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EFFECT OF CROWN RESTRICTION ON THE GROWTH AND PRODUCTIVITY OF SWEET CHERRIES

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The canopy of sweet cherry trees grown under cover has to be adapted to this growing system by canopy lowering, narrowing and renewing. Tree growth and productivity parameters were compared three years before and three years after canopy restriction (2006–2011) for cultivars 'Iputj' and 'Krupnoplodnaya' on rootstocks Gisela 4 and 5, Weiroot 154 and F 12/1 during the full production period. The largest trees with wider canopy both before and after canopy restriction were observed on rootstock F 12/1. Limiting pruning of trees on Weiroot 154 did not cause stronger shoot growth. On Weiroot 154 the canopy was slightly bigger than for trees on Gisela 4 and 5. Canopy volume was bigger for 'Iputj' before adaptation to the cover system than for 'Krupnoplodnaya'. After canopy reduction the fruiting wood renewed slowly, and therefore, yield per tree even in the third year after pruning was almost three times less than before pruning. As cultivar 'Krupnoplodnaya' renewed fruiting wood faster, it was 5–37% more productive than 'Iputj'. Productivity renewed more rapidly for trees on dwarfing rootstocks, especially on Gisela 5. The fruits of cultivar 'Krupnoplodnaya' were bigger both before and after pruning compared with 'Iputj'. Of the tested rootstocks, F 12/1 was found to be not suitable for plantations under cover.

Key words: *canopy, trunk, fruit weight, rootstocks, rain cover.*

INTRODUCTION

In growing cherry cultivars with large and firm fruits, cover systems are necessary to reduce fruit cracking and rotting. For this reason, "high tunnels" systems have been used, and not only in countries with high precipitation (Balmer, 1998; Meland and Skjervheim, 1998; Simon, 2006; Blanke and Balmer, 2008; Lang *et al.*, 2011). Trials with application of cover materials first began in Switzerland where rain during harvest frequently caused fruit splitting and crop loss (Simon, 2006). Covering of trees reduced the number of cracked and rotten fruits significantly, increased the marketable yield, and gave an efficient protection against frost during flowering (Balmer, 1998; Børve and Meland, 1998). Since the lifetime of a sweet cherry orchard may be 25–40 years long, establishment of a cover system should be considered also in the existing orchards.

In Hungary, researchers have carried out investigations to prevent fruit cracking by a less expensive method — spraying calcium formulas. Yet, application time (during rain etc.) and residues of Ca on fruit is a problem. In countries with very rainy climate, the application of rain protecting covers is the best solution to achieve high value marketable fresh cherries (Simon, 2006).

The largest part of sweet cherry orchards in Latvia have been established using *Prunus mahaleb* seedlings (Skrivele *et al.*, 2008). In such orchards it is necessary to reduce canopy height. This can initiate more or less strong growth of young shoots. Management (pruning to reduce) of the canopy can much influence tree growth and yield in the next years, which has effect on the economic efficiency of use of a cover system.

For high density planting systems with plant protection, dwarf rootstocks such as Gisela 5 are used for sweet cherries (Balmer, 1998; Blanke and Balmer, 2008; Meland and Skjervheim, 1998; Lang *et al.*, 2011). The local climate has limited the use of rootstocks with dwarfing effect, due to problems of rootstock and flower bud winter hardiness. However, investigations to obtain good rootstocks for conditions of Latvia have begun already (Ruisa and Rubauskis, 2004).

Different canopy training systems have been utilised, such as Spindle (Slender, tall, V-shaped, free spindle), Zahn, Vogel, vertical axis, vase-shaped, Y-trellis, upright fruiting offshoots (UFO) as ("fruiting wall") etc. (Hrotkó *et al.*, 1997; Balmer, 1998; Børve and Meland, 1998; Meland, 1998; Robinson *et al.*, 2004; 2011; Lang *et al.*, 2011). However, there is limited information on the reaction of trees to stress when the canopy of cherries is restricted and adapted to the cover system, especially during the full production period.

The aim of this investigation was to determine the reaction during the full yield period of sweet cherries adapted to a cover system, by comparing the trees three years before and three years after the canopy restriction.

MATERIALS AND METHODS

The investigation was performed in the period 2006–2011: three years pre-treatment and three years post-treatment. The experiment was carried out on the basis of a trial established already in 1998 (Ruisa and Rubauskis, 2004).

The trial was established with one-year-old plant material at planting distance 2.8 × 4 m. Two cultivars ('Iputj' (known also as 'Iput') and 'Krupnoplodnaya') were grafted on four rootstocks (Gisela 4, Gisela 5, Weiroot 154 and F 12/1). The cultivars were placed alternately, rootstocks were randomized. The trees were trained to maintain the pyramid form of canopy. The scaffold branches were maintained at the base of the canopy as long as their diameter did not exceed 2/3 of the trunk.

In a part of the orchard a VOEN cover system (see www.voen.en) was installed at the end of 2008. At the same time the canopy of trees was fitted to the cover system by reducing tree height, narrowing and renewing the canopy. This was performed in the area without cover also. Thus, the orchard was divided into two parts: one covered with a VOEN system and uncovered area. The first level split plots were cultivars, second level rootstocks with one tree per plot. The trial was performed in three replications. Rootstock F 12/1 was excluded from this trial in 2011, leaving rootstocks Gisela 4, Gisela 5 and Weiroot 154.

The following paramaters were estimated:

- Trunk perimeter 20 cm above grafting union, calculating trunk cross-sectional area (TCSA);
- Yield per each tree;
- Fruit weight;
- Tree height and width of canopy in two directions, used for calculation of canopy volume as suggested by I. Dimza (Rubauskis *et al.*, 2011), estimated every two years.

The soil in the trial was sod-podzolic sandy loam with pH 6.4, organic matter 3.2% and plant available K_2O and P_2O_5 293 mg·kg^{-1} and 234 mg·kg^{-1}, respectively (data of 2010). For fertilisation ammonium nitrate and potassium nitrate were used — the norm was calculated as 6 g·m^{-2} N and 12 g·m^{-2} K_2O respectively, applied in 1 m wide strips. Potassium nitrate was not used since 2011. Fertilisers containing phosphorus were not used.

In the study period, the average annual air temperature registered at the meteorological station Dobele and LUFFT near the trial was 6.2–8.1 °C. In winter, a relatively low air temperature was recorded in four of six years of observation. The temperature minimum was –24 to –27 °C except in 2008 and 2009. After a comparably warm December 2006 (average 5 °C), cold weather followed in February 2007 (temperature minimum reached –20 to –25 °C), when the dormancy period of sweet cherries had ended. Unfavourable weather occurred also in February 2011, when minimum temperature reached –24 °C in the III decade. However, in December 2010 the temperature was constantly cold (average –5 to –8 °C). The positive temperature sum varied between 2709 °C and 3155 °C in 2006–2011. In the study period, annual precipitation was 479–793 mm, and precipitation during the vegetation period was 312–648 mm. In 2010, the year with the largest amount of precipitation during the period of sweet cherry ripening (III decade of June and July), the precipitation sum was 152 mm.

Plant protection and orchard management were provided following a common plan of actions, considering the principles of Integrated (sustainable) Fruit Production (IFP).

SPSS for Windows was used for statistical analysis of data by ANOVA and Pearson bivariate correlation; the Tukey test was performed to determine significant differences between groups of rootstocks.

RESULTS

The largest trunk cross-sectional area (TCSA) was found on rootstock F 12/1, both before and after canopy restriction (Table 1). This difference was statistically significant. However, between the other rootstocks significant differences were not found. However, in 2011, when the largest trees on rootstock F 12/1 were cut out, the differences between

Table 1

TRUNK CROSS-SECTIONAL AREA THREE YEARS BEFORE AND AFTER RESTRICTION OF CANOPY IN AUTUMN OF 2008, cm^2

Factor	Year					
	2006	2007	2008	2009	2010	2011*
Cover:						
uncovered	121.2	149.9	164.8	166.5	185.0	144.7^b
VOEN cover**	123.2	156.9	177.3	177.3	193.7	170.0^a
Cultivar:						
Iputj	128.4	157.0	177.0	178.6	195.7	167.9^a
Krupnoplodnaya	116.0	149.7	165.1	165.7	183.4	146.9^b
Rootstock:						
Gisela 4	94.7^b	116.4^b	125.8^b	122.9^b	133.9^b	144.0^a
Gisela 5	93.9^b	116.1^b	127.7^b	124.7^b	142.6^b	151.7^{ab}
Weiroot 154	119.8^b	135.7^b	152.2^b	150.4^b	163.0^b	176.7^a
F 12/1	190.3^a	245.2^a	278.5^a	288.3^a	316.0^a	-
P-value						
cover	0.79	0.35	0.15	0.29	0.44	0.04
cultivars	0.10	0.34	0.17	0.18	0.25	0.01
rootstocks	0.00	0.00	0.00	0.00	0.00	0.01
interaction	0.08	0.15	0.10	0.19	0.18	0.02

* excluded trees on rootstock F 12/1; ** VOEN system installed only at the end of 2008; a and b, if different letters, then significantly different groups at the level of 95% significance

rootstocks Gisela 4, Gisela 5 and Weiroot 154 were significant. In 2011, the smallest trees of the cultivars were on rootstock Gisela 4, and the largest on Weiroot 154 (Table 1). TCSA was slightly and significantly larger for cultivar 'Iputj' after excluding trees on rootstock F 12/1.

In 2011, TCSA of trees under cover on the remaining rootstocks was larger. Significant interaction of factors was also found. In the area without cover 'Krupnoplodnaya' on Weiroot 154 had smaller TCSA than on both Gisela rootstocks, but the opposite occurred under cover. For cultivar 'Iputj' in both areas the TCSA was larger on Weiroot 154 than on both Gisela rootstocks.

Before canopy restriction the canopy volume was significantly larger for trees in the area where trees were not later covered. After installing the cover and tree restriction, no statistically significant differences were found between the areas in canopy volume (Table 2).

Cv. 'Iputj' had a significantly larger canopy volume than cv. 'Krupnoplodnaya' before tree growth restriction (Table 2). This difference remained also after canopy restriction. However, it was not significant when the vigorous rootstock F 12/1 was excluded in 2011.

The canopy volume significantly differed between rootstocks before tree restriction (Table 2). In 2007, both cultivars had significantly larger canopy on rootstock Weiroot 154 and F 12/1 than on the two Gisela rootstocks. Effect of rootstock on canopy volume was found also after restriction of canopy. Training of the canopy with restriction of volume of trees did not cause increased growth of shoots on rootstock Weiroot 154, and thus the canopy volume decreased (Table 2). On rootstock Weiroot 154, canopy volume was 22–32% larger in 2009 and 7–20% larger in 2011 than on rootstocks of Gisela type. For that reason the difference between rootstocks was not statistically significant after excluding the rootstock F 12/1 in 2011. Some interactions were found between the trial factors. Cv. 'Iputj' without cover had a relatively larger canopy on rootstock Weiroot 154 than under cover, but cv. 'Krupnoplodnaya' on Gisela 4 had a smaller canopy under cover in the open area. In 2011, when comparing trees only on three rootstocks, without cover cv. 'Krupnoplodnaya' on Weiroot 154 had smaller canopy than on both Gisela rootstocks, but under cover — larger. For cv. 'Iputj' in both areas the canopy was larger on Weiroot 154 than on both Gisela rootstocks.

Fruiting branches with spurs renewed slowly after canopy reduction, and therefore, the yield per tree was almost twice smaller than before restriction of canopy, even in the third year after restriction (Table 3). The flower buds and trees of cultivar 'Krupnoplodnaya' are more sensitive to lower temperatures during dormancy than 'Iputj'. They were damaged in the beginning of 2007, when air temperature fell extremely low in February. As a result, yield was reduced (Table 3). Nonetheless slightly larger yields on average were obtained from 'Krupnoplodnaya' trees before canopy restriction than after. The vigour of cultivar 'Krupnoplodnaya' was lower than cv. 'Iputj'. The fruiting area of cv. 'Krupnoplodnaya' trees was less destroyed by restriction pruning. In this case, the annual yield of trees increased faster on small vigourous rootstocks, and especially on root-

Table 2

VOLUME OF TREE CANOPY BEFORE AND AFTER RESTRICTION OF CANOPY IN AUTUMN OF 2008, m^3

Factor	Year		
	2007	2009	2011*
Cover:			
uncovered	10.9^a	8.4	6.4
VOEN cover**	9.4^b	7.7	7.6
Cultivar:			
Iputj	11.3^a	8.8^a	7.3
Krupnoplodnaya	9.0^b	7.3^b	6.8
Rootstock:			
Gisela 4	8.7^b	5.7^c	6.2
Gisela 5	9.0^b	6.5^{bc}	7.2
Weiroot 154	11.7^a	8.3^b	7.7
F 12/1	11.2^{ab}	11.7^a	-
P-value			
cover	0.04	0.21	0.18
cultivars	0.00	0.02	0.38
rootstocks	0.01	0.00	0.21
interaction	0.03	0.01	0.04

* excluded trees on rootstock F 12/1; ** VOEN system installed only at the end of 2008; a and b, if different letters, then different groups at the level of 95% significance.

Table 3

YIELD THREE YEARS BEFORE AND AFTER RESTRICTION OF CANOPY IN AUTUMN OF 2008, kg per tree

Factor	Year					
	2006	2007	2008	2009	2010	2011
Cover:						
uncovered	16.6	0.5^b	13.0	4.0	1.7	5.1
VOEN cover*	18.1	0.8^a	14.2	4.8	2.4	3.5
Cultivar:						
Iputj	19.0	1.2^a	9.1^b	4.1	2.0	3.5
Krupnoplodnaya	15.7	0.1^b	18.2^a	4.7	2.1	5.1
Rootstock:						
Gisela 4	14.1	0.1^c	8.9^b	3.9^{ab}	1.9^{ab}	5.1^{ab}
Gisela 5	17.5	0.4^{bc}	14.8^a	6.1^a	3.1^a	6.7^a
Weiroot 154	18.0	0.7^b	14.7^{ab}	4.4^{ab}	2.0^{ab}	3.2^{ab}
F 12/1	19.8	1.4^a	16.0^a	3.3^b	1.3^b	2.2^b
P-value						
cover	0.37	0.00	0.46	0.22	0.14	0.18
cultivars	0.06	0.00	0.00	0.36	0.92	0.12
rootstocks	0.13	0.00	0.01	0.05	0.05	0.01
interaction	0.18	0.08	0.07	0.22	0.32	0.16

* VOEN system installed only at the end of 2008; a and b, if different letters, then different groups at the level of 95% significance

stock Gisela 5. Therefore, the cultivar 'Krupnoplodnaya' was more productive than 'Iputj' after canopy restriction.

In 2006, no significant difference in yield was observed due to trial factors. However, the yield was higher of trees with larger vigour. In 2007, the yield was small, but significantly higher on F 12/1 than on other rootstocks due to the larger canopy and fruiting area located higher, where flower buds were less damaged in winter. Significantly larger yields were obtained on rootstocks Gisela 5 and F 12/1 than on the two other rootstocks before canopy restriction in 2008. The yield obtained on Gisela 5 was significantly larger than on F 12/1 after canopy restriction (Table 3).

There was no significant difference in yield between orchard areas with or without cover year to year. Slight differences in yield were observed after canopy restriction.

The cultivars differed significantly in fruit weight both before and after the canopy restriction, as expected. The cultivar 'Krupnoplodnaya' had larger fruits, compared to 'Iputj' (Table 4). The fruit weight for cv. 'Iputj' was in the range 4.8–6.5 g, and for cv. 'Krupnoplodnaya' — 7.7–9.5 g in the period of 2006–2011.

Before cover system installation no significant differences were observed for fruit weight between the areas (Table 4). Under the cover system the average fruit weight was larger, due to higher yield of cultivar 'Krupnoplodnaya'. Fruit weight was significantly larger under cover in 2011 than without cover.

Effect of rootstock on fruit weight of two cultivars differed from year to year. In general, fruits were larger on vigorous

Table 4

FRUIT WEIGHT THREE YEARS BEFORE AND AFTER RESTRICTION OF CANOPY IN AUTUMN OF 2008, g

Factor	Year					
	2006	2007	2008	2009	2010	2011
Cover:						
uncovered	6.6	7.4	6.6	7.3	6.9	7.8^b
VOEN cover*	6.6	7.3	6.7	7.6	6.9	8.5^a
Cultivar:						
Iputj	5.6^b	5.7^b	4.8^b	5.6^b	5.8^b	6.5^b
Krupnoplodnaya	7.7^a	9.0^a	8.4^a	9.2^a	8.0^a	9.5^a
Rootstock:						
Gisela 4	6.4^{ab}	7.5	6.3^b	7.4^{ab}	6.9	7.9
Gisela 5	6.1^b	7.3	6.3^b	7.3^{ab}	7.1	7.7
Weiroot 154	7.0^a	7.4	6.5^{ab}	6.9^b	6.9	8.4
F 12/1	7.0^a	7.2	7.5^a	8.1^a	6.8	8.3
P-value						
cover	0.78	0.39	0.38	0.07	0.97	0.01
cultivars	0.00	0.00	0.00	0.00	0.00	0.00
rootstocks	0.01	0.48	0.01	0.00	0.26	0.36
interaction	0.74	0.09	0.33	0.40	0.13	0.77

* VOEN system installed only at the end of 2008; a and b, if different letters, then different groups at the level of 95% significance

rootstocks. In 2006, fruit weight was significantly lower on Gisela 5 than on Weiroot 154 and F 12/1 (Table 4). In 2007 and in the last two years after canopy restriction (2010 and 2011), the rootstocks did not significantly differ in fruit weight. In 2008, fruits had significantly lower weight on the two Gisela rootstocks than on F 12/1. However, in 2009 fruits had significantly lower weight on Weiroot 154 than on F 12/1.

DISCUSSION

The aim of the investigation was to determine the effect of reduction and restriction of canopy, by cutting back of scaffolds, on tree growth and yield in the following years. Growth and yield parameters were compared during three years before and three years after restriction of the canopy.

Since young shoots of the tested cultivars grew intensively on rootstock F 12/1, there was no reduction of tree canopy volume. The coefficient of figurality was taken into account when canopy volume was calculated using the formula suggested by I. Dimza (Rubauskis *et al*., 2011). This formula also reflects the filling level of the canopy by young shoots. Both cultivars on F 12/1 had a significantly larger canopy volume before and after canopy restriction. A decision was made to cut the trees on F 12/1, as they were not suitable for growing under the utilised cover system.

Some studies have shown that sweet cherries when grown under cover are more vigorous than those without cover (Blanke and Balmer, 2008). Under Haygrove cover, trees were also observed to be taller (Lang *et al*., 2011). At the beginning of the study we observed only a tendency that volume of canopy on average for the three rootstocks (except F 12/1) was larger under cover in 2011. Also TCSA was larger under cover. The difference many be due to microclimatic differences, but also difference have been observed between cover type. Blanke and Balmer (2008) used a completely closed cover system; another possibility is use of a closed top by multi-bay connected tunnels (Lang *et al*., 2011). We tested a VOEN type cover system, where the air flow was not limited, especially from the sides.

Trees of 'Krupnoplodnaya' after canopy restriction were more productive than 'Iputj' and had larger fruits (Table 4) However, significant correlation was not found between yield and fruit weight. This can be explained by faster renewal of fruiting branches or cutting of a lower amount of branches than for 'Iputj'. Cultivars with higher vigour have fruiting zones located further from the tree stem, which would be more subject to cutting during canopy restriction. This negative impact of canopy restriction can be observed for cultivars that tend to tendency to move the fruiting zone faster onto younger parts of branches. On the other hand, sweet cherries have long-living spurs, and fruiting branches are not necessary to renew as frequently as for apple trees (Robinson *et al*., 2004; 2011). More frequent renewal of branches is practised for other canopy types, such as vertical axis, UFO etc.

However, more aggressive renewal of trees on Gisela rootstocks is needed in order to recover growth. The most vigorous rootstock (F 12/1) had larger yield per tree before restriction of the canopy (Table 3). After limiting the canopy the growth of shoots on this rootstock was too strong and they did not develop fruiting branches with spurs. Probably, for this case, another type of canopy training (Meland, 1998; Lang *et al*., 2011) needs to be adapted for suitable cultivars and rootstocks in Latvia. This means that another type of planting system, frequent renewal of fruiting branches, and a trellis (support) system needed. There is a need to consider a Competitive Orchard System (COS), which involves increased labour costs (Seavert and Whiting, 2011), fruit quantity and quality.

Induced growth by restriction of the canopy affected fruit quality. However, fruits were larger on rootstock F 12/1 before and after the canopy restriction. On rootstock F 12/1, before canopy restriction fruit weight was 7.0–7.5 g, but after canopy restriction fruit weight was 6.8–8.3 g. The difference in fruit weight was relatively low. Before cover system installation fruit weight was 6.9 g (6.6–7.4 g) on average for all rootstocks and cultivars combinations. After canopy restriction the average fruit weight without cover was 6.9–7.8 g, comparaed to 6.9–8.5 g under VOEN (Table 4). It is difficult to explain this effect. There was no significant correlation between fruit weight and yield, yield efficiency, and TCSA. The interaction of factors was not significant also. However, in the period after canopy restriction, the first observations indicated a slight tendency that the average fruit weight was larger when yields of cultivar 'Krupnoplodnaya' were larger. This cultivar has bigger fruits than 'Iputj'. In some conditions a cover system may have a negative impact on fruit weight. Under full cover the fruits can be slightly smaller, softer, but attractively coloured with a better taste (Blanke and Balmer, 2008). However, we expected that under cover fruits would be larger.

The trial indicated that rootstock F 12/1 was not suitable for growing under cover in plantation. Restriction of the canopy for growing under cover induced stronger growth of shoots and reduced production of sweet cherries on the vigorous rootstock F 12/1. Possibly, the same might occur for the vigorous rootstock *P. mahaleb* also, and thus might not be suitable as well. The smallest trees were observed on rootstock Gisela 4, but this rootstock will be not introduced into Latvia's orchards because of its virus sensitivity (Howell and Lang, 2001). Rootstock Weiroot 154 had unstable growth indices in our trial. In most areas of sweet cherry production, the dwarf rootstock Gisela 5, which is virus tolerant (Howell and Lang, 2001), has been introduced in dense orchard systems. Our results suggest that sweet cherries on Gisela 5 could be perspective in Latvia also, even when introducing a VOEN cover in an older orchard. At present, Gisela 5 is not widespread in Latvia (Skrīvele *et. al*., 2008). For that reason, it would be most promising to install a cover system like VOEN in new orchards, probably with another type of tree canopy. However, when installing VOEN systems, growers will need to make large investments and will need a long period to recover them.

The main conclusion is that of the tested rootstocks F 12/1 was found as not suitable for plantations under VOEN cover.

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VAINAGU IEROBEŽOŠANAS IETEKME UZ SALDO ĶIRŠU AUGŠANU UN RAŽĪBU

Ierīkojot segumu sistēmu esošā dārzā, saldo ķiršu vainagu nepieciešams pazemināt, sašaurināt un atjaunot. Lai izvērtētu šo darbību ietekmi, ražojošā dārzā augšanu un ražošanu raksturojošie rādītāji tika analizēti trīs gadus pirms un trīs gadus pēc seguma sistēmas ierīkošanas laika periodā no 2006. gada līdz 2011. gadam. Tika salīdzinātas šķirnes 'Iputj' un 'Krupnoplodnaja' uz potcelmiem Gisela 4 un Gisela 5, Weiroot 154 un F 12/1. Konstatēts, ka lielākie koki ar plašāko vainagu gan pirms, gan pēc vainagu ierobežošanas bija saldajiem ķiršiem uz potcelma F 12/1. Vainaga ierobežošana ķiršiem uz potcelma Weiroot 154 neizraisīja pastiprinātu vasu augšanu. Uz potcelma Weiroot 154 koku vainags bija tikai nedaudz lielāks nekā ķiršiem uz potcelmiem Gisela 4 un Gisela 5. Pirms vainaga ierobežošanas šķirnei 'Iputj' tas bija lielāks nekā 'Krupnoplodnaja'. Pēc vainagu samazināšanas klājzari ar augļzariņiem šķirnei 'Iputj' atjaunojās samērā lēni, tāpēc raža no koka pat vēl trešajā gadā pēc vainagu ierobežošanas bija gandrīz trīs reizes mazāka nekā pirms vainagu ierobežošanas. Šķirne 'Krupnoplodnaja' klājzarus atjaunoja nedaudz ātrāk, līdz ar to periodā pēc vainaga ierobežošanas tā bija par 5–37% ražīgāka nekā šķirne 'Iputj' šajā periodā. Ražošanas potenciāls straujāk atjaunojās kokiem uz maza auguma potcelmiem, sevišķi uz Gisela 5, uz kura iegūta augstākā raža. Uz augļu lielumu būtiska bija vienīgi šķirņu ietekme — gan pirms, gan pēc vainagu ierobežošanas šķirnei 'Krupnoplodnaja' augļi bija lielākie. Izvērtējot iegūtos datus, par neperspektīvu potcelmu ķiršiem dārzos ar segumiem atzīstams potcelms F 12/1.