight							0,527***
P%	68						

**Table 6. The influence of experimental factors on the nature and intensity of correlations between the total length of annual shoots and some fructification indicators**

*)	A experimental factor graduations							B experimental factor graduations			C experimental factor graduations					CN%	C.C-2
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	c2	c3	c4	c5			
1	0.737 ***	0.816 ***	0.892 ***	0.821 ***	0.725 ***	0.858 ***	0.902 ***	0.681 ***	0.217 *	0.776 ***	NS	0.530 ***	0.571 ***	0.570 ***	93	0.663	
2	0.757 ***	0.842 ***	0.896 ***	0.834 ***	0.739 ***	0.875 ***	0.912 ***	0.684 ***	0.220 *	0.792 ***	NS	0.530 ***	0.571 ***	0.571 ***	93	0.709	
3	0.631 ***	0.736 ***	0.350 *	NS	0.346 *	NS	0.516 **	0.421 ***	NS	0.586 ***	0.221 *	0.362 **	0.619 ***	0.485 ***	79	0.479	
4	0.663 ***	0.794 ***	0.857 ***	0.788 ***	0.801 ***	0.817 ***	0.829 ***	0.692 ***	0.455 ***	0.771 ***	NS	0.316 *	0.419 ***	0.528 ***	86	0.728	
5	0.743 ***	0.931 ***	0.797 ***	0.868 ***	0.814 ***	0.833 ***	0.895 ***	0.801 ***	0.573 ***	0.875 ***	NS	0.291 *	0.634 ***	0.634 ***	93	0.745	
P%	100	100	100	80	100	80	100	100	80	100	20	100	100	100			
C.C.1	0.706	0.824	0.758	0.828	0.685	0.846	0.811	0.656	0.366	0.760	0.221	0.310	0.563	0.558			

\*)1= The total length of annual shoots (cm)/ The number of flower buds/bush, 2= The total length of annual shoots (cm)/ The number of flower clusters/bush, 3= The total length of annual shoots (cm)/ Average mass of a berry (g), 4= The total length of annual shoots (cm)/ Number of fruits/bush  
5= The total length of annual shoots (cm)/Berry yield (g)

**Table 7. The influence of the experimental factor on the nature and intensity of the correlations between the total length of annual shoots and physical fruit quality indicators**

*)	A experimental factor graduations							B experimental factor graduations			C experimental factor graduations				
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	c3	c4	c5	CN%	C.C-2
1	0.656 ***	0.626 ***	0.421 *	0.485 *	0.746 ***	0.532 **	0.693 ***	0.511 ***	0.442 ***	0.415 ***	NS	0.362 **	0.559 ***	100	0.537
2	0.402 *	0.591 **	0.643 ***	NS	0.636 ***	0.418 *	0.508 **	0.434 ***	0.488 ***	0.450 ***	NS	0.528 ***	NS	66	0.477
3	NS	NS	NS	NS	NS	NS	-0.392 *	-0.496 **	NS	-0.463 *	NS	NS	NS	20	0.300
4	0.573 **	0.621 ***	0.518 **	0.552 **	0.765 ***	0.547 **	0.543 **	0.610 ***	0.549 ***	0.420 ***	NS	0.385 **	0.520 ***	93	0.514
P%	75	75	75	50	75	75	100	100	75	100	0	75	50		
CC.1	0.544	0.613	0.527	0.518	0.716	0.499	0.534	0.513	0.493	0.437	0	0.425	0.540		

\*)1= The total length of annual shoots (cm)/ Size index (cm), 2= The total length of annual shoots (cm)/ Shape index (cm), 3= The total length of annual shoots (cm)/ Firmness (N/cm<sup>2</sup>), 4= The total length of annual shoots (cm)/ Calyx cavity (mm)

**Tabel 8. The influence of the experimental factors on the nature and intensity of the correlations between the total length of annual shoots and chemical fruit quality indicators**

	A experimental factor graduations										B experimental factor graduations			C experimental factor graduations			CN%	C.C-2
	a1	a2	a3	a4	a5	a6	a7	b1	b2	b3	c2	c3	c4					
	1	NS	NS	0,687***	NS	0,557***	0,816***	NS	NS	NS	NS	-	NS	0,378**	33	0,609		
2	NS	NS	0,384*	0,484**	0,617***	0,646***	NS	0,651***	NS	0,286*	-	0,392**	NS	58	0,494			
3	NS	NS	0,527**	NS	0,621***	NS	NS	0,368**	NS	0,258*	NS	NS	NS	31	0,444			
4	NS	NS	NS	NS	NS	-0,408*	NS	-0,419*	NS	-0,451*	NS	NS	NS	23	0,426			
5	NS	0,510**	0,373*	0,418*	NS	NS	0,406*	NS	NS	NS	NS	NS	NS	31	0,427			
6	NS	NS	NS	NS	NS	NS	NS	0,272**	NS	NS	NS	NS	0,255*	15	0,263			
7	NS	NS	NS	NS	NS	0,651***	NS	0,410***	NS	0,531***	NS	NS	NS	23	0,531			
8	NS	NS	0,506**	NS	0,557**	0,815***	NS	NS	NS	0,261*	NS	0,390**	NS	38	0,506			
P	0	12	62	25	50	62	12	50	12	62	0	25	25					
CC1	0	0,51	0,495	0,451	0,588	0,667	0,406	0,462	272	0,357	0	0,391	0,316					

1= The total length of annual shoots(cm)/ % Brix, 2= The total length of annual shoots(cm)/pH, 3= The total length of annual shoots(cm)/ Phosphorus, 4= The total length of annual shoots(cm)/ Potassium, 5= The total length of annual shoots(cm)/ Total sugar, 6= The total length of annual shoots(cm)/ Titrable acidity, 7= The total length of annual shoots(cm)/ Dry weight, 8= The total length of annual shoots(cm)/ Ash(%)

**Table 9. The influence of the variety on the nature and intensity of correlations between some fructification indicators and some physical and chemical fruit quality indicators**

Simultan variety (a1)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	0,409*	NS	*** 0,629	NS
b	-0,379*	NS	NS	NS	*** 0,522	NS	NS	0,429*	NS
c	-0,379*	NS	NS	NS	NS	NS	NS	NS	0,455*
% c.s	26								
Delicia variety (a2)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	0,511*	NS	0,383*	NS
b	*** -0,591	-0,417*	NS	*** 0,677	NS	NS	-0,399*	0,407*	0,375*
c	*** -0,379	NS	NS	*** 0,801	NS	NS	*** 0,596	** 0,532	0,504*
% c.s	48								
Lax variety (a3)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	** 0,563	NS	0,427*	NS
b	** -0,501	** 0,524	NS	NS	0,402*	NS	NS	*** 0,610	NS
c	NS	NS	NS	NS	NS	NS	NS	NS	NS
% c.s	26								
Compact variety (a4)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	0,371*	0,431*	0,504**	0,383*	NS
b	NS	NS	NS	NS	0,389*	NS	NS	NS	NS
c	NS	NS	NS	** 0,506	0,484**	NS	NS	0,444*	NS
% c.s	30								
Augusta variety (a5)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	0,517*	NS	NS	NS	NS	NS	0,729***	NS
b	-0,457*	NS	0,372*	0,486**	NS	0,588***	0,582***	0,494**	0,515**
c	-0,384*	NS	0,404*	0,452*	NS	NS	NS	0,684***	0,676***
% c.s	52								
Azur variety (a6)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	NS	NS	0,598***	NS
b	-0,391*	NS	0,393*	NS	NS	NS	NS	0,442*	0,640***
c	-0,511**	NS	0,393*	NS	NS	NS	0,394*	0,445*	0,696***
% c.s	37								
Blueray variety (a7)									
Fructification indicators	physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	0,460*	NS	NS	0,532**	NS
b	-0,519**	NS	NS	NS	0,415*	0,410*	NS	0,527**	0,462*
c	-0,531**	NS	NS	NS	0,468*	NS	0,676***	0,583***	0,399*
% c.s	44								

Fructification indicators: a = Average mass of a berry (g); b= Number of fruits/bush; c= Berry yield /bush  
 Quality indicators: 1= Firmness (N/cm<sup>2</sup>); 2= %Brix; 3= pH; 4= Phosphorus ( mg);5=Potassium (mg); 6 = Total sugar (%); 7=Titrate acidity (%); 8= dry weight (%); 9 = Ash (%). N.S. = Non significant at 0,5%

**Table 10. The influence of planting substrates (b1, b2,b3) and of research years (c2-c4) on the nature and intensity of correlations between some fructification indicators and some chemical fruit indicators**

Planting substrate (b1)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	0,287*	0,251*	NS	0,488***	0,335**	NS	0,331**	NS
b	- 0,527***	NS	0,382**	NS	NS	0,26*	NS	NS	NS
c	- 0,507***	NS	0,332*	NS	0,308**	NS	NS	NS	0,334**
P%	44								
Planting substrate (b2)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	NS	NS	0,465***	NS
b	NS	NS	NS	NS	NS	NS	NS	NS	NS
c	-0,252*	NS	NS	NS	NS	NS	NS	NS	NS
% c.s	7								
Planting substrate (b3)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	-0,382**	NS	NS	NS	0,537***	NS	NS	0,588***	NS
b	- 0,581***	NS	0,310*	NS	0,367*	0,312*	0,511***	NS	0,251*
c	- 0,504***	NS	NS	0,257*	NS	NS	NS	NS	0,290*
% c.s	44								
Year 2 (c2)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	-	NS	0,304*	NS	NS	NS	0,291*	0,568***	NS
b	-	0,554***	0,266*	0,250*	0,392**	0,250*	NS	NS	0,318*
c	-	0,522***	NS	0,579***	0,667***	NS	NS	0,511***	0,665***
% c.s	52								
Year 3 (c3)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	NS	NS	0,414*	NS
b	NS	0,317*	0,321*	NS	0,317*	0,258*	NS	NS	NS
c	-0,381**	0,586***	NS	0,275*	0,598***	NS	NS	0,349**	0,495***
% c.s	41								
Year 4 (c4)									
Fructification indicators	Physical and chemical fruit quality indicators								
	1	2	3	4	5	6	7	8	9
a	NS	NS	NS	NS	NS	NS	0,465***	0,535***	NS
b	NS	NS	0,376**	0,418***	0,540***	NS	NS	NS	0,430***
c	NS	NS	0,393**	0,460***	0,523**	NS	NS	0,330*	0,328***
% c.s	41								

Fructification indicators: a = Average mass of a berry (g); b= Number of fruits/bush; c= Berry yield /bush  
 Quality indicators: 1= Firmness (N/cm<sup>2</sup>); 2= %Brix; 3= pH; 4= Phosphorus ( mg);5=Potassium (mg); 6 = Total sugar (%); 7=Titrate acidity (%); 8= dry weight (%); 9 = Ash (%). N.S. = Non significant at 0,5.