The Changes of Biochemical Content in Sea Buckthorn (*Hippophae rhamnoides* L.) during Harvesting Time

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With increase of the demand for the produce containing natural biologically active substances, great attention is paid to the sea buckthorn. Fruits of the sea buckthorn (*Hippophae rhamnoides* L.) have not only high nutritional but also remedial value. They are valuable due to the high content of vitamins C, E, P, K, carotinoides and oil. The sea buckthorn leaves and skin also contain valuable substances. As a raw material, the sea buckthorn is required in medicine, veterinary and cosmetology.

Material and methods

The research was carried out in the year 2006; the sea buckthorn plantation was arranged in the spring of 1998 where the annual plants were propagated by green cuttings. The pattern of the planting - 4x2 m. The arable layer of soil had pH 7.2, humus – 2.5, content of P_2O_5 – 210 mg/kg, K_2O – 180 mg/kg. Four sea buckthorn varieties are investigated- 'Avgustinka', 'Botaniceskaja', 'Podarok sadu' and 'Trofimovskaja'. In the period of fruit ripening, the yield of the sea buckthorn, changes in the mass are evaluated. The mechanical strength of the fruits skin, the fruit tearing power from the branch are determined. The biochemical analyses of the fruits are carried out (5 times in the period from 25 July to 19 September). During harvesting, the manual gathering and the branch cutting were compared. Before freezing, the annual shoots and the greatest part of the leaves were cut off. Branches with the fruits were frozen at -30 °C. The frozen fruits were shaken down from the branches. The yield of the sea buckthorn, condition of bushes was evaluated. The amount of the sea buckthorn fruits when cutting by a branches was evaluated. Labor input by the manual gathering of the fruits was evaluated. The data were statistically elaborated using dispersion analysis. The smallest essential difference limit (p=0.05) was determined for several parameters within the period from 20 August to 20 September when the sea buckthorn fruits were manually gathered in the variety comparison testing.

Results and Discussion

The data obtained in the research show that at their ripening the fruit gathering process becomes more complicated- density of the fruit skin becomes lower but the tearing force of the fruits from the branches essentially does not change (Table and Figures 1-9). Close negative correlation exists between density of the fruit skin and the average fruit mass: for the variety 'Botaniceskaja' r=-0.99 but for the other varieties r=-0.84. Despite the increase in mass during ripening, it is not advisable to delay the fruit gathering. The gathering time could be extended by cutting branches with the fruits, freezing them and after that-shaking them down. Using such method, decrease of the mechanical strength of the fruit skin does not affect the fruit quality. It is advisable to further study gathering of the sea buckthorn fruits using the branch cutting in Lithuania and Latvia. Presently, it is not clear how the branch cutting affects regeneration of the sea buckthorn bushes, how much time will pass until the next full yield. The research carried out in Estonia gives evidence that in the third year after cutting, the sea buckthorn bushes started to give yield but after one more year, the yield was rich r=-0.84.

The extension of the gathering time is an essential factor from the other point of view as well- with the increase of the fruit mass, essential negative biochemical changes are not observed. The content of some components (sugar, carotinoides) increased but the total content of acids decreased which makes the fruits of the sea buckthorn to be a valuable raw material exactly for the production of food products.

Sea buckthorn yield, Babtai, 2006

Variety	Yield, t ha^{-1}		Yield, %
	Manually gathered	Cutting branches	
'Avgustinka'	11,3	11,4	82 c
'Botaniceskaja'	8,0	10,1	79 abc
'Podarok Sadu'	10,9	13,1	77 a
'Trofimovskaja'	9,2	7,7	81 bc
R_{05}	***2,40***	***3,91***	
Average	***9,8***	***10,6***	
R_{05}	***0,77***		

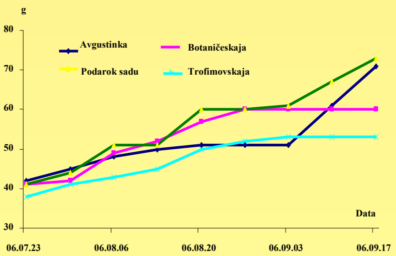

Fig. 1. Changes of 100 sea buckthorn fruits mass during fruit maturity, R_{05}=6,8 (06.08.20); R_{05}=11.7 (06.09.17.)

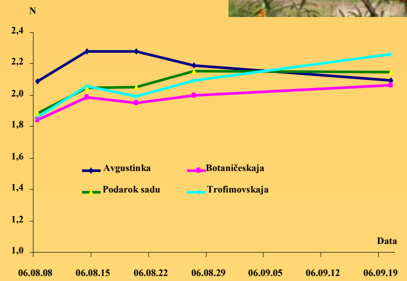

Fig. 2. Changes of tearing force of sea buckthorn fruits from stalk during fruit maturity, R_{05}=0.22 (06.08.22.)

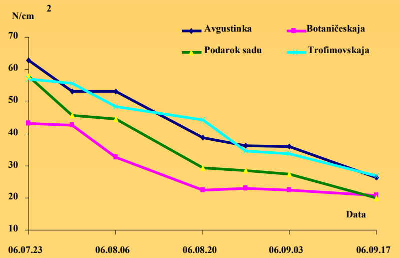

Fig. 3. Changes of mechanical strength of the fruit skin during fruit maturity, R_{05}=6.9 (06.08.20.)

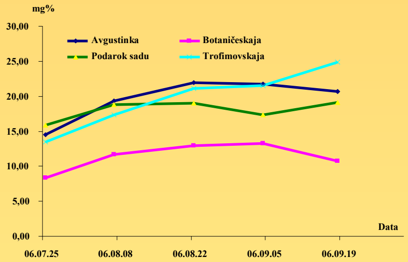

Fig. 4. Content of total acids in sea buckthorn fruits during fruit maturity, R_{05}=0.33 (06.08.22.)

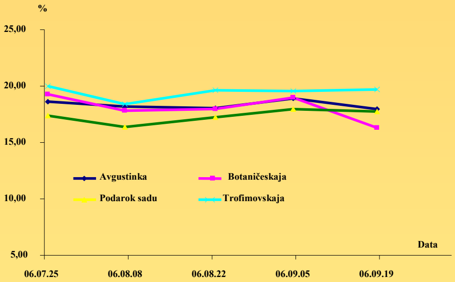

Fig. 5. Content of dry matter in sea buckthorn fruits during fruit maturity, R_{05}=1,51 (06.08.22.)

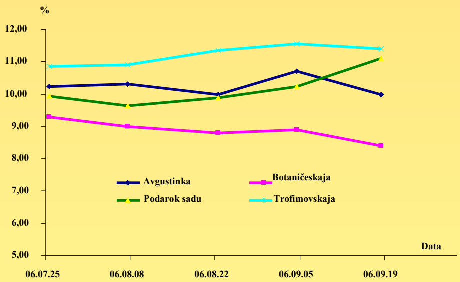

Fig. 6. Content of soluble solids in sea buckthorn fruits during fruit maturity, R_{05}=1.06 (06.08.22.)

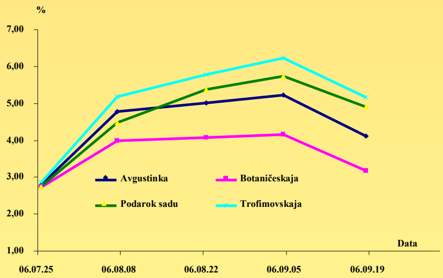

Fig. 7. Content of total sugar in sea buckthorn fruits during fruit maturity, R_{05}=0,77 (06.08.22.)

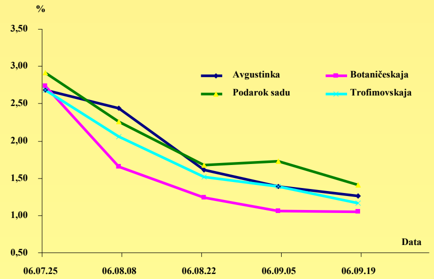

Fig. 8. Content of carotenoids in sea buckthorn fruits during fruit maturity, R_{05}=4.54 (06.08.22.)

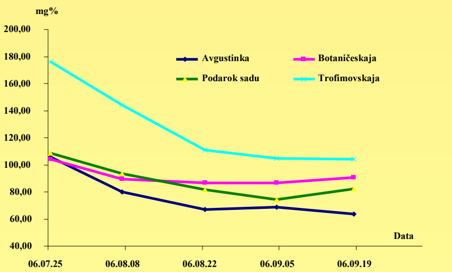

Fig. 9. Content of vitamin C in sea buckthorn fruits during fruit maturity, R_{05}=9.44 (06.08.22.)

Conclusions

Summing up the results obtained in the year 2006, it is possible to conclude that the highest yield was obtained from the varieties 'Avgustinka' and 'Podarok Sadu"- manually gathering averagely 11.3 un 10.9 t ha^{-1} but cutting with branches- 11.4 and 13.1 t ha^{-1}, respectively. When cutting with branches, the yield result reaches 80%.

The highest content of the total and soluble solids, total sugars and vitamin C is in the fruits of the variety 'Trofimovskaja'. In turn, the highest content of carotinoides is in the fruits of 'Avgustinka' and 'Trofimovskaja'.

With ripening of the fruits of the sea buckthorn, their mass increased, the mechanical strength of the fruit skin decreased, the tearing force from the branches did not essentially change, the content of the total sugars increased, then reaching its maximum, decreased; content of the total acids and vitamin C decreased but content of carotinoides increased. During fruit ripening, content of the total sugars and soluble solids did not essentially change.

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