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STUDIUL COMPORTĂRII UNOR SOIURI DE MĂR ÎN CONDIȚIILE PEDOCLIMATICE DIN ZONA CÂMPIEI COVURLUI

STUDY OF THE BEHAVIOR OF SOME APPLE VARIETIES IN THE PEDOCLIMATIC CONDITIONS IN THE AREA OF COVURLUI PLAIN

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Abstract

The present study was carried out on the winter apple varieties 'Golden Delicious', 'Idared', 'Starkrimson', 'Jonathan' and 'Jonagold', grafted on the rootstock 'M9 ', in a private plantation (15 ha), from Covurlui plain, Plevna place, Rediu commune, Galati county, in the agricultural year 2020-2021. Planting distances are 3.5 m between rows and 1.5 m between plants per row, crown-shaped vertical axis, with support system on 3 wires. During the research period, observations and determinations were made regarding the initiation and development of vegetation phases, determinations regarding the productivity of varieties, fruit production and their quality. The surface of the trunk section as a basic indicator in the appreciation of the growth vigor reflects the reaction of the trees to the environmental conditions and to the applied agrotechnics. There is a close connection between the vigor of the trees expressed by the surface of the trunk section and the production. Higher force of the tree than the specific one, causes a delay in fruiting, instead a medium or low force induces early fruiting, but decreases the longevity of the trees. In terms of productivity, expressed by the amount of fruit per hectare (t/ha) 'Golden Delicious' and 'Idared' mice stood out with productions of 45, 2 and 41.4 t/ha respectively. The largest fruits were obtained from sour 'Jonagold', respectively 194 g.

Cuvinte cheie: cultura mărului, fertilizare foliară, biostimulatori.
Key words: apple culture, foliar fertilization, biostimulatory.

1. Introduction

The pedoclimatic diversity of the fruit growing areas in Romania ensures favorable conditions for most temperate fruit growing species, as a result, there is a long fruit growing tradition. Interest in apple cultivation is still high, due to its high food value, economic, commercial value and social importance.

The cropping system has an important influence on apple productivity, on their quality and on the efficiency of the whole system. The transition from conventional to integrated practices is a necessary way to increase sustainability and reduce the negative impact of fruit production on the environment (Stanica et al., 2008).

Varieties assortment together with the climatic, edaphic and biotic factors represent a determining element in the apple culture, its decisive contribution being reflected both in the quantity and in the quality of the production. For these reasons, the variety assortment was in a permanent dynamic, the cultivated varieties being better and better in terms of fruit productivity and quality (Istrate et. all, 2011).

The present study aimed at a series of observations and determinations, regarding aspects related to the peculiarities of growth and fruiting, following: the phenology of the growth and fruiting organs, the vigor of tree growth and the type of fruiting, the productive potential and fruit quality.

2. Material and methods

The experiment was organized in an apple plantation of 3 ha, established in 2004, belonging to the Rediu Fruit Farm, Galati County. The varieties studied are: 'Golden delicious', 'Idared', 'Jonagold', 'Starkrimson', 'Jonathan', grafted on the 'M9' rootstock.

The trees were planted at a distance of 3.5 m between rows, and 1.5 m between trees per row, resulting in a planting density of 1,905 trees/ha. The plantation is provided with a support system on 3 wires. The crown shape of the trees is the thin spindle.

The soil in the plantation is maintained as a naturally grassed field, the interval between rows is maintained by using the shredder whenever the grass reaches 20 cm in height, and the interval between plants in a row is maintained by herbicide whenever needed.

The necessary water to ensure the realization in optimal parameters of the growth and fruiting processes is provided by the drip irrigation system, with the drips arranged at 50 cm from each other and with a flow rate of 2 l per hour.

Basic fertilization takes place in two stages, in the first stage is administered 500 kg per ha of NPK 16:16:16 at the end of November and 400 kg of the same fertilizer at the end of January.

The control of diseases and pests in apple orchard consists in carrying out 14 phytosanitary treatments, combined with foliar fertilization.

Observations and determinations were made, regarding aspects related to the peculiarities of growth and fruiting, following: the phenology of the growth and fruiting organs, the vigor of tree growth and the type of fruiting, the productive potential and the quality of the fruits.

3. Results and discussions

The knowledge of the biological peculiarities of the apple varieties allows the adoption of differentiated cultivation technologies depending on: the cultivation area; the vigor and type of fruiting of the trees; crown shape and planting distance of trees (Sotiropoulos et. al., 2013).

Development of the phenophases of the fruiting organs. The phenophases of the fruiting organs are specific to the biology of each fruit species and their onset and duration are related to the climatic conditions of that year. In the conditions of the Rediu area, Galați County, apple flowering takes place generally in the third decade of April and has an average duration of 10-11 days (Table 1). There were no major differences between the studied varieties in terms of flowering, but between the years studied there is a delay of 8-9 days in 2021 compared to 2020. Flowering overlapped with all varieties, ensuring favorable conditions for cross-pollination.

The number of days from the end of flowering to the harvest maturity of the studied varieties ranges between 128 and 163 days. Because of this, the harvest of apples was also delayed, requiring a longer number of days for the apples to reach maturity. In particular, in the case of the fruits of 'Idared', 'Jonathan', 'Starkrimson' varieties, it was not possible to harvest them until they reached the characteristic color of the variety.

In 2021, the beginning of harvesting of all analyzed varieties was delayed, however in the case of this specie this did not influence in any way the quality of the fruits and their storage.

Data on the vigor of tree growth in some apple varieties. The vigor of tree growth expressed by the surface of the trunk section recorded different values depending on the variety (Table 2). The surface of the trunk section as a basic indicator in assessing the growth vigor reflects the reaction of the trees to the environmental conditions and to the agrotechnics applied in the plantation. The thickness of the tree trunk measured in the field as a circumference and transformed into diameter sums up the effect of the resulting the variety - rootstock combination vigor, age, ecopedological conditions with the improvement of the annual fertilization sequence. There is a close connection between the vigor of the trees expressed by the surface of the trunk section and the production. A higher tree vigor than the specific one, determines the delay of their fruiting, instead a medium or low vigor determine fruiting precocity, but decreases the longevity of the trees.

Taking into account the fact that all varieties are grafted on the same rootstock, 'M9' and the applied cultivation technology was identical, we can conclude that the growth increase of the trunk is the result of the influence of the variety.

'Jonathan' and 'Jonagold' varieties stand out with an increase of 0.64 cm^2 compared to the average, this being 6.26 cm^2 and 1.14 cm^2 respectively. The variety with the lowest growth rate was 'Starkrimson' with 4.83 cm^2, having a difference from the control of 0.95 cm^2. In 'Idared' and 'Golden delicious' varieties, the growth increase does not differ much from the average, being 0.46 and respectively 0.36 cm^2.

The crown volume is a synthetic indicator, which provides specialists with eloquent information about the evolution of the tree crown over the years of study (Table 3). The extension of the crown can only be done up to a certain limit, so that the trees should not interfere with each other. At the same time,

it has to be ensured the penetration of light into the crown and the easy circulation of agricultural aggregates.

Annual growths in the crown of trees represent an indicator that must be taken into account, providing information on the vigor of the trees. This is in correlation with the variety-rootstock association, environmental conditions, crown shape, agrotechnics practiced and the level of production obtained. The average length of the annual branches is considered one of the most representative indicators of the physiological state of the trees, conditioned by ecological and technological factors. The productivity of the trees is the result of the activity of growing the shoots, branches and fruit buds differentiated later (Blagov et. al., 2009).

The value of the average length of the annual branches is considered optimal within the limits of 30 - 45 cm, ensuring a balance between growth, fruiting, differentiation and entropy. When the annual growths are less than 10 cm, it indicates that the alternating fruiting phenomenon is installed, the harvests decrease and the degeneration in the whole crown is manifested (Ilie and Stănică, 2013).

The average length of the shoots (and later of the annual growths), is closely related to the biological peculiarities of the variety, changing essentially depending on the density of the trees in a row and depending on the shape of the crown. It is influenced by the applied technology (pruning, fertilization and irrigation).

The smallest annual increases in the two years of study were recorded in 'Starkrimson' and 'Idared' varieties (26.30 and 30.9 cm, respectively).

At the opposite pole was 'Golden Delicious' variety with the largest growths, the average being 48.05 cm.

The lower rainfall regime in 2020 has negatively influenced the level of annual growth compared to 2021.

Fruit production obtained and fruit quality in the studied apple varieties.

In terms of productivity (table 5), 'Golden Delicious' and 'Idared' varieties were noted with yields of 45.2 and 41.4 t/ha, respectively. The lowest yields were recorded by 'Jonathan' variety (22.5 t/ha).

Regarding the quality of the fruits expressed by the average weight, varieties 'Jonagold' (194 g) and 'Idared' (182 g) were highlighted.

4. Conclusions

The pedoclimatic conditions in the Rediu area, Galați are favorable for the apple crop, in the conditions of ensuring irrigation, to complete the precipitation deficit.

The vigor of the trees, expressed by the surface of the cross section of the trunk, reveals the strong influence of the variety. During the observation period, 'Jonathan' and 'Jonagold' varieties stand out with an increase of 0.64 cm^2 compared to the average, this being 6.26 cm^2 and 1.14 cm^2 respectively, with the smallest increase in growth was 'Starkrimson' with 4.83 cm^2, having a difference from the control of 0.95 cm^2. In the 'Idared' and 'Golden Delicious' varieties, the growth increase does not differ much from the average, being 0.46 and 0.36 cm^2, respectively.

The beginning of flowering for all the apple varieties studied begins in mid-April and the average duration is 10 to11 days.

The crown volume for the studied varieties was between 2863.4 m^3, for the 'Starkrimson' variety and 3677.0 m^3 for the 'Golden Delicious' variety.

In terms of productivity there were noted, the 'Golden Delicious' and 'Idared' varieties with yields of 45.2 and 41.4 t/ha, respectively.

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Tables and Figures

Table 1. Development of the main fruiting phenophases in some apple varieties during the years 2020-2021

Variety	Budding	Flowering		Flowering time	Nr. of days from the end of flowering till harvest
		Beginning	End		
Golden delicious	05.04-14.04	27.04 -04.05	7.05-15.05	11	137-149
Idared	03.04-12.04	25.04-02.05	5.05-12.05	10	148-159
Starkrimson	07.04-16.04	28.04-05.05	8.05-15.05	10	152-163
Jonathan	05.04-14.04	27.04-04.05	7.05-14.05	10	128-141
Jonagold	05.04-14.04	27.04-04.05	7.05-15.05	11	137-149

Table 2. The surface of the trees trunk cross section (cm^2)

Variety	The surface of the trees trunk cross section (cm^2)		Annual growth increase (cm^2)
	2020	2021	
Golden delicious	38.00	43.42	5.42
Idared	42.52	47.84	5.32
Starkrimson	25.45	30.28	4.83
Jonagold	56.92	63.34	6.42
Jonathan	41.62	48.54	6.92
Control (media)	41.47	47.73	5.78

Tabele 3. Crown volume and predominant fruit formations (2020)

Variety	Trees vigour	Crown size (m)			Fruit formations	Crown volume	
		D	d	H		m^3/tree	m^3/ha
Golden delicious	medium	1.5	0,75	3,310	Long formations	1.93	3,677.0
Idared	medium	1.5	0,75	2,930	Long formations	1.70	3,254.9
Starkrimson	small	1.5	0,65	2,823	Spurs	1.50	2,863.4
Jonathan	medium	1.5	0.75	3,101	Spurs	1.81	3,444.0
Jonagold	medium	1.5	0.75	3.233	Long formations	1.56	3,591.5

Table 4. The length of the annual growths recorded for studied apple varieties (cm)

Variety	Annuale growth lenght (cm)		Average 2020-2021	Diference to the control (cm)
	2020	2021		
Golden delicious	30.7	65.4	48.05	-7.05
Idared	27.2	34.6	30.90	-24,20
Starkrimson	20.2	32.4	26,30	-28.80
Jonagold	34.5	45.6	40.05	-15.05
Jonathan (Control)	40.8	69.4	55.10	-

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Table 5. Fruit production obtained and fruit quality in the studied apple varieties

Variety	Number of fruits/tree	Production		Fruit average weight (g)	Skin color
		kg/tree	t/ha		
Golden delicious	141.4	23.8	45.2	168	Golden-yellow
Idared	119.6	21.7	41.4	182	Red on 2/3 of surface
Starkrimson	97.1	15.9	30.3	164	Dark red
Jonagold	85.5	16.6	31.6	194	Very dark red
Jonathan	74.1	11.8	22.5	160	Red on 2/3 of surface

Fig. 1. Aspects of the apple flowering and fruit growth phenophases

Fig. 2. Aspects regarding flowering and fruiting of 'Golden Delicious', 'Idared' and 'Starkrimson' varieties

Fig. 3. Aspects from the flowering period of the 'Golden Delicious' variety and fruits before harvesting

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Fig. 4. Aspects from the flowering period of 'Idared' variety and fruits before harvesting

Fig. 5. Aspects from the flowering period of 'Jonagold' variety and fruits before harvesting

Fig. 6. Aspects from the flowering period of 'Starkrimson' variety and fruits before harvesting