

REDUCTION OF THE TREE PRODUCTION CYCLE OF *IN VITRO* PROPAGATED STANLEY PLUM CULTIVAR AND THE TREE BEHAVIOUR IN AN ORCHARD.

2. REPRODUCTIVE BEHAVIOR

STANLEY PLŪMJU PAVAIROŠANAS CIKLA SAĪSINĀŠANA, IZMANTOJOT PAVAIROŠANU *IN VITRO* UN KOKU IZVĒRTĒJUMS DĀRZĀ: 2.REPRODUKTĪVIE PARAMETRI

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Kopsavilkums

Viengadīgi un divgadīgi mikroklonāli pavairoti plūmju šķirnes `Stanley` stādi tika salīdzināti ar tradicionāli pavairotiem stādiem, kuri acoti uz potcelma Janka 4 (*Prunus cerasifera* Ehrh.). Mērķis - novērtēt ražu un ekonomisko efektivitāti dārzā. Tika izvērtēti sekojoši parametri: ražošanas sākums, raža un ražas efektivitāte izteikta kā ražas un stumbra šķērsriezuma laukuma attiecība, kā arī ražas un vainaga projekcijas laukuma attiecība. Saīsinātā stādu audzēšanas ciklā iegūtie mikropavairotie stādi sāka ražot otrajā gadā, tāpat kā acotie, bet tiem bija mazāk augļu un pirmajā ražas gadā ziedpumpuri bija izvietoti zaru galos. Patsakņu kokiem bija zemāka raža, salīdzinot ar acotajiem. Ražas efektivitāte augstāka bija mikropavairotajiem stādiem.

Abstract

The study was carried out on the reproductive behaviour of own-rooted micropropagated trees of 'Stanley' plum cultivar grown for only a year in a nursery. Traditionally produced trees grafted on the seedling rootstock Janka 4 (*Prunus cerasifera* Ehrh.) as well as *in vitro* propagated trees of the same cultivar, but grown in the nursery for two vegetation periods, were planted for comparison. The aim of the study was to establish the reproductive and economic qualities of the micropropagated own-rooted planting material produced by reducing the cycle and to evaluate the possibility of establishing fruit orchards from these plants. The following characteristics were observed: beginning of fruiting, yield, biometric indices and fruit production efficiency expressed as yield to trunk cross-section area and to crown projection area ratios. The trees obtained by reducing the production cycle began to bear fruits during the second vegetation like grafted trees. They had less fruit buds per tree compared to the grafted ones and the buds were located in the apical parts of the shoots. Such juvenile behaviour was observed only for the first year after the beginning of fruiting. The own-rooted trees were less fertile in comparison to the grafted ones. However, there were no differences in fruit quality and in the biometric indices. The efficient productivity calculated on the basis of the trunk cross-section area and the crown projection area was higher than that of the traditionally produced trees.

Keywords: micropropagation, own-root, fruit tree, yield, plum, behavior.

Introduction

The efficiency of a plantation is determined by the production value and the price of the planting material, as well as by the economic results depending on the reproductive behaviour of the trees used. The *in vitro* method is a modern approach in the propagation of rootstocks and own-rooted cultivars of species for which the traditional methods proved to be difficult to apply or inapplicable at all. Reducing the nursery production cycle of micropropagated own-rooted trees of Stanley cultivar is a fact and the application of this technology in practice enabled the establishment of orchards using such planting material. Its behavior in orchard was unknown. Therefore necessity of the studies in this question was defined.

In the results of some investigations delayed beginning of fruiting was reported (Cobianchi *et al.*, 1988). The lower yields resulting from the poorer growth were underlined as the problem of using micropropagated own-rooted trees. Because of the poorer growth of that type of trees their productivity was higher in comparison with the grafted ones (Cobianchi *et al.*, 1993; Sansavini *et al.*, 1990). Faber *et al.* (2002) reported that the productivity of the traditionally produced trees of Stanley cultivar was higher. The differences in the reported results as well as the use of planting material

produced by the reduced cycle gave us the theoretical base for carrying out the presented study. Its aim was to show the effect of reducing the production cycle by a year on the reproductive behavior of own-rooted micropropagated trees in comparison with the trees grown in the nursery for two years and the traditionally obtained trees by grafting on the seedling rootstocks.

Materials and Methods

The study was carried out in the fields of the Fruit Growing Institute – Plovdiv in the period 1993-2004. The object of the experiment was the plum cv. Stanley. Own-rooted micropropagated trees (produced without grafting), grown in a nursery for only one vegetation period, were studied. Trees grown in a nursery for two years and trees grafted on the seedling rootstock Janka 4 (*Prunus cerasifera* Ehrh.) obtained by the traditional technology for grafted fruit tree planting material, were produced and planted on the experimental plot for control. The explants and the cuttings for grafting were collected from the same trees planted and grown for that purpose. The trees were planted at 6 m distance between the rows and 4 m distance within the rows. The experimental plot was grown under irrigation conditions, the space between the rows was periodically tilled in accordance with the technological requirements for fruit production. Pruning was very slight – only in the first years – for training of free growing crown. Stem thickening, the crown size and height were measured during vegetation. The following indices were reported: beginning of fruiting, yield per tree and total yield for the period, productivity on the basis of the trunk cross-section area and the crown projection area, as well as fruit quality expressed by fruit and stone biometry. The morphological characteristics were visually observed for detecting any eventual changes resulting from the method of propagation. Data were statistically processed by applying Anova – single factor and the Duncan test.

Results and Discussion

First flowering was reported during the second vegetation after planting in the spring of 1993. All the three variants had flower buds. In the micropropagated variants the flowering trees were 66.7 – 68.8 % for those produced for one and those produced for two years, respectively, while 93.3 % of all the grafted trees had flowers. The own-rooted trees formed 4 to 5 times less flower buds than those grafted on the seedling rootstock Janka 4 (*Pr. cerasifera* Ehrh.). At the end of the vegetation single fruits were also reported in 60 % of the grafted trees and in 13.3 and 25 % of the own-rooted *in vitro* propagated trees, grown in a nursery for one and for two years, respectively.

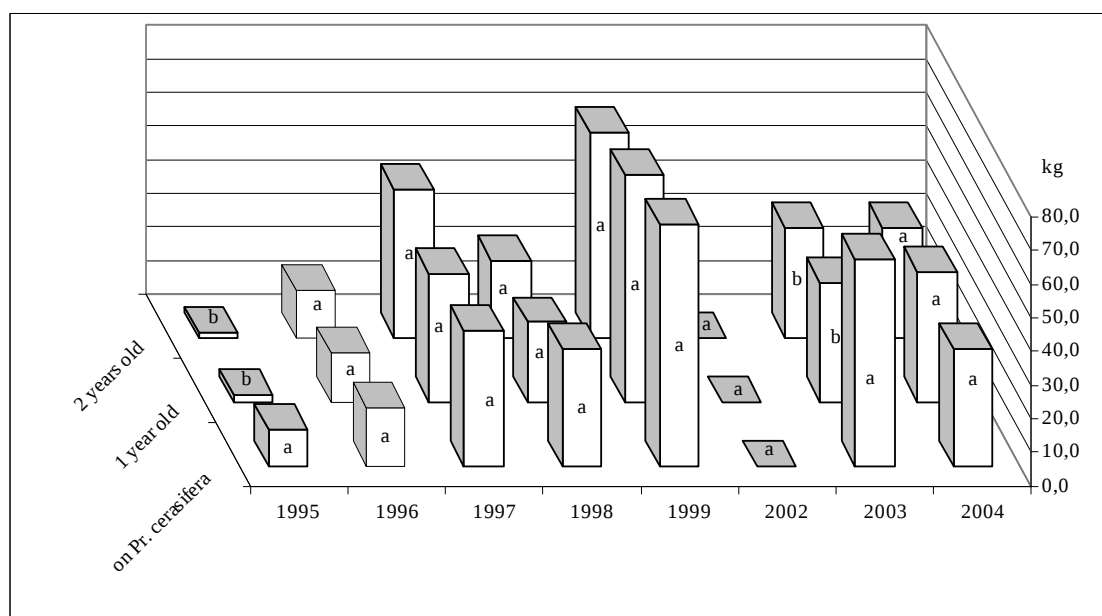


Figure1. Fruit yield of micropropagated own-rooted trees of cv. 'Stanley' produced by reducing the nursery cycle

The own-rooted trees had flowers located in the apical part of the shoots, a fact typical of the juvenile seedling plants. That was observed only in the first year of flowering. By the fertility index the own-rooted micropropagated trees of both variants fell behind the traditionally produced ones. The bigger number of flowers in the first years after the beginning of fruiting brought the higher yields per tree in the variant with grafted trees. The tendency was maintained until the end of the study period. The trees produced by reducing the nursery cycle were slightly more fertile than the own-rooted ones grown for two years in the nursery with the exception of the year 1997. Maximal yields per tree were obtained - 72.2 kg, 67.8 kg and 61.4 kg, respectively, from the grafted trees, the own-rooted trees grown for one and for two years in a nursery (Fig. 1).

The total yield per tree for the period of investigation was the highest for the traditionally produced - 272.8 kg versus 221.8 kg and 210.3 kg for the trees produced by reducing the nursery cycle and for those grown for two years in the nursery, respectively. The yields calculated as a ratio to the trunk cross-section area (Fig. 2) and to the crown projection area (Fig. 3) showed that the traditionally produced trees had higher values of production efficiency at the end of the period. The differences were statistically insignificant.

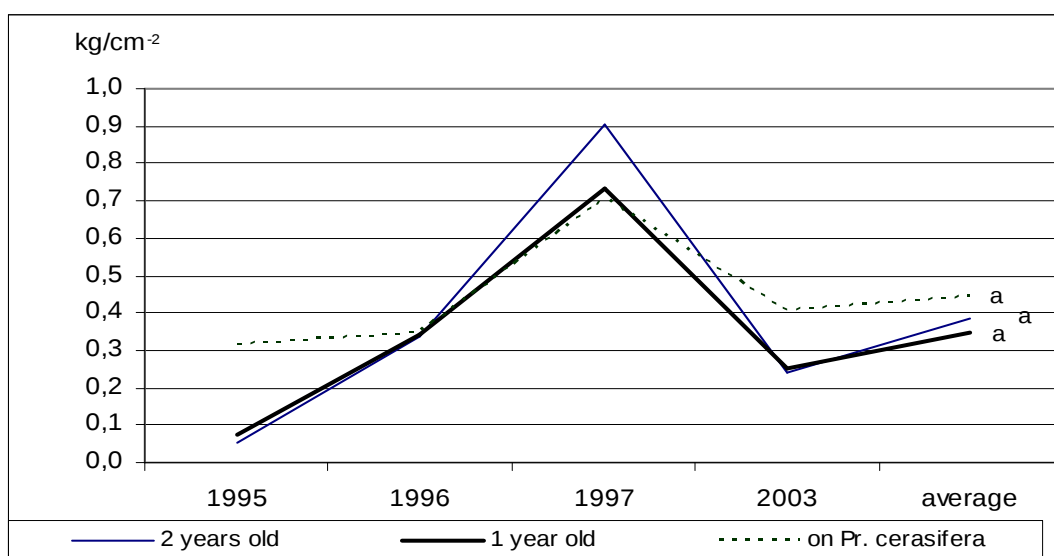


Figure 2. Productivity according to trunk cross-section area, kg cm⁻²

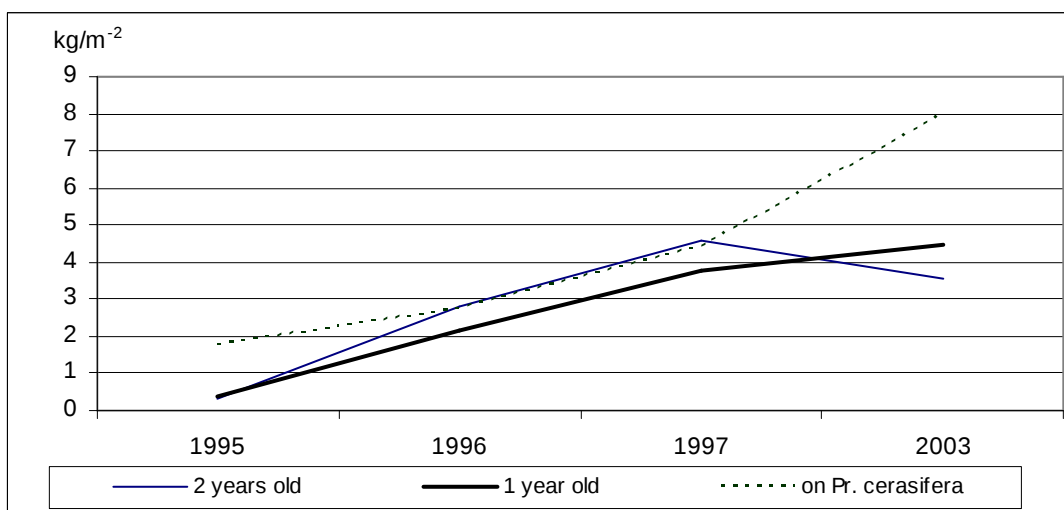


Figure 3. Productivity according to crown projection area, kg m⁻²

The average fruit mass for three years varied insignificantly between 2.99 to 32.6 g (Fig. 4). The fruits of the micropropagated trees were slightly bigger in comparison to the traditionally produced, probably due to the smaller number of fruits per tree and, respectively, to the lower yield. The fruit size expressed in grams correlated to the stone weight. No big differences among the three variants were detected in the sizes of the fruits and stones. They were statistically insignificant. It confirms the lack of any pomological changes resulting from the propagation method and the application of the original technology developed at the Fruit Growing Institute – Plovdiv. Variations of the fruit and stone sizes increased with tree aging, the value of the variation coefficient about the length of the fruit peduncle being almost twice higher at the end of the period.

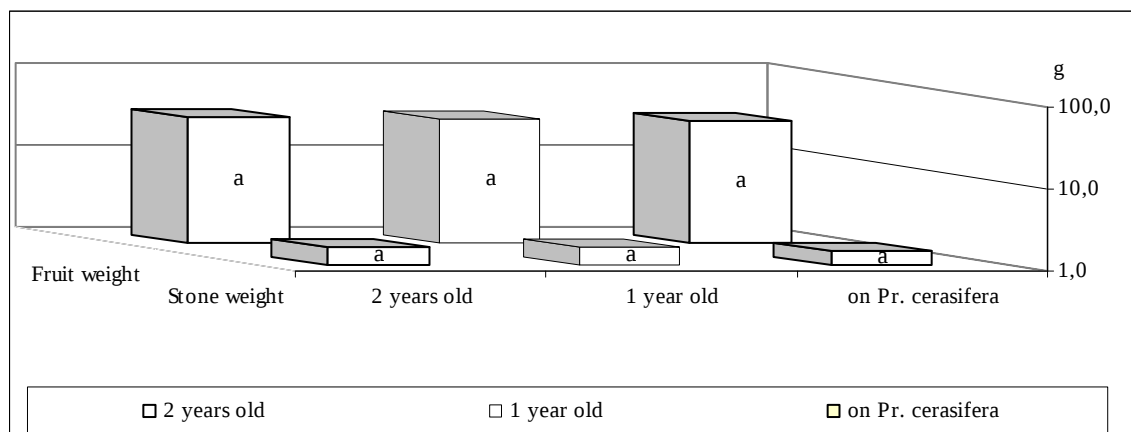


Figure 4. Average weight of fruits and stones of micropropagated own-rooted trees of cv. 'Stanley' plum produced by reducing the nursery cycle.

It should be mentioned that our results definitely confirmed the opinion of Sansavini *et al.* (1990) about the fact that fruit quality was not affected by the method of propagation and production of the planting material. The visual observations on the morphological characteristics of leaves, shoots, flowers, period of flowering, fruit ripening and the separate phenophases during vegetation also did not show any differences between the trees produced by different methods. The technology of reducing the production cycle of the own-rooted micropropagated trees can be applied in practice due to the lower product cost and lower price of the planting material. However, at the establishing of orchards it should be taken into account that the yields and productivity are slightly lower.

Conclusions

The micropropagated own-rooted trees grown for a year in a nursery, began to fruit in the second vegetation after planting in the orchard, similar to the trees grown in the nursery for two years and the trees grafted on seedling rootstocks.

The total yield per tree for the period of study was the highest for the traditionally produced trees of Stanley cultivar. The own-rooted plants produced by reducing the nursery cycle were slightly more fertile than the trees of the other variant with micropropagated trees.

In the period of full fruiting pomological changes as a result of the micropropagation were not observed concerning the fruits and stones, which was also confirmed by the comparatively slight differences in the biometric sizes.

The establishment of fruit orchards with planting material produced *in vitro* and further grown in a nursery for only a year is possible and not risky at all. It should be kept in mind that the lower yield in both variants with own-rooted trees is a fact and it should not be neglected when making the final decision.

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