

# ROOTSTOCK INFLUENCE ON APPLE CANOPY ARCHITECTURE UNDER HIGH RADIATION AND TEMPERATURE

Hafuz Domi\*, Telat Spahiu\*, Endrit Kullaj\*\*, Fadil Thomaj\*\*

\*ADAD, Tirana, Albania

\*\*Department of Horticulture, Faculty of Agriculture and Environment, Agricultural University of Tirana, Koder – Kamëz, Tirana, Albania. [endritkullaj@yahoo.com](mailto:endritkullaj@yahoo.com)

## Introduction

Apple, which is generally cultivated in temperate and cold areas, in the last decade is having a large dissemination in the coastal lowlands, by using clonal rootstocks and mainly M9 – EMLA.

The purpose of this research was to study the behavior of the five most disseminated cultivars in the Western Plain of Albania, namely 'M. Gala', 'Golden Delicious', 'Starking', 'Fuji' and 'Pink Lady' on M9 rootstock and the influence of the latest on the canopy elements and production. Reciprocal effects are seen in the development of vegetative and reproductive elements, duration of phenological stages as well as on the quantity and quality of production. This enables us to broaden our knowledge on rootstock selection and choice of best cultivars for Lushnja region.

## Materials and methods

The five cultivars chosen for this research, 'M. Gala', 'Golden Delicious', 'Starking', 'Fuji' and 'Pink Lady' on M9 rootstock are the most common in the coastal lowlands. The orchard was planted in 2006 in Lushnja. It is located at 3 m of altitude, with planting distances 3,7 x 1,2 m. The system is French axe.

Five trees for each cultivar were labeled and the following measurements were carried out:

- Rootstock and scion diameter (10 cm above and under the grafting line)
- Diameter of two main branches at 1.5 m from soil level
- Length of vegetative shoots
- Number of spurs, bourses and brindles.
- Number of fruits set per branch

Data were statistically analyzed using the Tukey – Kramer test for  $\alpha = 0,05$ .

## Results and discussions

The results show that after five years from the planting in the orchard, there is a slight visible difference in development of rootstock/scione for the five cultivars under study. The highest change is found in the combination M9/ 'M.Gala' and 'M9/'Pink Lady', with affinity indices of 0.49 and 0.52 respectively which is smaller than 0.6. (Figure 1 and 2 and photos 1 and 2). For the other cultivars, although with different values from each others, the affinity index is above 0.6, which is within the acceptable limits for clonal rootstocks and mainly for M 9.

This results show clearly a partial incompatibility between the two components, which has an effect on the modification of other canopy elements; (shoots of different categories), as well as on the vegetation and production.

The same principle was also observed for the diameter of the main branches, where 'M. Gala' is the smallest. Even for this index, no significant differences were observed for cv. 'Golden Delicious' and 'Pink Lady' (photo 3).

**Vegetative shoots:** The dwarfing effect was observed also by the amount of vegetative growth of the trees. The lowest number of vegetative shoots per tree was found in cv. 'M. Gala', while the highest number in cv. 'Fuji' and 'Pink Lady'. Their annual growth follows the same principle, with cv. 'Fuji' and 'Pink Lady' having the highest values. 'Golden Delicious' and 'Starking' showed a similar growth although significantly different from each other, while 'M. Gala' has the weakest growth (Figure 3).

Figure 3: Comparison of vegetative shoot length by cv.

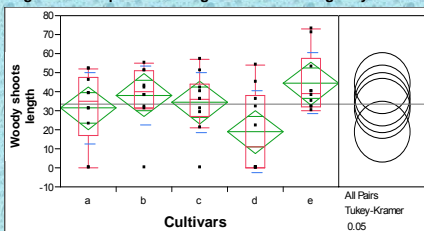


Figure 1: Affinity index by cv.

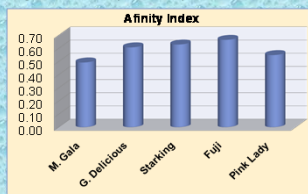


Figure 2: Scion diameter by cv.

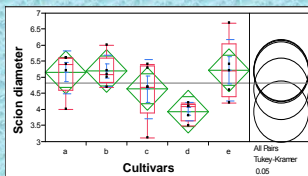


Table 1: Biometric measurements of canopy elements

Cultivar	Diameter (mm)		Affinity Index	Number of shoots				Woody branches length (cm)	Branch diameter (mm)	Fruits formed
	rootstock	scion		Spurs	Bourses	Brindle	Woody			
'M. Gala'	40	19.7	0.49	79	5	49	5	189	14.7	45.3
'G. Del.'	42.5	25.8	0.61	59	12	50	12	483	15.4	39.8
'Starking'	36.9	23.2	0.63	47	14	31	14	600	16.4	20.8
'Fuji'	39.3	26.1	0.66	48	19	52	19	811	15.7	41.8
'Pink Lady'	47.4	26	0.55	34	16	45	16	660	15.5	27.6

## Fruiting shoots

Modifications of structural elements of the canopy were distinguished by referring to the fruiting shoots; spurs, bourses and brindles. Data shown in Figures 6, 7 and 8 showed that cv. 'M.Gala' forms a much higher number of spurs and bourses, while cv. 'Fuji' and 'Pink Lady' with a higher vegetative growth, had fewer fruiting shoots.

It was interested to find that cv. 'Starking' which is known for its reduced growth, under a high radiation and temperature regime in Lushnja had more vegetative shoots than 'Golden Delicious' and less than 'Fuji' and 'Pink Lady'. In this context, it has less bourses and brindles, while having the same number of spurs like cv. 'Fuji'. In other conditions, on the same rootstock (M9), cv. 'Starking' has a reduced vegetative growth and high reproductive growth (Figure 4).

## Fruit set

The development of more fruiting elements in the entire canopy was reflected in the quantity of fruits set per cultivar. Data shown in Figure 5 and 6, prove the same principle. Significant changes are seen at 'M. Gala', with a smaller diameter of the main branch, but with more fruiting shoots and fruit set (45.3 fruits/branch), followed by 'Fuji' and 'Golden Delicious' cultivars. 'Starking', although with a higher diameter of the main branches forms more vegetative shoots and lesser fruit sets (20.8 fruits/branch) (Figure 5, 6).

The correlation between the fruiting shoots diameter and fruits set is interesting (Figure 7). The cultivar that forms more stronger branches ('Starking' in our case) has lesser fruits.

Figure 4: Number of fruiting shoots by cv.



Figure 5: Number of fruits set by cv.

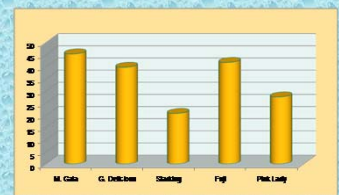


Figure 6: Variability level for fruit set index by cv.

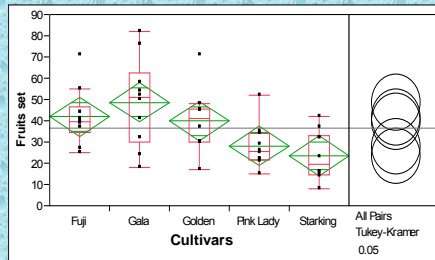
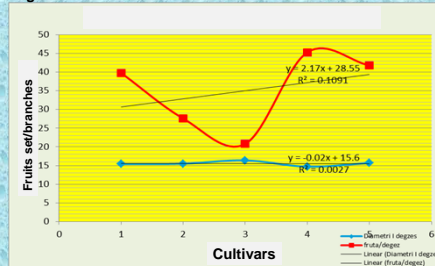


Figure 7: Correlation between shoot diameter and fruit set



## Conclusions

- M9 rootstock has a significant effect on the architectural elements of the canopy as well as productivity
- In combination with 'M. Gala', the dwarfing effect is higher accompanied by a reduced vegetative growth and a higher development of fruiting shoots in the first years of the orchard
- Cv. 'Starking' in Lushnja on M9 has a good vegetative growth but delays the formation of fruiting shoots
- For all cultivars, there a significant correlation between the diameter of the main branches and fruiting

## References

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