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DISTINCTIVE BEHAVIOUR OF SOME SWEET CHERRY CULTIVARS RELATED TO ROOTSTOCK TYPE

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Abstract

The key for a successful investment in the sweet cherry orchard management consists in the way we choose the right cultivar/rootstock combination in conjunction with modern technological inputs and interventions. A testing plot is needed in the future orchard location or in the nearest area in order to have a precise response of the sweet cheery cultivars/rootstocks to the specific climatic and soil features. In this regard, we aimed to test ten sweet cherry/rootstock combinations such as: Kordia/Colt, Kordia/PHLC, Ferrovia/Colt, Ferrovia/PHLC, Skeena/Colt, Skeena/PHLC, Van/PHLC, FirmRed/CAB6P, GiantRed/CAB6P and EarlyRed/CAB11E. The experimental plot was established in the Faculty of Horticulture orchard, in Bucharest area, in 2009. Since then, biometrical and phenological data was collected and revealed EarlyRed/CAB11E and FirmRed/CAB6P as the most vigorous combinations. 20% reduced vigour was observed in the trees grafted on PHLC comparative to the same cultivars grafted on Colt. The highest yield was calculated for Ferrovia/Colt but the largest and most attractive fruit were noticed in GiantRed and FirmRed grafted on CAB6P.

Key words: *Prunus avium L., PHLC, Colt, CAB 6P, CAB 11E, morpho-productive traits.*

INTRODUCTION

Much research has been conducted in the last years regarding the morpho-productive behavior of some new or old sweet cherry cultivars (Tomaszewska and Nychnerewics, 2006; Chelpin'ski, 2000). Nevertheless, the adaptability of specific scion/rootstock combinations to different climate and soil conditions (De Salvador et al., 2005) reveals that some cultivars and sweet cherry rootstocks react better than others in terms of growth (Santos A.S. et al., 2007), productivity (Santos A. et al., 2006) or even compatibility (Asănică A. et al., 2012).

In order to accomplish the growers and market needs regarding the modern orchards and sweet cherry fruit quality, we propose to continue the study of some new and classic sweet cherry commercial cultivars behaviour in combination with different rootstocks that influence directly the main traits of the trees (Asănică A. and Tudor V., 2011).

MATERIALS AND METHODS

The experiment comprised the 5-year-old trees of different sweet cherry cultivars in combination with more or less vigorous rootstocks.

All trees planted in 4 x 1.5 m spacing were grouped in an experimental plot of the University of Agronomic Sciences and Veterinary Medicine of Bucharest with a clay soil, medium/soft texture, deep ground water, 10.5^0C annual temperature and 550-600 mm precipitation. The experimental field of the Horticulture Faculty is equipped with trellis system and drip irrigation, all the technological interventions being done in respect with the modern sweet cherry orchards exploitation technology.

The cultivar/rootstock combinations chosen for the trail were Kordia/Colt, Kordia/PHLC, Ferrovia/Colt, Ferrovia/PHLC, Skeena/Colt, Skeena/PHLC, Van/PHLC, FirmRed/CAB6P, GiantRed/CAB6P and EarlyRed/CAB11E.

The vigour of trees was calculated according to the mean trunk sized (TCSA) and the total height of the plant. The annual number and length of the spur and medium/long branches

was expressed as percentage of each one per tree. All the production elements were also counted starting with the number of inflorescences and flowers and ending with the estimated yield, considering the total number of fruit per tree and the average fruit weight (25 samples of fruit).
The means were compared using the Duncan's Multiple Range Test and LSD tests ($P<0.05$).
Phenophases were noted accordingly to Fleckinger's method of reference stages (Leckinger, 1960, Chapman et al., 1976).

RESULTS AND DISCUSSIONS

Regarding the growth vigour of the sweet cherry trees, the cultivars growth differences marked the same trend as the previous years, the most vigorous combination in terms of trunk cross-sectional (Table 1) area and total length of annual increases (Table 2) remained the combinations EarlyRed/CAB11E (22.38 cm^2, 1395 cm) and FirmRed/CAB6P (17.12 cm^2, 902 cm).
The least vigorous cultivar was Skeena, also grafted on Colt and PHLC. Increased growth in thickness had the highest values the combination Firm Red/CAB6P (11.11 cm^2) and Early Red/CAB11E (9.81 cm^2), trees that also reached the highest levels of height (3.05 m respectively 2.95 m).
PHLC compared to Colt rootstock determined a growth reduction in thickness of the trunk, influencing the vigour of growth of approximately 20% for Kordia, 28% in the Ferrovia case and 13% to Skeena (Figure 1).

Table 1. Growth of sweet cherry cultivars on different rootstocks

Cultivar/rootstock	Trunk Cross Sectional Area (TCSA) (cm^2)		Increased growth in thickness (cm^2)	Tree height (m)
	2011	2012		
Kordia/Colt	9.12ab	15.27b	6.15a	2.26a
Kordia/PHLC	6.44b	12.12c	5.68a	2.84a
Ferrovia/Colt	7.93b	15.41b	7.48a	2.13a
Ferrovia/PHLC	6.69b	11.04c	4.35a	2.41a
Skeena/Colt	3.58b	5.43d	1.85a	2.22a
Skeena/PHLC	3.38b	4.71d	1.33a	1.85a
Van/PHLC	9.29ab	15.61b	6.32a	2.92a
FirmRed/CAB6P	6.01b	17.12b	11.11a	3.05a
GiantRed/CAB6P	10.25ab	16.11b	5.86a	2.88a
EarlyRed/CAB11E	12.57a	22.38a	9.81a	2.95a
Mean	*7.52*	*13.52*	*6.00*	*2.55*

Means followed by the same letter in the same column are not significantly different (Duncan's multiple range test, $P\leq0.05$)

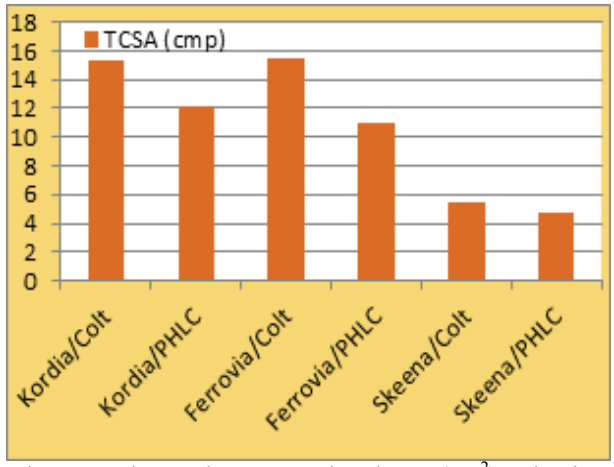

Figure 1. The trunk cross sectional area (cm^2) reduction by PHLC rootstock

For all cultivars, the percentage of short branches was higher than the long one due to the summer pruning performed the previous year, which proved to stimulate early-lateral small shoots occurrence.

Table 2. Types of branches and length distribution of annual increases sweet cherry cultivars grafted on different rootstocks (2012)

Cultivar/ rootstock	No of long branches		No of short branches		Amount of growth per tree (cm)		Total annual growth / tree (cm)	Share of long branches (%)	Share of spur branches (%)
	Medium branches	Long branches	Fruiting spur branches	Vegetative spur branches	Medium branches	Long branches			
Kordia/Colt	23a	3c	57e	38b	690a	252i	942c	21.48c	78.50e
Kordia/PHLC	14c	10bc	46g	37b	434c	610d	1044b	22.43c	77.57e
Ferrovia/Colt	17b	6c	32h	25e	476b	366f	842e	28.75a	71.25g
Ferrovia/PHLC	16bc	7c	59d	8g	352d	315g	667g	25.55b	74.45f
Skeena/Colt	4e	4c	5i	38b	84h	164j	248j	15.68de	84.32b
Skeena/PHLC	2e	5c	3i	27d	48i	290h	338i	18.91d	81.09d
Van/PHLC	10d	12ab	85b	21f	230g	672c	902d	17.18de	82.82c
FirmRed/CAB6P	4e	12ab	52f	48a	36j	792b	828f	13.79e	86.21a
GiantRed/CAB6P	11d	7c	76c	21f	286e	371e	657h	15.65de	84.35b
EarlyRed/CAB11E	8de	15a	87a	35c	240f	1155a	1395a	15.86de	84.14b
Mean	*10.90*	*8.10*	*50.20*	*29.80*	*287.60*	*498.70*	*786.30*	*19.53*	*80.47*

Means followed by the same letter in the same column are not significantly different (Duncan's multiple range test, $P\leq0.05$)

Following some of the fructification traits of the 10 cultivar/rootstock combinations (Table 3), we observed that most flowers were present in the variant EarlyRed/CAB11E (859 flower/tree) that belongs mostly to the inflorescence located on the spur fruiting branch type. A very small number of flowers were found in Skeena/PHLC (10 flowers/tree) and Skeena/Colt (44 flowers/tree).

Table 3. Fruiting traits of some sweet cherry cultivars grafted on different rootstocks in the experimental field of UASVM Bucharest (2012)

Cultivar/ rootstock	No of inflorescences			Total no of flowers / tree	Total no of fruit / tree	Fruit set (%)	Fruit weight (g)	Yield	
	Spur fruiting branches	Medium Branches	Long branches					(g/tree)	(kg/ha)
Kordia/Colt	238f	190a	11h	440e	128c	29.19c	6.4a	818.8d	1364d
Kordia/PHLC	197g	98d	50d	346g	86e	24.95d	6.5a	560.3f	933f
Ferrovia/Colt	140h	119b	45e	304h	194a	63.81a	6.2a	1193.0a	1988a
Ferrovia/PHLC	357d	113c	32f	502d	75f	14.96g	6.1a	453.8g	756g
Skeena/Colt	14i	11i	19g	44i	12h	27.82c	5.3a	65.1i	108i
Skeena/PHLC	2j	2j	7i	10j	4i	42.11b	5.5a	22.0j	37j
Van/PHLC	435b	57g	117b	609b	86e	14.13h	6.7a	577.1e	961e
FirmRed/CAB6P	255e	33h	60c	348f	38g	10.94h	8.0a	305.1h	508h
GiantRed/CAB6P	419c	61f	49d	528c	115d	21.78e	8.1a	936.1c	1560c
EarlyRed/CAB11E	647a	90e	122a	859a	157b	18.32f	7.3a	1142.2b	1903b

Means followed by the same letter in the same column are not significantly different (Duncan's multiple range test, P≤0.05)

A high percentage of fruit set (63.81%), in conjunction with higher productivity than the other cultivars, was recorded by the combination Ferrovia/Colt (1193 g/tree). A similar production was also achieved by the combination EarlyRed/CAB11E (1142 g/tree) due to a larger fruit size of EarlyRed than Ferrovia.

In this regard, it was noticed that the largest and attractive fruit were obtained from combinations GiantRed/CAB6P (8.1 g) (Figure 2) and FirmRed/CAB6P (8.0 g) (Figure 3).

Figure 2. Fruit harvested from GiantRed/CAB6P

Figure 3. Big and attractive fruit of FirmRed/CAB6P

Related to the phenological stages development of the cultivars studied (Table 4), we observed that the bud burst of the trees held between 21.03.2013 and 26.03.2012. Early Red/CAB6P was the first who burst the buds and Kordia/mahaleb the last one. In the first decade of April the white buttons showed up which conducted to the blossoming start in few days. Skeena/PHLC had the latest blossom (11.04), the other cultivars started blossom on April 6th or 8th. Fruit set was noted at the end of April. Most cultivars reached maturity in late May - early June, with very small differences between them. The only exception was noticed in the Skeena/PHLC combination in which fruit maturation was achieved on June, 8th.

Table 4. Development of the main phenophases of some sweet cherry cultivars grafted on different rootstocks during 2012 in UASVM Bucharest experimental field

Cultivar/rootstock	Bud burst	Early white bud	First blossom	Petal fall	Fruit set	Fruit ripening date
Kordia/ Colt	24.03	5.04	8.04	15.04	21.04	28.05
Kordia/PHLC	24.03	4.04	6.04	12.04	20.04	1.06
Ferrovia/ Colt	22.03	6.04	8.04	16.04	20.04	29.05
Ferrovia/PHLC	22.03	5.04	8.04	15.04	20.04	28.05
Skeena/Colt	22.03	6.04	8.04	15.04	20.04	29.05
Skeena/PHLC	23.03	8.04	11.04	17.04	23.04	8.06
Van/PHLC	25.03	4.04	6.04	13.04	20.04	4.06
FirmRed/CAB6P	22.03	4.04	6.04	12.04	19.04	28.05
GiantRed/ CAB6P	22.03	4.04	6.04	13.04	20.04	27.05
EarlyRed/CAB11E	21.03	4.04	6.04	13.04	20.04	27.05
Kordia/mahaleb	26.03	6.04	8.04	15.04	21.04	1.06
Van/mahaleb	25.03	6.04	8.04	15.04	21.04	1.06

CONCLUSIONS

Most vigorous combinations were EarlyRed/CAB11E and FirmRed/CAB6P.

PHLC rootstock reduced the vigour of trees by 20%, comparative to the same cultivars grafted on Colt.

For all cultivars, the share of spur branches per tree was greater than the long/medium type.

Ferrovia/Colt and EarlyRed/CAB11E recorded the highest number of fruit/tree.

The most attractive and largest fruit belonged to the cultivars GiantRed and FirmRed grafted on CAB6P.

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