RESEARCH REGARDING THE BEHAVIOUR OF SOME PEACH CULTIVARS IN THE ORCHARD AREA OF ORADEA

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RESEARCH ARTICLE

Abstract

In the condition of the fruit- tree growing area of Oradea, where the multiannual medium temperature is 10.3^{0}C. the sum of multiannual rainfall of 635 mm and the soil is brown, with the content of 36% clay, the superintensive growing pf peach- tree has been studied. The biological material was represented by several cultivars (Suncrest, Padana, Michelin), which were grafted on franc peaches. Considering the results, one may notice that diminishing the distance between the free from 4.3.2.1 and 0.5 m aa row has reduced the vigor of the trees to as much as 36%. The fruit production has exceeded with 67.5% for the trees planted at 4x 2 m and with 159-196% for the trees planted at 4x1 and 4x 0.5 m. Settling orchards with density of up to 2500 trees/ ha is possible and is recommended, in these cases the production obtained on small surfaces (1-5 ha) is of 30-150 tons.

Keywords: superintensive, peach cultivar, fruit production.
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INTRODUCTION

Cultivating trees in a super-intensive system is an increasingly common method for fruit-bearing species from the *pomoidae* subfamily, where the presence of rootstocks and low-vigor varieties offers wide possibilities for expanding plantations with a high density of trees per surface unit. Although relatively recent, the culture of the peach has gained a large scale in our country due to the special quality of the fruits, their very complex chemical composition and the large productions that can be obtained without much effort. The peach is a species little adapted to our climatic conditions, it suffers from frost in the winter, but it can ensure constant and large productions for 10-15 years (Blind, 2020). Peaches have the following in their composition: 10.4-16.2% dry matter, 5.4-11.9% total sugar, 0.36-0.44% total acidity, 12.6-21.5 mg% acid ascorbic, 0.3-0.6 g% pectins, 0.7-0.9 g% proteins, 0.07-0.16 g% tannoid substances, 0.03 mg% vitamin B1, 0.05 mg% vitamin B2, 0.90 mg% vitamin B6, 0.30 mg% vitamin A, 0.43 mg% vitamin E, a series of mineral ions: K, P, Mg, Ca , Na, Mn, Fe, Cu, Zn, etc., have an energy value of 29-64 calories per 100 g. Fruits are appreciated by consumers fresh or processed, in the form of compote, jam, juices, nectars, dehydrated, etc. (Cepoiu & co.,2008).

In the case of the peach species, the establishment of orchards with a high density of trees per hectare under the conditions of the presence in the culture of varieties and vigorous rootstocks was and is viewed with reserve by specialists. In Romania, peach culture is limited by the high demands on heat, the sensitivity shown by it to frost (Drăgănescu, 2006). The peach is a species with high heat requirements. It grows and develops in areas with an average annual temperature of 10-11.5°C. During the winter, it withstands temperatures of -24°C. Buds withstand temperatures of -3.9°C, and flowers abort at temperatures lower than -3°C (Asănică & Hoza, 2013).

The peach is resistant to prolonged drought, but for high productions, water becomes a limiting factor. In the absence of water, the peach fruits remain small, flattened,

the production being diminished both qualitatively and quantitatively. It reacts well to irrigation, especially in the period before the fruits ripen, thus obtaining significant increases in production.

Excess water in the soil, even for short periods, is harmful to the peach, causing asphyxiation of the roots. The high humidity in the air favors the establishment of diseases, and the fog in winter amplifies the negative effects of the frost (Ghena & co, 2014).

The face of the light has high requirements, so that, to make good use of the solar radiation, the cuttings must ensure good ventilation of the crown, and the orchard must be located only on slopes with southern exposure. In the absence of light, the shoots grow little, the trees are sensitive to frost, and the production is weak from a quantitative or qualitative point of view. It is very precocious, bears fruit from the 2-3rd year after planting, has high fertility, differentiates very well, etc.

The peach forms a richly branched root system, with thick skeletal roots, mostly oriented relatively parallel to the soil surface and some of them penetrating vertically to great depths. The lateral extension of the roots exceeds 1.7-2 times the projection of the crown, and vertically most of them are spread between 20 and 80 cm, a few reach 3-4 m. Regardless of the planting density, the roots of neighboring peaches do not intertwine. Because of this, in older plantations, filling in gaps does not give results, the roots of young trees no longer find the necessary space to supply the tree with water and mineral salts. The roots have two growth maxima, in spring and autumn, when the soil is 8-20°C, considered the optimal temperature.

Being a very productive species, the peach reacts well to fertilization, the optimal ratio between N:P:K elements being 1:0.25:1. Annually, per ton of fruit, the peach consumes about: 10 kg of nitrogen, 2 kg of phosphorus, 8 kg of potassium and a series of microelements: Fe, Mg, B, Zn, etc. Depending on the age of the plantation, the number of fertilizers is different (Papouschek, 2022). Thus, in the young plantation apply per surface unit: 80 kg of nitrogen, 60 kg of phosphorus and 40 kg of potassium annually and periodically 25-30 t of manure, and in the mature plantation annually apply: 120-150 kg of nitrogen, 50 -60 kg of phosphorus and 90-120 kg of potassium, along with 40 t of manure applied every 2-3 years.

Irrigation of peach plantations is mandatory to obtain productive performance and appropriate quality. Through irrigation, it is possible to reach an increase in production of over 40% and an increase in the quality of the fruits, which makes it economical to water the peach. By irrigating the peach at the entrance to the field, it is possible to obtain a 20-25% increase in production. The amount of water applied at one watering is 400-600 m3/ha, enough to moisten the thickness of the soil profile where most of the roots are distributed, and the number of waterings is 4-5, depending on the climatic conditions. Critical water needs are before flowering, during endocarp hardening, before fruit ripening and after harvest. The most economical way of applying water is dripping, but furrow irrigation also gives good results.

The duration of economic exploitation of peach plantations is 12-15 years, sometimes longer for solitary trees. The peach bears fruit on mixed branches with a length of 40-60 cm, branches that bear many fruit buds placed in groups, usually three, of which one is vegetative, which implies the thinning of the fruits after the physiological fall in June. During fruiting, most of the mixed branches are exhausted, so that they are not of interest in the crown for the following years' production (Oprea & Ropan, 2010).

The peach is located on light, fertile soils and well exposed to the sun. If there is a slope, only the middle and upper third will be planted to avoid or reduce the effect of spring return frost. The peach cannot be planted after itself in any form, because the roots leave toxic substances in the soil (amygdalin which hydrolyzes and forms hydrocyanic acid), but it can be planted after an apple or hair. Planting is done in autumn or spring, depending on the amount of material to be planted and the climatic conditions (Smith, 2022).

The peach being generally self-fertile, there are no problems with arranging the varieties in the plot, to cross-pollinate (Wallin, 2020). The number of varieties that are planted is directly related to the way the fruits are used; if they are sold directly on the market, many varieties will be planted with a small number of trees, because the fruits are quite perishable, and if they are used through industrial processing, 2-3 varieties will be planted to ensure large batches of fruit, convenient processing plant. Selling on the market is convenient for producers near cities and in the coastal area. Due to the greater

sensitivity of the nectarine to powdering, it will be planted in groups or even in separate plots, which allows ensuring the appropriate phytosanitary protection (Wheeler, 2023).

Through the very varied assortment, fresh fruit can be produced and consumed for a long period of time, from the end of June to the end of October, ensuring both the market and canneries. Due to these advantages, peach culture should be expanded in all favorable areas (Schmid, 2021).

The first attempts made in the fruit-growing area of Oradea revealed the fact that as the peach planting distance in a row is reduced from 5 to 4, 3, 2 m, the vigor of the trees decreases by up to 31%, while the fruit production increases by up to at 67%.

To deepen these aspects to contribute to increasing the productivity and efficiency of this valuable species due to the increase in the density of trees per hectare using existing biological material, experiments were carried out with variants that included high densities of up to 10-20 thousand trees /Ha.

MATERIAL AND METHOD

The experience was in Oradea in 2015 on weak brown soil with a slight slope with southern exposure and a clay content of over 36%. The amount of precipitation fluctuated from 471 mm in 2016 to 799 mm in 2019, so that in the last four years, the rainfall level was 50-120 mm higher than the normal 635 mm, the experience not being irrigated. Multiannual average temperature of 10.30 C it oscillated annually around this value, and there were no climatic accidents attributed to the lowered temperatures. The planting material was Suncrest, Padana, Michelin, and frank peach as rootstock. The agrotechnical level applied was an ordinary one, obtained with soil maintenance, cultivated field and annual fertilization not N_{150}, P 1_{50}, K $_{150}$ kg/ha, active substance, and green and dry cuttings.

The observations and determinations referred to the increase in trunk thickness, fruit production and their quality in terms of size and dry matter content.

RESULTS AND DISCUSSIONS

The increase in the thickness of the trunk is shown in table 1. It is found that the diameter of the trunk decreases as the distance between the trees in a row decreases from 5, 4, 3 and 2 m by up to 36%.

Table 1

Increase in trunk thickness (cm)

Planting distance (trees/ha)	Cultivar			Average cultivar x distance	%
	Michelin	Padana	Suncrest		
V1= 4x 3 m= 833 trees/ ha	16.5	13.1	17.4	15.7	100
V2= 4 x 2 m= 1250 trees/ ha	19.9	15.4	17.9	17.7	112
V3= 4x 1 m= 2500 trees/ ha	15.0	12.1	13.6	13.6	87
V3= 4 x 0.5 m= 5000 trees/ ha	11.1	10.2	11.5	10.9	69
Average distance x cultivar	15.6	12.3	15.1	14.5	-

It is found that the simple thickening of trees in a row can reduce the vigor of the trees by up to 36% in the first 9 years after planting, a fact that opens the possibility of designing and implementing in the field orchards with a larger number of trees per surface unit. In table 1, the row distance was 3 m, then 2, 1 and 0.5 m, returning 833, 1250, 2500 and 500 trees/ha, the vigor of the trees at the end of the 3rd year from planting follows an almost identical trend to the first experience, the trees planted at distances of 1 and 0.5 m per row being 13 and 31% thinner compared to those planted at 3 m. Depending on the variety, the decrease in tree vigor as the nutrition space decreases is more reduced in the Padana variety, which is 23%, while the more vigorous Suncrest and Michelin varieties reduce their trunk thickness more by up to 38% as the distance of planting per row decreased to 0.5 m.

In table 2, including fruit production in the fourth year after planting, there are big differences depending on the number of trees planted per hectare. Following the values given in this table, we are convinced that as the trees were planted at smaller distances, the production per surface unit increased by 4, 7.8 and 9.3 t/ha, by planting 1250, 2500 and 5000 trees compared to the variant which includes 833 trees/ha.

Table 2

Fruit production (t/ha)

Planting distance (trees/ha)	Cultivar			Average cultivar x distance	Difference of distance	%
	Michelin	Padana	Suncrest			
V1= 4x 3 m= 833 trees/ ha	3.0	4.4	6.6	4.7	-	100
V2= 4 x 2 m= 1250 trees/ ha	7.0	8.9	10.5	8.8	4.1^{+}	187
V3= 4x 1 m= 2500 trees/ ha	9.4	12.3	15.1	12.2	7.8^{++}	259
V3= 4 x 0.5 m= 5000 trees/ ha	12.8	10.1	18.9	14.0	9.3^{+++}	298
Average distance x cultivar	8.5	8.9	12.7	10.0	-	

DL 5% 3.58
DL 1% 5.42
DL 0.1% 8.70

Table 3

Average fruit weight (g)

Planting distance (trees/ha)	Cultivar			Average cultivar x distance	%
	Suncrest	Padana	Michelin		
V1= 4x 3 m= 833 trees/ ha	88	123	166	126	100
V2= 4 x 2 m= 1250 trees/ ha	81	112	171	121	96
V3= 4x 1 m= 2500 trees/ ha	83	108	165	119	94
V3= 4 x 0.5 m= 5000 trees/ ha	84	100	152	112	89
Average distance x cultivar	84	111	164	-	-

The quality expressed by the average weight of a fruit is shown in table 3.

As expected, the differences under this aspect are primarily related to the variety, in the sense that they are larger from the Suncrest variety to the Michelin variety, which doubles its weight, making 6 fruits per kilogram. Depending on the nutrition space, a decrease in weight is observed, the variant with 5000 trees/ha presenting 11% smaller fruits, respectively instead of 8 fruits per kilogram, this variant presents 8, 9 fruits/kg. The slight tendency to reduce fruit weight can be greatly reduced by fertilization and differentiated irrigation depending on the number of trees/ha.

CONCLUSIONS

Based on the research undertaken in several stages, extended over a period of 9 years in which planting distances from 4 m to 0.25 m per row were experimented, the following conclusions can be formulated: the reduction of the nutrition space achieved by decreasing the distance of planting per row influences the vigor of the trees expressed by the thickness of the trunk, which is reduced by almost 40% compared to trees planted at standard distances; the production of fruits obtained under planting conditions of over 1250 trees/ha doubles and reaches average annual values of 20 t/ha. The further increase in the number of trees/ha by restricting the nutrition space per row and between rows proved beneficial for production up to the level of 5-10 thousand trees/ha, when over 30 t/ha, the average harvest, was recorded, after which reducing the nutrition space by planting a larger number of trees per surface unit leads to the capping of the yield curve and then to its sudden decrease; the quality of the fruits obtained from the variants with trees planted at small distances has a slight tendency to decrease in terms of average weight, but this can be corrected by resorting to known agrotechnical means such as fertilization, irrigation; the super-intensive system that is envisioned to be promoted following these results has, in addition to the economic component given by the very high production and the reduction of expenses per ton of fruit, and a social side in the sense that on small areas of 1-5 ha, large quantities of fruits for industrialization and in fresh condition of the order of 30-150 tons annually.

The super-intensive peach cultivation system still needs to be perfected in terms of the production of planting material, the establishment of plantations, fertilization, and irrigation to make it more efficient and easier to exploit by an average qualified staff.

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