

Influence of M9 Rootstock on Reproductive Behaviour of Apple Cultivars under Dry, Semi-arid Growing Conditions

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Abstract

In the last decade, apple has been intensively cultivated in the western coast of Albania. The scope of this research was to study the influence of M9 rootstock on the reproductive behaviour of apple cultivars ‘M. Gala’, ‘Golden Delicious’, ‘Starking’, ‘Fuji’ and ‘Pink Lady’. The trial was conducted from 2010 – 2011 in 5-year old orchards with 2,250 trees/ha grown as French axe and in full production located in Lushnja. The following indicators were measured: diameter of two main branches, number of fruits/branch, fruit growth dynamic and sugar content (%). Global radiation, temperature and humidity were recorded. The reproduction behaviour has also been measured by fruiting spurs in the general structure of the canopy as well as the number of fruits formed for each cultivar. The results have shown that in terms of fruit set, cultivars are ranked as follows: ‘M. Gala’ with the highest number of fruits, then ‘Golden Delicious’, ‘Fuji’, ‘Pink Lady’ and ‘Starking’, respectively. The dynamic of fruit dropping shows that ‘Starking’, having the lowest fruit set, after the June drop is more stable while ‘M. Gala’, with the highest fruit set, besides an abundant June drop, had another drop in July. This is due to higher competition among the fruits and failure of the rootstock to supply the adequate quantities of sap. In terms of fruit growth dynamic, it was observed that intensive growth was measured for all the cultivars during the end of July after which fruit growth slowed down. Changes between cultivars were observed in relation to the maturation period of each cultivar, with ‘M. Gala’ maturing in August, ‘Fuji’ and ‘Pink Lady’ in October and November. ‘Starking and ‘Golden Delicious’ cultivars had a more rapid maturation (20 September), accompanied with a higher sugar content which is far more related to climatic factor rather than M9 rootstock. In conclusion, it was found that the cultivars under study have different reproductive behaviour with M9 rootstock. It can also be stated that ‘Starking’ is not appropriate for this coastal region due to inadequate fruiting behaviour.

Key words: rootstock, fruit set, fruit growth dynamics, ‘Starking’ cultivars.

Introduction

Apple cultivation in the coastal lowlands in the last decade has received higher interest using high-density growing techniques and clonal rootstocks. In the structure of these orchards, both traditional and young cultivars are used. The scope of this research was to study the influence of M9 rootstock on the productivity of apple cultivars 'M. Gala', 'Golden Delicious', 'Starking', 'Fuji' and 'Pink Lady'.

Materials and methods

The study was conducted in five-year old orchards with a density of 2,250 trees/ha, with a French axe system and in full production. The plot is located on a plain, using the same cultural practice (soil was kept fallow with furrow irrigation with a fortnightly frequency, etc). For each combination, five trees were selected to carry out the following measurements related to productivity indices: (i) Diameter of two main branches; (ii) Number of fruits set/branches; (iii) Fruit fall; (iv) Fruit growth dynamic and (v) Sugar content.

Results and discussion

Fruit set

The observations found that many fruiting shoots were present more in the combination M9/Gala and less in the combination M9/Starking. This was shown by the quantity of fruits set (Fig. 1). The differences in the quantity of fruit setting are significant for all the cultivars under study.

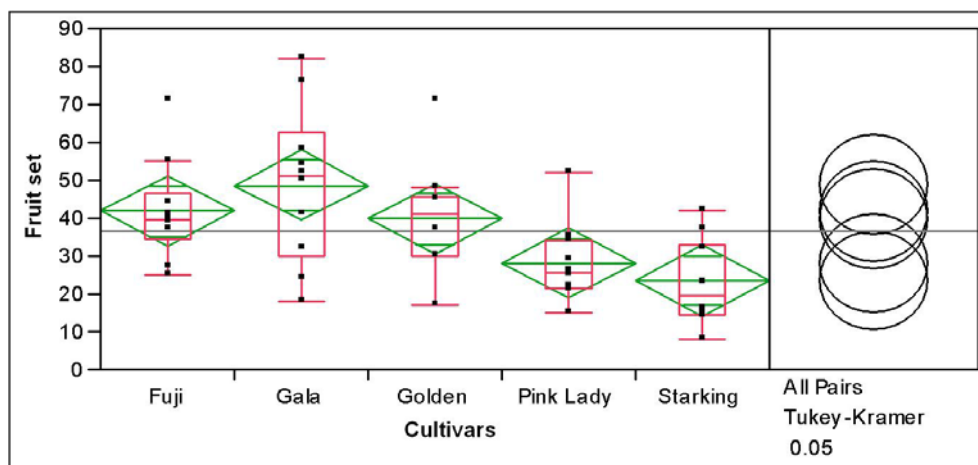


Fig. 1. Variability levels for fruit set indices
Nivoi varijabilnosti za indekse zamatanja ploda

Fruit fall

Another index measured during vegetation was the fruit fall dynamics for all the cultivars under study. The data showed that cv. ‘Starking’ had less fruits set whereas after the June drop it showed more stable fruit set in comparison to the other cultivars. The cv. ‘M. Gala’, having the highest fruit set, besides a heavy drop in June, had another wave of dropping during July, about one month before harvest. This phenomenon is related to the higher competition of fruits for nutrients and the failure of the rootstock to provide them (Fig. 2).

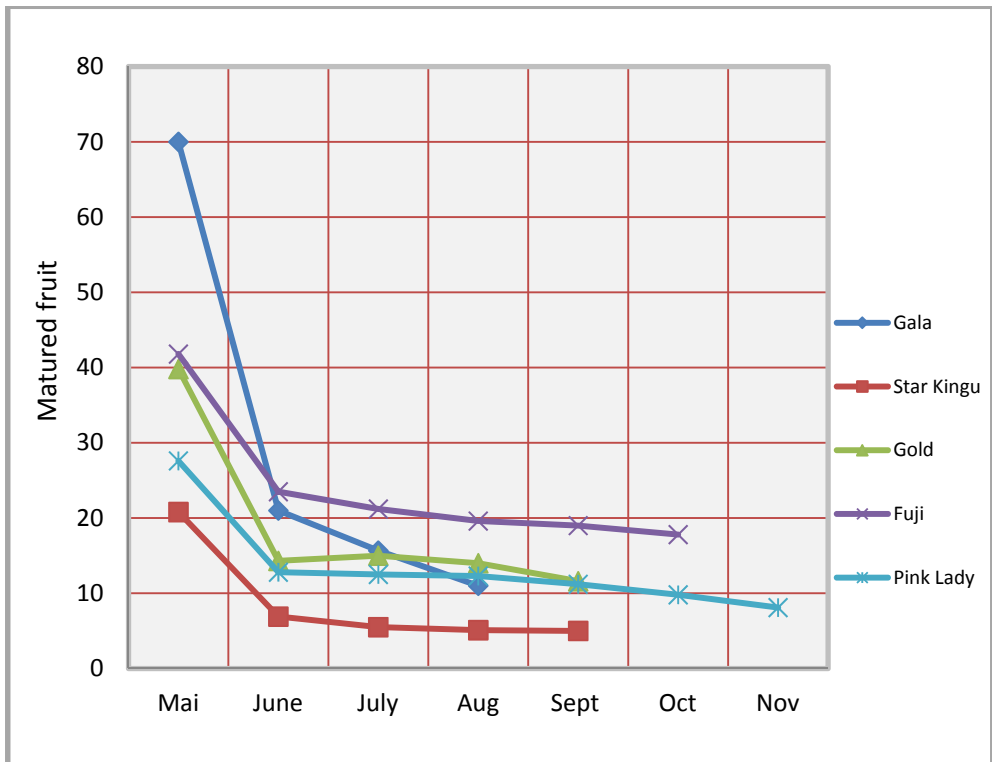


Fig. 2. Fruit drop dynamics
Dinamika otpadanja plodova

Fruit growth dynamics

Measurements of the fruit cross section diameter showed that the cultivar ‘Starking’ had faster dynamics due to the lower load. This is due to a better supply of nutrients for fruit growth. It was interesting to find that the intensive fruit growth period for all the cultivars was the end of July which coincided with embryo formation. Later, growth rate was reduced, with differences between cultivars (Fig. 3).

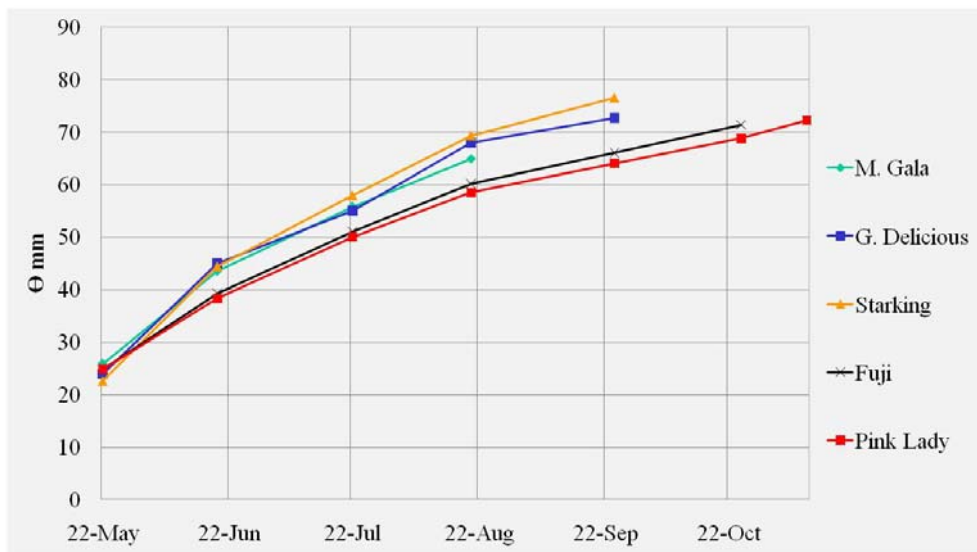


Fig. 3. Fruit growth dynamics
Dinamika rasta plodova

Fruit growth and maturation

Although classified as autumnal cultivars, under the climatic conditions of Lushnja, ‘Starking’ and ‘Golden Delicious’ mature at the beginning of the third decade of September, while ‘Fuji’ and ‘Pink Lady’ mature in the middle of October and middle of November respectively.

Data on sugar contents showed that ‘Starking’ and ‘Golden Delicious’ cultivars accumulate higher quantity of sugar at harvest, which is not their trait when grown in colder climates. In the case of ‘Starking’ cultivar, the quantity of sugar was even higher than the quantity obtained in the summer cultivar, such as ‘M. Gala’. This has a negative influence on the fruit conservation and they should be consumed as quickly as possible. The other four cultivars have slight differences, due to specific properties of each variety (Fig. 4).

Conclusions

From the data analysis and interpretation, the following can be concluded:

- The cultivars under study have different behaviour to M9 rootstocks, with significant differences regarding the indicators of fruit productivity and quality.
- ‘Starking’ cultivars under the semi-arid conditions of the coastal lowlands have low quantitative and qualitative indices.

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Utica j podloge M9 na reproduktivno ponašanje sorti jabuke u sušnim i polusušnim uslovima uzgoja

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Sažetak

U toku posljednjih deset godina jabuka se intenzivno uzgaja na zapadnoj obali Albanije. Obim ovog istraživanja je bio da se ispita uticaj podloge M9 na reproduktivno ponašanje sljedećih sorti jabuke: „M. Gala“, „Golden Delicious“, „Starking“, „Fuji“ i „Pink Lady“. Istraživanje je sprovedeno u toku 2010–2011. godine na petogodišnjim voćnjacima sa 2250 voćaka/ha u uzgojnom sistemu vertikalno vreteno i u punoj rodnosti na lokalitetu Lushnja. Mjereni su sljedeći indikatori: prečnik dvije glavne grane, broj plodova po grani, dinamika rasta plodova i sadržaj šećera (%). Praćeno je i evidentirano globalno zračenje, temperatura i vlažnost. Reproductivno ponašanje je takođe mjereno na osnovu rodni izboja u opštoj strukturi krošnje kao i broj formiranih plodova za svaku sortu. Rezultati su pokazali da su u pogledu zametanja ploda sorte zauzele sljedeći poredak: „M. Gala“ sa najvećim brojem plodova, zatim „Golden Delicious“, „Fuji“, „Pink Lady“ i „Starking“. Dinamika opadanja plodova pokazuje da je „Starking“, sa najnižim zametanjem ploda, nakon junskog opadanja stabilniji, dok je „M. Gala“, sa najvećim zametanjem ploda, pored

obimnog junskog opadanja, imala još jedno opadanje u julu. To se dešava usljed veće kompetencije plodova i nemogućnosti podloge da obezbjedi adekvatne količine biljnog soka. Što se tiče dinamike rasta plodova, primjećeno je da je intenzivan rast izmjeren za sve sorte krajem jula nakon čega dolazi do usporavanja rasta. Razlike između sorti su primjećene u vezi sa periodom zrenja svake pojedine sorte pri čemu „M. Gala“ sazrijeva u avgustu, „Fuji“ i „Pink Lady“ u oktobru i novembru. „Starking“ i „Golden Delicious“ su brže sazrijevale (20. septembar), što je pratio i veći sadržaj šećera koji se više povezuje sa klimatskim faktorom nego sa podlogom M9. Može se zaključiti da smo ustanovili da proučavane sorte imaju različito reproduktivno ponašanje na podlozi M9. Takođe se može tvrditi da „Starking“ nije odgovarajuća sorta za ovaj obalni region zbog neadekvatne rodnosti.

Cljučne riječi: podloga, zametanje ploda, dinamika rasta ploda, „Starking“ sorte.

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