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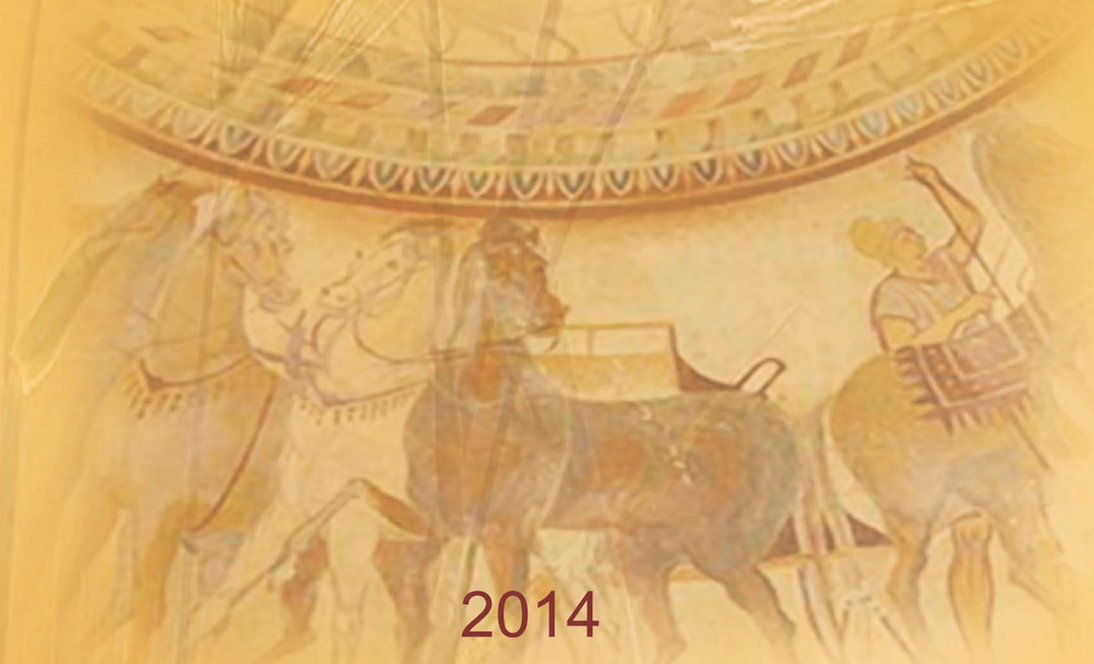

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Growth and fruiting of the apple variety Braeburn 7926 grafted on M9 Pajam2 and MM106

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Abstract. *The growth and reproductive characteristics of the apple variety Braeburn 7926 grafted on two rootstocks with different growth potential – M9 Pajam2 and MM106 is studied. Both rootstocks induce growth manifestations on the variety which are in compliance with their commonly accepted characteristics in fruit growing – proven higher values of the cross – section area of the stem, as well as, in respect to the volume of the crown of the grafted variety are recorded in a combination with the semi – weakly growing rootstock MM106 in comparison to the weakly – growing M9 Pajam2. The combination Braeburn 7926/M9 Pajam2 is more productive during the first year of the observed period and this is due to the earlier fruitgrowing stage of the variety which is affected by the weakergrowing rootstock. The yields are slowly declining in the following years in comparison to the combination Braeburn 7926/MM106 because of the reflected smaller crowns volume affected by the weaker rootstock. The productivity coefficient shows higher values when rootstock M9 Pajam2 is used only during a part of the observed period. A higher planting density can be recommended when the weaker growing sort-rootstock combination is applied for a more rational usage of the vegetative area.*

Keywords: apple, sorts, rootstocks, growth, yield

Introduction

The choice of appropriate rootstock is of crucial importance for developing of intensive apple trees. The choice of rootstock largely determines trees' growth potential (Domozetov, 2004; Webster et al., 2000), the initial fruiting time (Webster, 1993; Csigai and Hrotko, 2007; Fischer,1996), as well as the overall fruit productivity and quality (Mitov et al., 1979; Pepelyankov and Tabakov, 1997).

The growth and reproductive manifestations of the trees are dependent not only on the rootstocks per se, but also from the characteristics of the grafted sorts. The choice of a suitable sort is another important element for the development of intensive apple growing nowadays. The above mentioned selected sorts should quickly reach the stage of full fruiting, together with guaranteeing periodic and high yields and allowing for maximum work efficiency (Stoyanov, 1980; Tabakov and Yordanov, 2007). Recently, producers' attention has been drawn by some new and promising sorts which are gradually but inevitably occupying a larger share in fruit production due to their superior characteristics (Lichev et al., 2012).

The purpose of the current study is to trace the impact of two rootstocks with different growth potential – M9 Pajam2 and MM106 – on the growth and fruit yields of the moderately growing apple sort Braeburn 7926.

Material and methods

The experiment was conducted in the area of Plovdiv. The soil at the experiment location is classified as Chromic cambisols according to the international FAO classification. The plant was created in the autumn of 2001 with a plat density of 1388 trees per a hectare (4.00 m X 1.80 m). The moderately growing sort Braeburn 7926 is used. It is grafted on the rootstocks M9 Pajam2 (weakly growing) and MM106 (semi – weakly growing), respectively. The tree crowns are formed as free spindle. All agricultural activities typical for intensive apple orchards have been conducted.

The experiment applies a block method with 4 repetitions from each tree-rootstock combination and every repetition consists of 4 plants. The vegetative and reproductive manifestations are recorded for the 2005 – 2010 period when the plants are experiencing the stage of initial and fast-growing fruiting.

Results are calculated by applying the variance comparison method.

Results and discussion

The cross-section area reflects the tree stem thickening. During the first reporting year, which in this case is the third year of the vegetation period of the plants, rootstock MM106 has thicker stems (Table 1). In the following year, trees with rootstock MM106 again demonstrated greater weight gain. The same trend was observed until the end of the follow-up period, and in 2008 the reported differences are statistically significant. In general, the thickening of the stems and during the entire 6-year period meets the conventional characteristic of the tracked rootstocks (Trachev et al., 1975). Trees with rootstock M9 Pajam2 start their development with a smaller thickening during the observed period. One might assume that to some extent this is due to the earlier initial fruit growing stage among the trees with weaker growth rootstock.

In respect to the crown size the similar tendency is observed. The moderately growing variety Breaburn 7926 is heavily influenced by the rootstock characteristics. Throughout the entire observed period, trees with rootstock MM106 have significantly larger crown in comparison with the other options. The differences are statistically significant (Table 1). According to the crown size indicator, the rootstock M0 Pajam2 proves its common feature to induce smaller dbove ground vegetative growth of the grafted sort.

The data for much smaller size of the crowns on rootstock

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Table 1. Vegetative activities. Cross-section area of the stem (cm^2) and volume of crowns (cm^3)

Index	Cross-section area of the stem, cm^2						Volume of crowns, cm^3					
Variants	Years											
	2005	2006	2007	2008	2009	2010	2005	2006	2007	2008	2009	2010
M9 Pajam2	12.04	20.83[a]	35.60	51.43[a]	60.31	68.05	1.63[b]	2.54[c]	4.03[c]	4.49[c]	6.93	7.40[c]
MM106	12.71	23.87[a]	39.25	53.36[a]	62.00	71.59	4.27[b]	7.81[c]	10.18[c]	10.37[c]	15.97	18.67[c]
*GD at 5 %	2.09	2.00	3.71	1.11	2.92	3.65	0.83	0.62	0.49	0.77	11.48	0.91
1%	3.83	3.67	6.81	2.04	5.36	6.70	1.53	1.14	0.89	1.41	21.07	1.67
0.1%	8.49	8.13	15.09	4.52	11.87	14.84	3.39	2.52	1.98	3.13	46.69	3.71

*Level of proof: a - p<0.05, b - p<0.01, c - p<0.001

Table 2. Reproductive activities. Yield per tree (kg), yield per hectare (kg) and productivity coefficient (kg/ cm^2)

Index	Yield per tree, kg						Yield per hectare, kg						Productivity coefficient, kg/cm^2					
Variants	Years																	
	2005	2006	2007	2008	2009	2010	2005	2006	2007	2008	2009	2010	2005	2006	2007	2008	2009	2010
M9 Pajam2	14.12[a]	23.19	44.95	67.26	78.68	79.62	19489.1[a]	31995.3	62034.5	74820.8	108581.9	109875.6	1.18[a]	1.13	1.27[a]	1.31	1.31	1.17
MM106	11.91[a]	26.25	46.76	68.71	80.71	82.86	16433.4[a]	36217.1	64528.8	94824.3	111387.0	114341.0	0.96[a]	1.12	1.20[a]	1.29	1.30	1.16
*GD at 5 %	1.59	3.13	2.02	3.43	4.27	15.96	2185.2	4315.2	2789.5	57577.6	5888.0	22027.2	0.17	0.14	0.04	0.09	0.10	0.31
1%	2.91	5.75	3.71	6.29	7.83	29.30	4011.2	7921.1	5120.6	105691.6	10808.2	40433.9	0.31	0.26	0.07	0.16	0.18	0.57
0.1%	6.45	12.73	8.21	13.94	17.35	64.92	8887.0	17549.6	11344.9	234164.5	23946.1	89583.1	0.68	0.57	0.15	0.36	0.40	1.27

*Level of proof: a - p<0.05, b - p<0.01, c - p<0.001

combinations Braeburn 7926/M9 Pajam2 gives us a reason to believe that Interlinear distances for trees with rootstock M9 Pajam2 are large and can be reduced.

The reproductive activities of the two options, as described in Table 2, show the combination Braeburn 7926/M9 Pajam2 as being more productive during the first year of observations. This is perhaps due to the earlier time of sort's fruit growing induced by the slower growth rootstock. During the second year, the fruit yields from this combination begin to gradually decrease in comparison with Braeburn 7926/MM106 but there are no statistically significant differences. We think that this is due to the smaller crowns volume which is affected by the weaker rootstock, despite its earlier initial fruiting. This is one of the reasons together with the larger planting distances that determine the lower yields per hectare for the variety Breaburn 7926 grafted on rootstock M9 Pajam 2 during the observed period.

The productivity coefficient to the stem cross-section shows higher values for option with rootstock M9 Pajam2. The differences only in the first and third year are statistically significant (Table 2). There are no statistically significant differences in the other years of the experiment.

Conclusion

The increase of the stem cross sectional area together with the crown volumes in both cases are with accordance with the general characteristics of the studied rootstocks. Significantly higher values have been recorded with the grafted sort on the semi – weakly growing rootstock MM106 in comparison to the weakly growing M9 Pajam2.

The varieties grafted on weakly growing rootstocks show statistically significant higher yields per a tree and per a hectare in comparison with the other combination only during the first year. In order to receive higher yields per a hectare, use more effectively the vegetative areas and having in mind the smaller above–ground areas and the fruitgrowing intensification, we recommend higher planting density in the case of the weakly growing combination.

Higher productivity coefficient is shown by Breaburn 7926 which is grafted on M9 Pajam 2 rootstock only during the 1st and the 3rd year of the study.

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Instruction for authors

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Papers shall be submitted at the editorial office typed on standard typing pages (A4, 30 lines per page, 62 characters per line). The editors recommend up to 15 pages for full research paper (including abstract references, tables, figures and other appendices)

The manuscript should be structured as follows: Title, Names of authors and affiliation address, Abstract, List of keywords, Introduction, Material and methods,Results, Discussion, Conclusion, Acknowledgements (if any), References, Tables, Figures.

The title needs to be as concise and informative about the nature of research. It should be written with small letter /bold, 14/ without any abbreviations.

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Results are presented in understandable tables and figures, accompanied by the statistical parameters needed for the evaluation. Data from tables and figures should not be repeated in the text. **Tables** should be as simple and as few as possible. Each table should have its own explanatory title and to be typed on a separate page. They should be outside the main body of the text and an indication should be given where it should be inserted.

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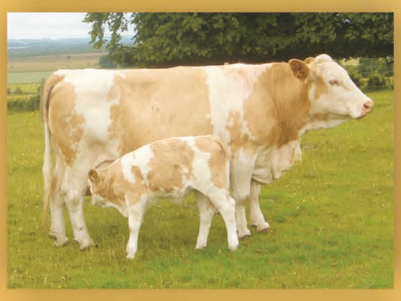

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