

# GROWTH, PRODUCTIVITY AND FRUIT QUALITY OF 'KORDIA' SWEET CHERRY TREES ON EIGHT CLONAL ROOTSTOCKS

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## A B S T R A C T

In the field experiment, 11-year-old 'Kordia' sweet cherry trees grafted on 'GiSeLA 5', 'P-HL A', 'P-HL B', 'P-HL C', 'Maxma Delbard 14 Brokforest', 'Wei-root 158' and 'Tabel Edabriz' semi-dwarfing and dwarfing rootstocks were compared with trees of the same cultivar on the standard rootstock 'F 12/1'.

The results revealed that all semi-dwarfing and dwarfing rootstocks tested (with the exception of 'Maxma 14'), in comparison to the standard rootstock 'F 12/1', significantly reduced the growth of 'Kordia' sweet cherry trees. The most dwarfing rootstock was 'Tabel Edabriz', followed closely by 'GiSeLA 5', 'P-HL A' and 'P-HL C'. The highest cumulative yields were harvested from trees grafted on 'GiSeLA 5', 'Maxma 14' and 'P-HL B'. Rootstocks with the highest yield efficiencies were 'GiSeLA 5' and 'Tabel Edabriz'. The lowest yield efficiency in this study was recorded for trees on 'F 12/1'. Trees grafted on 'Tabel Edabriz' produced smaller fruits than those grafted on other rootstocks tested. In this trial, the concentration of soluble solids in fruits of 'Kordia' sweet cherry trees grafted on 'F 12/1' and 'Maxma 14' vigorous rootstocks, was significantly lower than in fruits harvested from trees grafted on dwarfing or semi dwarfing rootstocks.

**Key words:** sweet cherry, rootstock, growth, yield, tree productivity, fruit quality

## INTRODUCTION

Dwarf rootstocks are an important orchard component for developing sweet cherry orchards at higher

planting densities, and for reduction of management costs. For this purpose, various breeding programs around the world have released a number of new rootstocks that are

worthy of testing. Among rootstock series, for example P-HL selected in the Czech Republic, Weiroot and GiSelA bred in Germany, M x M (Maxma) crossed in USA, there are types that retard tree growth and increase their productivity in comparison to vigorous standard rootstocks such as Mazzard seedlings or 'F 12/1' (Azarenko and McCluskey, 1998; Franken-Bembenek, 1998, 2005; Hilsendegen, 2005; Kloutvor, 1991; Stehr, 2005).

Investigation of the dwarf rootstocks in different soil and climatic conditions began in Poland in 1988. Results of those experiments with 'P-HL A' and 'P-HL C' rootstocks have already been published by Grzyb et al. (1996, 1998, 2005), Sitarek and Grzyb (1998, 2002a, 2002b, 2003), and Sitarek et al. (1999). In the next few years new trials were planted to test some of the successive rootstocks. This report provides the results from the trial with 'Kordia' sweet cherry used as the scion for eight clonal rootstocks.

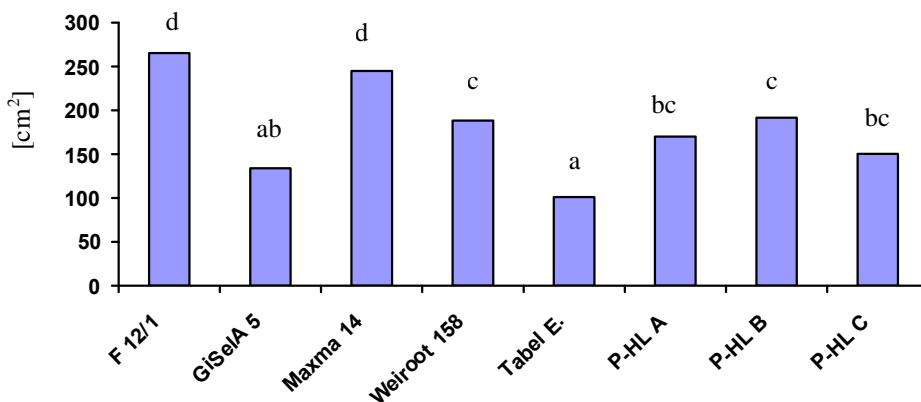
## MATERIAL AND METHODS

In the field experiment, 'Kordia' sweet cherry trees grafted on semi-dwarfing and dwarfing rootstocks 'GiSelA 5' (*P. cerasus* 'Schattenmorelle' x *P. canescens*), 'P-HL A', 'P-HL B', 'P-HL C' (all three *P. avium* L. x *P. cerasus* L.), 'Maxma Delbard 14 Brokforest' (*P. avium* L. x *P. mahaleb* L.), 'Weiroot 158' and 'Tabel Edabriz' (both *P. cerasus* L.) were compared with trees of the same cultivar on the vigorous rootstock 'F 12/1' (*P. avium* L.).

One-year-old trees were planted in the spring of 2000, at the Experimental Station in Dabrowice, near Skierniewice, in the central part of Poland. The trees were planted in a grey-brown podzolic soil at a distance of 5 x 3 m. An arrangement of four random blocks with three trees per plot was used. Thus, the total number of 12 'Kordia' sweet cherry trees on each rootstock was investigated. From 2000 to 2001, weeding was done by mechanical cultivation. During the following years, soil management included frequent grass mowing in the alleyways and maintenance of 1-m-wide herbicide strips along the tree rows. Trees were trained to a Vogel Central Leader system with irrigation, and application of herbicides as well as other pesticides imposed according to recommendations for sweet cherry commercial orchards in Poland. To prevent damage by birds, Bird Gard Super Pro by Weitech was used. The data collected included tree vigour (expressed as trunk cross-sectional area), yield, and fruit weight as well as content of soluble solids in fruit. The results were processed using statistical analysis of variance. To evaluate the significance of the differences between means, the Duncan's Multiple Range test was employed at  $p \leq 0.05$ .

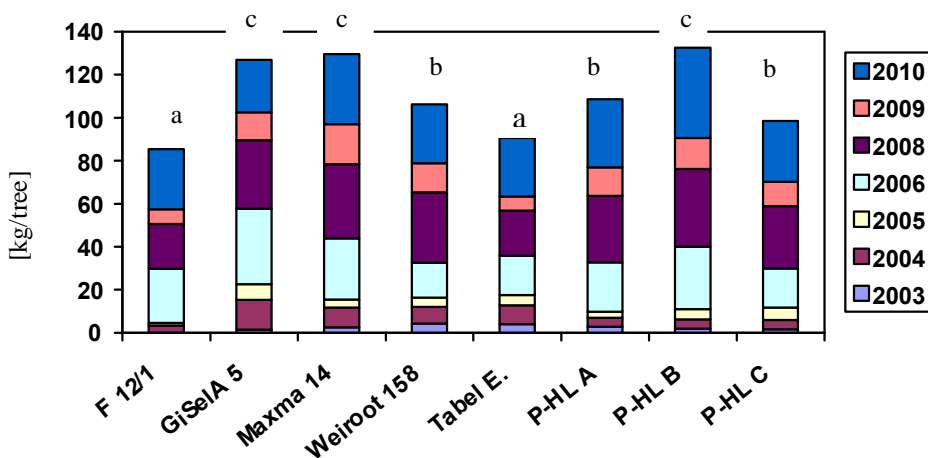
## RESULTS

The results revealed that all rootstocks tested, with the exception of 'Maxma 14', in comparison to 'F 12/1', significantly reduced the growth of 'Kordia' sweet cherry trees



Bars with the same letter are not significantly different at  $p \leq 0.05$

**Figure 1.** Effect of rootstock on trunk cross-sectional area of 11-year-old 'Kordia' sweet cherry trees



Explanation: see Figure 1

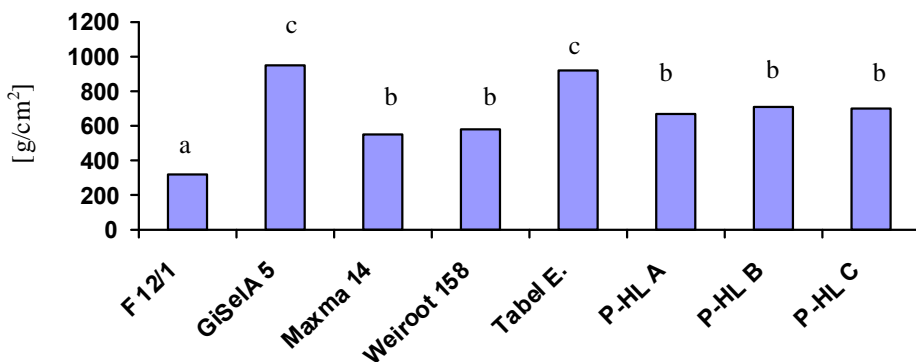
**Figure 2.** Effect of rootstock on cumulative yield (2003-2010) of 'Kordia' sweet cherry trees

In 2005, yielding of all trees was very low and in 2007 no fruits on trees were found due to spring frost.

(Fig. 1). The most dwarfing rootstock was 'Tabel Edabriz', followed closely by 'GiSeIA 5', 'P-HL A' and 'P-HL C'.

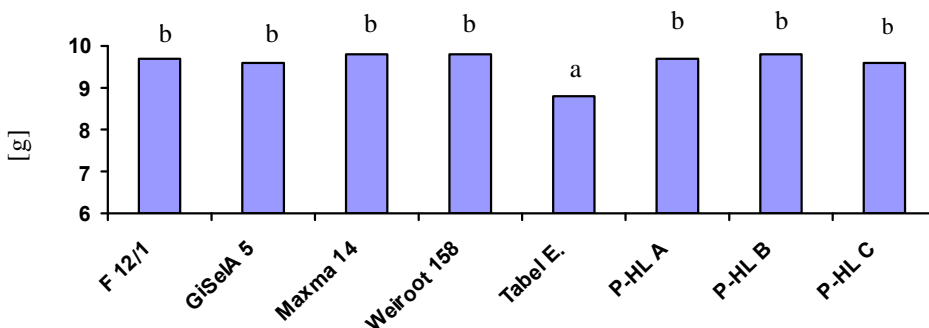
Depending on the rootstock, the mean cumulative yield per tree collected during the 11 years of the experiment ranged between 83.9 kg and 132.4 kg (Fig. 2). The highest cumulative yields were harvested from trees grafted on ‘P-HL B’, ‘Maxma 14’ and ‘GiSeLA 5’ while the lowest from those on ‘Tabel Edabriz’ and ‘F12/1’. However, it is important to note that in 2005, fruiting of all trees was very low and in 2007 no fruits on trees were found due to spring frost. Therefore, in general, the total yield of sweet cherry trees was lower than expected. Rootstocks with the highest cumulative yield efficiencies were ‘GiSeLA 5’, followed by ‘Tabel Edabriz’ (Fig. 3). The lowest yield efficiency in this study was recorded for trees on ‘F 12/1’.

Trees grafted on ‘Tabel Edabriz’ produced significantly smaller fruits than those grafted on ‘F 12/1’ (Fig. 4). The rest of the rootstocks tested in terms of an effect on fruit weight had a similar value to ‘F 12/1’. The rootstocks influenced the content of soluble solids in fruit too. In this trial, content of soluble solids in fruits of ‘Kordia’ sweet cherry trees grafted on ‘F 12/1’ and ‘Maxma 14’ vigorous rootstocks, was significantly lower than in fruits harvested from trees grafted on dwarfing or semi dwarfing rootstocks. On the whole, the rootstocks which promoted a higher concentration of soluble solids in fruit than the ‘F 12/1’ rootstock were ‘Tabel Edabriz’ and ‘Weiroot 158’ (Fig. 5).



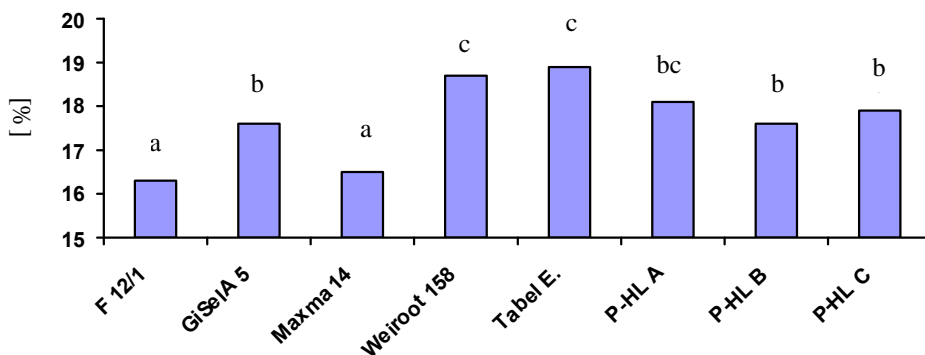
Explanation: see Figure 1

**Figure 3.** Effect of rootstock on cumulative yield efficiency of ‘Kordia’ sweet cherry trees (2003-2010)



Explanation: see Figure 1

**Figure 4.** Effect of rootstock on mean fruit weight of 'Kordia' sweet cherry trees (2004-2010)



Explanation: see Figure 1

**Figure 5.** Effect of rootstock on mean content of soluble solids in fruit of 'Kordia' sweet cherry (2004-2010)

## DISCUSSION

In this trial, all rootstocks tested, with exception of 'Maxma 14', significantly reduced the growth of sweet cherry trees in comparison to the standard 'F 12/1'. Thus, these results are in accordance with the data obtained earlier by Franken-Bembek (1998, 2005), Grzyb et al. (1998), Kloutvor (1991), Sitarek et al. (1999, 2005), Stehr (2005),

Walther (1998), and other authors. Previously published data indicate that, of the rootstocks examined, the 'Maxma 14' is dwarf (Grzyb et al., 2005) or semi-dwarf (Simon et al., 2004). However, in this experiment the trees of cv. 'Kordia' were of similar size on the 'Maxma 14' and 'F 12/1'. The most reduction in tree size was achieved on trees grafted on 'Tabel Edabriz'. This rootstock is considered as one of the most dwarf-

ing rootstocks for sweet cherry (De Salvador et al., 2005; Kappel et al., 2005; Stehr, 2005).

Cumulative yield and cumulative yield efficiency were very high on rootstock 'GiSela 5'. These high results were not surprising because there are many reports stating that sweet cherry trees grafted on 'GiSela 5' are extremely productive (Franken-Bembenek, 1998, 2005; Sitarek et al., 2005; Stehr, 2005). Usually, those rootstocks that reduce tree growth also have smaller fruits (De Salvador et al., 2005; Grzyb et al., 1998; Sansavini and Lugli, 1998; Walsh, 1998). In this trial, trees grafted on 'Tabel Edabriz' had the lowest trunk cross-sectional area and produced smaller fruits than those grafted on other rootstocks tested. However, it is difficult to comment about the influence of rootstock on fruit size, generally due to low yielding of sweet cherry trees in four of the eight years of the evaluation.

Among rootstocks tested, 'Tabel Edabriz' was most effective in the cumulating of soluble solids in fruit. However, harvest date is based on the typical fruit colour for a variety, and rootstock can influence the maturity time of fruits. In this study, the 'Kordia' fruits from trees grafted on 'Tabel Edabriz' were likely picked too late.

## CONCLUSIONS

1. Controlling sweet cherry tree vigour with 'GiSela 5', 'P-HL A', 'P-HL B', 'P-HL C', 'Weiroot 158' and 'Tabel Edabriz'

rootstocks, in comparison with 'F 12/1', is very effective. The most dwarf among rootstocks tested was 'Tabel Edabriz'. 'Maxma 14' proved to be vigorous rootstock in this trial.

2. 'GiSela 5' is a very precocious and productive rootstock. Rootstocks 'Weiroot 158', 'P-HL A' and 'P-HL B' are also valuable.
3. Fruit size is affected by rootstock. In this trial, 'Tabel Edabriz' produced the smallest fruits and therefore its use in a commercial orchard can be limited.
4. Content of soluble solids in fruit can be modified by rootstock. However, it is very difficult to pick fruit at the same maturity state, from trees grafted on different rootstocks.

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## WZROST, PRODUKTYWNOŚĆ I JAKOŚĆ OWOCÓW DRZEW CZEREŚNI 'KORDIA' SZCZEPIONYCH NA OŚMIU PODKŁADKACH WEGETATYWNYCH

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### S T R E S Z C Z E N I E

W latach 2000-2010 w sadzie Doświadczalnym w Dąbrowicach oceniano wzrost, owocowanie i jakość owoców czereśni odmiany 'Kordia' szczepionych na ośmiu podkładkach wegetatywnych: 'GiSelA 5', 'P-HL A', 'P-HL B', 'P-HL C', 'Maxma Delbard 14 Brokforest', 'Weiroot 158', 'Tabel Edabriz' i 'F 12/1'. Wszystkie badane podkładki, z wyjątkiem 'Maxma 14', istotnie ograniczały wzrost drzew czereśni w porównaniu ze standardową podkładką 'F12/1'. Najsłabiej rosnącą okazała się podkładka 'Tabel Edabriz', a tuż za nią podkładki 'GiSelA 5', 'P-HL A' i 'P-HL C'. Najwyższe plony sumaryczne uzyskano z drzew szczepionych na: 'GiSelA 5', 'Maxma 14' i 'P-HL B', najniższe zaś miały drzewa na 'F12/1' i 'Tabel Edabriz'. Najwyższe wartości wskaźnika plenności stwierdzono dla drzew rosnących na podkładkach 'GiSelA 5' i 'Tabel Edabriz', najniższą wartość na 'F12/1'. Podkładka 'Tabel Edabriz' powodowała drobnienie owoców. Owoce drzew szczepionych na podkładkach 'F12/1' i 'Maxma 14' miały niższy poziom ekstraktu niż owoce zebrane z drzew rosnących w pozostałych kombinacjach.

**Słowa kluczowe:** czereśnia, podkładka, wzrost, owocowanie, jakość owoców