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FORMATION OF A COMPLEX OF POLYPHENOLS IN FRUITS COMMON LATE VARIETIES OF APPLE GROWN IN THE CONDITIONS OF FOREST-STEPPE OF UKRAINE

Abstract.
The influence of weather growing conditions and varietal features on the formation of a complex of natural polyphenols of apple fruit is analyzed. It was revealed that the fruits of varieties had a greater concentration of polyphenols: Priscilla, Plamennoye, Ruby Duki, Sapphire, Mekintosh. It has been established that the dependence of the formation of polyphenols depending on some elements of weather conditions for some varieties. A more stable content of polyphenols over the years of research was found in varieties: Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, Renet Simirenko.

Keywords*:fruits, apple, fruits, fruits, weather, polyphenols, stability.*

Introduction.

Apple tree is the most common fruit crop in Ukraine. It occupies more than 80-85% of the area of gardens. Currently, over the past 20 years, the area under the gardens has decreased by almost 39% and amounts to 171 thousand hectares. Given the favorablesoil and climatic conditions, Ukraine has a great prospect of this industry [1-4].

Apple fruits are the most affordable fruits for the population of Ukraine and Europe. Its fruits have valuable preventive and curative properties. Apples contain a complex of polyphenols, which have antioxidant properties. One of these polyphenols is the flavonoid epicatechin, which can help lower blood pressure. Sufficient consumption of natural flavonoids helps to reduce the risk of stroke by 20%.Flavonoids can help prevent some heart disease by reducing the "bad" oxidation of low-density lipoproteins. With the daily consumption of apples and the intake of statins (reduce the level of bad cholesterol), an effective reduction in mortality from heart disease is observed. Daily consumption of apples potentially reduces the risk of developing type 2 diabetes by 28%.Even eating only a few apples a week has a positive protective effect. Apple polyphenols prevent damage to pancreatic beta cell tissue. Beta cells produce insulin in the body and are often damaged in people with type 2 diabetes [5-12].

The formation of the biochemical composition of the fruit largely depends on the conditions of the growing season, especially the last 20-40 days before harvesting. To obtain a more complete description of the variety, namely: the stability of individual components of the fruit, the reaction to agrotechnical and weather conditions, etc., it is advisable to use 3 or more years of observation [13-14].

The formation of a specific complex of polyphenols varies significantly in most fruit and berry crops over the years and in most cases is a varietal trait. Excessive precipitation during the formation and ripening of fruits, the amount of these substances increases, and drought reduces them.Warm sunny weather with sufficient rainfall, especially in the second half of summer, contributes to the formation of higher concentrations. There was a slight increase in polyphenols for damage by pests and diseases. The formation of a complex of polyphenols in the fruits of an apple tree in the conditions of the forest-steppe of Ukraine has not been sufficiently investigated. This is especially true of the influence of lighting (in the qualitative context of direct, scattered and photositnetically active solar radiation (FAR) [15-16].

Materialsandmethods.

Research conducted at the Institute of Horticulture (IS) of the Academy of Sciences of Ukraine and NULES of Ukraine. Used data from many years of research. Concentration of the complex of polyphenols carried out with the use ofFolin-Denis reagent. Data on active temperatures and precipitation during the years of research are provided by the meteorological group of

the IS NASU.Statistical data processing was carried out according to generally accepted methods. The calculation of stability is carried out on the example of calculating the coefficient of variation [17-18].

Resultsanddiscussion.

The conducted studies made it possible to investigate the average content, the stability of the complex of polyphenols in the fruits of common varieties and the reaction of individual varieties of apple trees to the meteorological conditions of formation and ripening of fruits. For some varieties, a significant influence of weather elements on the formation of the content of polyphenols has been identified.

The content of the amount of phenolic substances in the fruits of the apple tree is quite different (table). On average, the variety value is 187.05 mg/100 g of crude matter. The highest content of phenolic substances on average during the years of research had varieties Priscilla (252.8 mg/100 g), Plamennoe (222.7), Ruby Duki (216.7), Sapphire (208.62), Mekintosh (210.37 mg%). The deviation of the content of phenolic substances by variety ranges from 17.5 mg% (Mekfrey), to 123 mg% (Liberty). High stability among the studied varieties for this indicator was observed in the varieties Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, Renet Simirenko.

Table-1.

Phenolic content in apple fruits, mg per 100 g

Variety	Average for research years	Fluctuations by year		Maximal deviation	CV, %
		minimal	maximal		
Aidared	132,93	106,5	159,8	53,3	26,6
Boiken	163,51	145,1	190,1	45,0	17,6
Jonathan	198,22	180,1	223,5	43,4	16,9
Calville snow	150,82	135,3	162,1	26,8	8,9
Delicia	110,96	69,0	125,3	56,3	19,6
Winter lemon	156,03	138,1	181,4	43,3	22,5
Liberty	192,93	105,1	228,1	123,0	38,4
Mekintosh	210,37	108,0	160,6	52,6	21,2
Mekfrey	194,22	185,1	202,6	17,5	9,3
RenetSimirenko	199,09	152,4	244,9	92,5	33,6
Ruby Duci	216,7	205,4	236,2	30,8	16,9
Plamenne	222,72	208,0	227,9	19,9	11,1
Priam	191,72	158,6	233,6	75,0	30,8
Priscilla	252,8	240,1	260,4	20,3	9,5
Sapphire	208,62	183,2	221,2	38,0	17,6
Florina	191,17	158,5	218,5	60,0	23,2
Average	187,05	154,90	204,76	49,85	8,9
LSD05	47,8	-	-	53,1	5,28

The concentration of phenolic substances in fruits is mostly a varietal feature, but fluctuations have been observed, depending on changes in weather conditions in different years of cultivation. For the Aidared variety, a large relationship was found with the amount of precipitation during the growing season ($\eta yx=0.997\pm0.014$; $y = 0.3497x + 4.9657$).The fruits of the Boyko variety dramatically increase the content of poly phenol with excessive moisture for the 30-day period before harvesting ($\eta yx=0.92\pm0.08$; $y = 0.7579x + 146.54$). It was noted that an increase in GTC for a 20-day period before harvesting in the fruits of the Ruby Duki variety contributes to an increase in the content of polyphenols ($\eta yx=0.999\pm0.0043$; $y = 5.3417x + 204.74$). (figure 1).

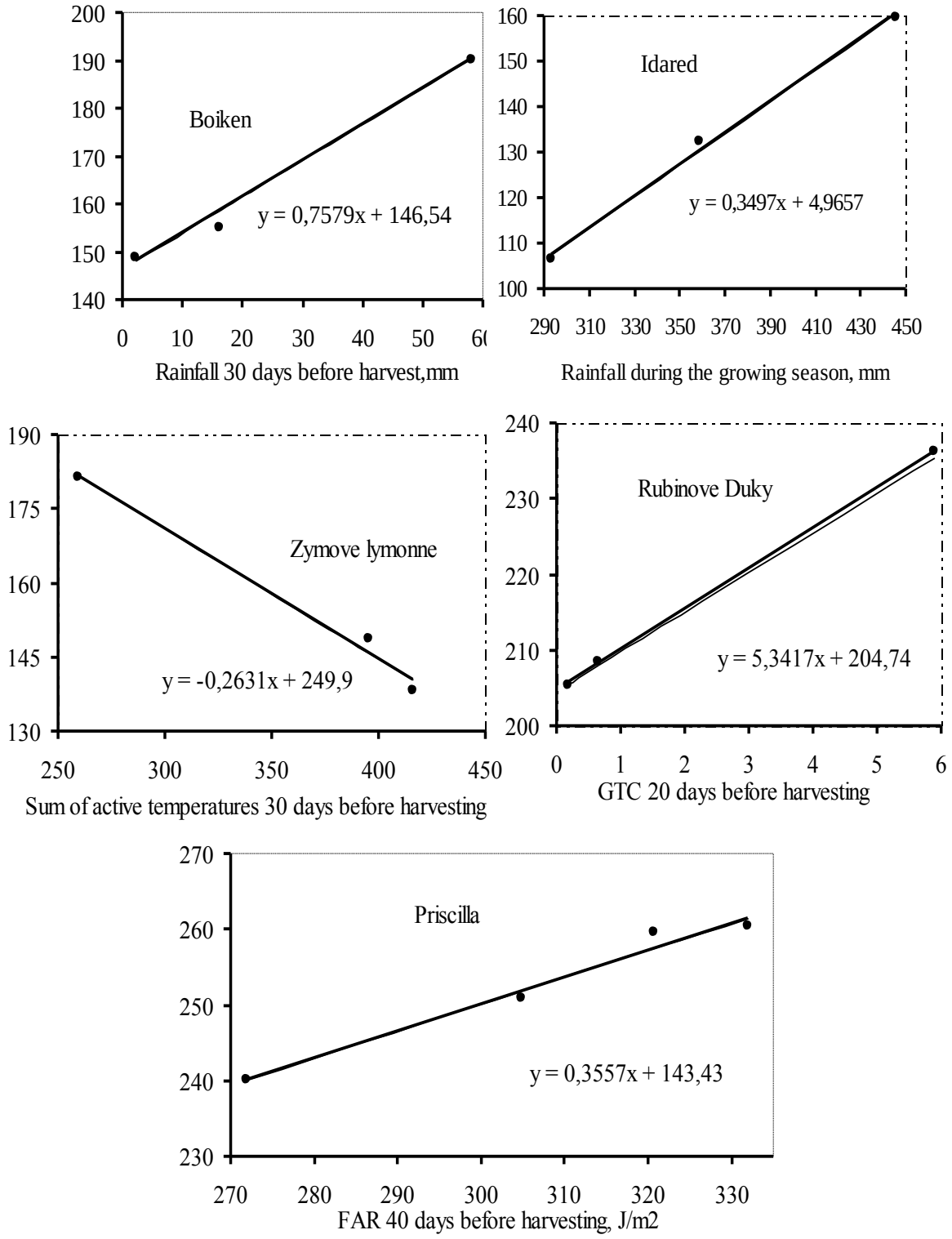

Fig. 1. The influence of elements of weather conditions on the formation of the content of complex polyphenols in apple fruits

A comparative analysis of the obtained data revealed that the content of phenolic substances in fruits significantly depends on the amount of precipitation during the growing season and the intensity of direct solar radiation for 20- and FAR 20-, 30-day period before harvest.

Dispersion analysis of the influence of weather growing conditions and varietal features on the formation of the concentration of a complex of polyphenols in the fruits of the studied apple varieties over the years of research has shown that the formation of the concentration of polyphenols most depends on the varietal characteristics of the crop and the interaction of the studied factors (Figure 2).

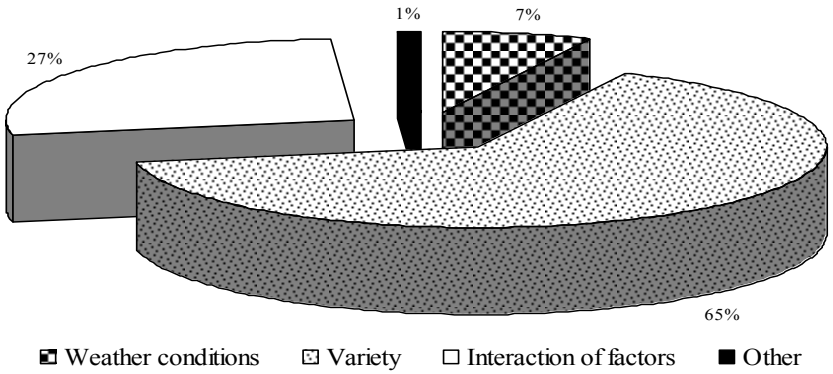

Fig. 2. Influence of the studied factors on the formation of the complex of polyphenols in apple fruits

Conclusions and suggestions.

Meteorological conditions have a complex effect on the formation of a complex of polyphenols in the fruits of the studied varieties of apple trees. The highest content of polyphenols had the fruits of varieties: Priscilla, Plamennoye, Ruby Duki, Sapphire, Mekintosh. It has been established that the dependence of the formation of polyphenols depending on some elements of weather conditions for some varieties.A more stable content of polyphenols over the years of research was found in varieties: Priscilla, Plamennoye, Mekfrey, lower in the varieties Liberty, Delicia, RenetSimirenko. Knowledge of these features should be used in the selection of varieties whose fruits will be used for storage and certain types of processing. The obtained data should be taken into account in the production of fruits and products of processing of high quality and biological value.

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