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First results of a dwarfing plum rootstocks trial

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Abstract. For many years, *Prunus cerasifera Ehrh.* seedlings of high vigour have been the most widespread seedling rootstock in Estonia. Plum growers are interested in less vigorous plum rootstocks which are productive with good fruit quality, easily harvested, early fruiting and less expensive to manage. In a new experiment (a collaborative project together with Latvian, Lithuanian and Byelorussian scientists), two plum cultivars, Queen Victoria and Kubanskaya Kometa, grafted onto 16 different rootstocks: *Prunus* Ackermann, *Prunus* Brompton, *Prunus* Brompton S, *Prunus* G 5–22, *Prunus marianna* GF 8–1, *Prunus* St. Julien A, *Prunus* St. Julien GF 655/2, *Prunus* St. Julien INRA 2, *Prunus* St. Julien Noir, *Prunus* St. Julien d'Orleans, *Prunus* St. Julien Wädenswill, *Prunus* Pixy, *Prunus domestica* Wangenheims, *Prunus cerasifera* 'Hamyra', *P. cerasifera* (local) and *P. cerasifera myrobalana*, were planted in an orchard in spring 2001. The objectives of these trials were to give an assessment of newly introduced plum rootstocks and to find out their compatibility with the studied plum cultivars. According to the results obtained in the first growing season, 45 (11.7%) of the 384 trees planted in 2001 died. The lowest tree dimensions both of 'Queen Victoria' and 'Kubanskaya Kometa' were noted on *Prunus* St. Julien Wädenswill. Trees of 'Kubanskaya Kometa' on different rootstocks started to bear fruit in the 2nd year after planting (except *P. cerasifera* Hamyra). 'Kubanskaya Kometa' trees grown on *Prunus* St. Julien INRA 2 and *Prunus* St. Julien Noir produced significantly better first yield than on control rootstocks. 'Kubanskaya Kometa' on *Prunus* St. Julien A and *Prunus* Pixy gave the largest fruits (41 g and 40.5 g, respectively).

Key words: plum, dwarfing rootstocks, growth, yield, fruit quality, Estonia

INTRODUCTION

In Estonia the more serious work with plum rootstocks was began at the Polli Experimental Station in 1945, when Jakob Palk set up the first experiments at Morna. At first, seedlings of *Prunus domestica* L. cultivars Liivi Kollane Munaploom, Reine Claude Verte and Wilhelmine Späth were used as rootstocks. Althought these seedlings have produced some control of plum cultivars vigour when used as rootstocks, none of them reduces growth sufficiently. Some *Prunus* species such as *Prunus domestica var. insititia*, *Prunus spinosa* L. and *Prunus besseyi* Bail. have also been tested for their potential as vigour-reducing rootstocks. On the basis of investigations by Palk (1984), it was stated that *P. spinosa* and *P. besseyi* seedlings were considered no perspective as rootstocks due to their bad graft compatibility with local cultivars and sensitiveness

towards fruit rot and leaf spots. It is worth mentioning that, according to Wertheim (1991), *P. besseyi* was found unsuitable in Netherland trials, too. It was noted also by Palk (1960) that the growth of dwarf seedlings of *P. domestica var. insititia* is too slow and their suckering too extensive for having any prospect here as plum rootstocks. In production efficiency, no cultivar on other rootstocks equalled or surpassed *P. cerasifera* Ehrh. Up to the present, *P. cerasifera* seedlings have remained the only rootstocks for plum in Estonia. However, plum growers are interested in less vigorous plum rootstocks which are productive with good fruit quality, easily harvested, early fruiting and less expensive to manage (prune, spray and harvest). Webster (1981), Wertheim (1991) and Ystaas et al. (1994) reported that, as a rule, plum trees grafted onto weak growing rootstocks are more productive than similar trees grafted onto strong growing rootstocks, for example, on *Prunus*, the seedlings of *cerasifera myrobalana* are more productive. However, Grzyb at al. (1998) showed that there can be exceptions to that rule.

In spring 2001, the new trial (a collaborative project together with Latvian, Lithuanian and Byelorussian scientists) with two plum cultivars Queen Victoria and Kubanskaya Kometa on sixteen different rootstocks was planted in an experimental orchard at the Polli Horticultural Institute. So far, no regular plum rootstocks testing has been carried out in this region (Bite et al., 1999). The objectives of these trials were to give an assessment of new introduced plum clonal rootstocks (tree size, winterhardiness, resistance to diseases, productivity, fruit quality and fruit biochemical content) and to establish out their compatibility with the studied plum cultivars, possibilities for their propagation and use, and their economic importance.

MATERIALS AND METHODS

In the new experiment, two plum cultivars, Queen Victoria and Kubanskaya Kometa, were grafted onto 16 rootstocks: *Prunus* Ackermann, *Prunus* Brompton, *Prunus* Brompton S, *Prunus* G 5–22, *Prunus marianna* GF 8–1, *Prunus* St. Julien A, *Prunus* St. Julien GF 655/2, *Prunus* St. Julien INRA 2, *Prunus* St. Julien Noir, *Prunus* St. Julien d'Orleans, *Prunus* St. Julien Wädenswill, *Prunus* Pixy, *Prunus domestica* Wangenheims, *Prunus cerasifera* 'Hamyra', *P. cerasifera* (local) and *P. cerasifera myrobalana* in four replicates. Each replication included three trees. *P. cerasifera* (local) and *P. cerasifera myrobalana* were chosen as controls. The grafted trees were planted in the orchard in spring 2001. Tree spacing was 3 x 5 m.

The following parameters were evaluated in the experimental trees in the first year: tree vigour (assessed by measuring the trunk circumference at 25 cm above the graft union), flowering intensity (assessed according to a scale: 1 = no flowers, 5 = abundant flowering) (Wertheim, 1991), fruit numbers and yield (harvested and weighed per tree in kilograms), the average weight of the fruit (obtained by counting and weighing all fruits) and fruit biochemical content (the soluble solids, titratable acids, total sugar content and Vitamin C of the fruit evaluated on a sample of 20 fruits taken at harvest) (Renaud et al., 1991). The data on the circumference of the trunk, yields, fruit weight and the biochemical content of fruits were processed by the analysis of variance.

RESULTS AND DISCUSSION

According to the results obtained in the first growing season, 45 (11.7%) of the 384 trees planted in the 2001 died. Tree survival of cultivar Queen Victoria was relatively good on almost all the studied rootstocks, and only the survival of trees on *Prunus* G 5–22 was somewhat poorer (75%) (Table 1). Trees of 'Kubanskaya Kometa' exhibited the poorest survival on rootstocks *Prunus* St. Julien A, *P. cerasifera* 'Hamyra' and *P. cerasifera* (local) (50%).

Table 2 shows the dimensions of trees and the trunk circumferences of the rootstocks with the cultivars Queen Victoria and Kubanskaya Kometa. The greatest tree dimensions both of 'Queen Victoria' and 'Kubanskaya Kometa' were noted on *P.marianna* GF 8–1 and the lowest on *Prunus* St. Julien Wädenswill. Renaud et al. (1991) showed that *P. marianna* GF 8–1 is also vigorous in French conditions. Trunk circumference was the smallest with 'Queen Victoria' grafted onto *Prunus* St. Julien Wädenswill (3.95 cm) and the largest on *P. marianna* GF 8–1 (6.50 cm). In 'Kubanskaya Kometa' the smallest trunk circumference was on *Prunus* St. Julien d'Orleans (3.74 cm) and the largest on *P. marianna* GF 8–1, followed by *Prunus* St. Julien Noir (6.41 cm and 6.37 cm, respectively).

The abundant flowering in spring 2002 was recorded in the trees of 'Kubanskaya Kometa' on *P. marianna* GF 8–1 and *Prunus* St. Julien GF 655/2 while the flowering of trees on *Prunus* St. Julian Wädenswill was poor (Table 3). The trees of 'Queen Victoria' on all rootstocks produced no yields yet in this year. Trees of 'Kubanskaya Kometa' on different rootstocks started to bear fruit in the 2nd year after planting, except the trees on *P. cerasifera* 'Hamyra'. 'Kubanskaya Kometa' gave some more fruits on *Prunus* St. Julien INRA 2, *Prunus* St. Julien Noir, *Prunus* St. Julien d'Orleans and on *P. marianna* GF 8–1 rootstocks (Table 3). In the first year of bearing, the average yields of 'Kubanskaya Kometa' per tree ranged between 0.10 kg (*Prunus* G 5–22) and 0.74 kg (*Prunus* St. Julien INRA 2) (Table 3). It was shown that 'Kubanskaya Kometa' trees grown on *Prunus* St. Julien INRA 2 and *Prunus* St. Julien Noir produced significantly better first yields than those on the control *Prunus cerasifera* and *Prunus cerasifera myrobalana* rootstocks. The ripening time of the fruits was a little earlier on *Prunus* St. Julien d'Orleans, compared with others (Table 3). 'Kubanskaya Kometa' on *Prunus* St. Julien A and *Prunus* Pixy gave the largest fruits (41 g and 40.5 g, respectively) (Table 3). This result is contradictory to the reports of Renaud et al. (1991), Hartmann (1995) and Grzyb et al. (1998) who obtained smaller fruits on Pixy compared to other rootstocks. Fruits from trees on *Prunus domestica* Wangenheims were somewhat smaller than on the remaining rootstocks (23.5 g). The highest soluble solids content was found in fruits from trees on *Prunus* G 5/22 (16.9%) and the lowest on *Prunus* St. Julien Noir (12.6%) (Table 4). The lowest acidity (1.26%) was found in the fruits of 'Kubanskaya Kometa' on *Prunus domestica* Wangenheims and the highest on *Prunus* St. Julien A. The total sum of sugars in fresh fruits ranged from 6.3%, in the fruits of 'Kubanskaya Kometa' on *Prunus* St. Julien Noir, to 9.7% on *Prunus cerasifera*. It should be pointed out that no significant differences in the Vitamin C content appeared in the trial presented.

Table 1. Cultivar/rootstock survival in the first growing season.

Cultivar	Rootstock	Number of trees	Observed survival	
			No	%
Queen Victoria	*P*. Ackermann	12	11	91.7
	P. Brompton	12	12	100.0
	P. Brompton S	12	12	100.0
	P. G 5-22	12	9	75.0
	P. marianna GF 8–1	12	12	100.0
	P. cerasifera Hamyra	12	11	91.7
	P. Pixy	12	11	91.7
	P. St. Julien A	12	11	91.7
	P. St. Julien INRA 2	12	10	83.3
	P. St. Julien GF 655/2	12	11	91.7
	P. St. Julien Noir	12	12	100.0
	P. St. Julien d'Orleans	12	11	91.7
	P. St. Julien Wadenswill	12	11	91.7
	P. Wangenheims	12	11	91.7
	P. cerasifera (local)	12	11	91.7
	P.cerasifera myrobalana	12	11	91.7
Kubanskaya Kometa	*P*. Ackermann	12	12	100.0
	P. Brompton	12	12	100.0
	P. Brompton S	12	12	100.0
	P. G 5-22	12	11	91.7
	P.marianna GF 8–1	12	12	100.0
	P.cerasifera Hamyra	12	6	50.0
	P. Pixy	12	11	91.7
	P. St. Julien A	12	6	50.0
	P. St. Julien INRA 2	12	9	75.0
	P. St. Julien GF 655/2	12	12	100.0
	P. St. Julien Noir	12	12	100.0
	P. St. Julien d'Orleans	12	11	91.7
	P. St. Julien Wädenswill	12	9	75.0
	P. Wangenheims	12	12	100.0
	P. cerasifera (local)	12	6	50.0
	P. cerasifera myrobalana	12	9	75.0

Table 2. 'Queen Victoria ' and 'Kubanskaya Kometa' on different plum rootstocks in spring 2002.

Cultivar, rootstock	Queen Victoria			Kubanskaya Kometa		
	Average dimension of trees, m		Average trunk circumference, cm	Average dimension of trees, m		Average trunk circumference, cm
	Tree height, m	Tree spread, m		Tree height, m	Tree spread, m	
P. Ackermann	1.18	0.54	4.96	1.08	0.59	5.40
P. Brompton	1.16	0.48	5.53	1.06	0.64	6.15
P. Brompton S	1.13	0.58	5.31	1.15	0.71	5.75
P. G 5-22	0.95	0.36	4.36	0.91	0.37	3.95
P. marianna GF 8–1	1.59	0.80	6.50	1.26	0.77	6.41
P. cerasifera Hamyra	1.01	0.48	5.40	0.80	0.39	4.65
P. Pixy	1.15	0.46	5.34	1.02	0.66	5.34
P. St. Julien A	1.04	0.41	4.80	0.76	0.30	4.65
P. St. Julien INRA 2	1.04	0.42	5.34	1.03	0.62	5.40
P. St. Julien GF 655/2	1.04	0.48	4.83	1.08	0.61	4.99
*P.*St.Julien Noir	1.20	0.48	4.83	1.06	0.76	6.37
P. St. Julien d'Orleans	1.07	0.46	5.65	0.97	0.49	3.74
P. St. Julien Wädenswill	0.80	0.28	3.95	0.75	0.26	4.02
*P.*Wangenheims	0.98	0.41	4.36	0.97	0.48	5.02
P. cerasifera (local)	1.21	0.55	4.90	1.02	0.65	5.40
P. cerasifera myrobalana	1.01	0.49	5.53	1.07	0.65	5.56
LSD05*			3.48			3.44

Explanation: *LSD05 – the least significant difference between means at $P = 0.05$.

Table 3. Flowering intensity, harvest time, number of fruits, average fruit weight and the average yield per tree of 'Kubanskaya Kometa' on different rootstocks in 2002.

Rootstock	Flowering intensity rating 1…5 points	Harvest date	Total number of fruits	Average fruit weight, g	Average yield per tree, kg
P. Ackermann	2.0	3.08	56	34.3	0.25
P. Brompton	3.5	31.07	43	37.0	0.26
P. Brompton (s)	3.0	2.08	18	38.1	0.15
P. G 5/22	3.0	3.08	12	29.7	0.10
P. marianna GF 8–1	5.0	1.08	110	30.7	0.35
P. Pixy	4.0	4.08	56	40.5	0.34
P. St. Julien A	2.5	4.08	8	41.0	0.16
P. St. Julien INRA 2	4.0	31.07	160	34.8	0.74
P. St. Julien GF 655/2	5.0	3.08	47	36.8	0.22
P. St. Julien Noir	3.5	31.07	121	32.8	0.50
P. St. Julien d'Orleans	4.0	29.07	115	29.0	0.31
P. St. Julian Wädenswill	1.5	1.08	13	38.3	0.14
*P.*Wangenheims	3.0	4.08	27	23.5	0.15
P .cerasifera (local)	4.0	3.08	45	38.1	0.24
P. cerasifera myrobalana	4.5	2.08	94	33.4	0.33
LSD05*				NS**	NS**

Explanations: *LSD05 – the least significant difference between means at $P = 0.05$.
**NS – nonsignificant at $P = 0.05$.

Table 4. Content of soluble solids, titratable acids, total sugars and vitamin C in the fruits of 'Kubanskaya Kometa' on different rootstocks in 2002.

Rootstock	Soluble solids, %	Titratable acids, %	Total sugars, %	Vitamin C, mg/100 g
P. Ackermann	13.7	1.60	8.2	8
P. Brompton	14.2	1.58	7.6	8
P. Brompton (s)	14.8	1.58	7.5	9
P. G 5/22	16.9	-	-	-
P. marianna GF 8/1	14.0	1.58	7.3	9
P. Pixy	14.7	1.64	9.0	8

Table 4 (continued).

P. St. Julien A	13.2	1.70	7.3	8
P. St. Julien INRA 2	14.1	1.45	7.9	9
P. St. Julien GF 655/2	13.8	1.51	8.9	8
P. St. Julien Noir	12.6	1.31	6.3	8
P. St. Julien d'Orleans	14.0	1.30	8.3	9
P. St. Julien Wadenswill	14.8	1.66	8.3	8
P. Wangenheims	14.9	1.26	9.1	9
P. cerasifera (local)	15.1	1.56	9.7	8
P. cerasifera myrobalana	13.4	1.58	6.9	8
LSD05*	0.09		0.10	

Explanation: *LSD05 – the least significant difference between means at $P = 0.05$.

CONCLUSIONS

According to the preliminary research results carried out in the second year after planting, we can draw the following conclusions:

1. The lowest tree dimensions both of 'Queen Victoria' and 'Kubanskaya Kometa' were noted on *Prunus* St. Julien Wädenswill.
2. Trees of 'Kubanskaya Kometa' on different rootstocks started to bear fruit in the 2nd year after planting, except on *P. cerasifera* 'Hamyra'.
3. 'Kubanskaya Kometa' trees grown on *Prunus* St. Julien INRA 2 and *Prunus* St. Julien Noir produced significantly better first yields than those on the control rootstocks.
4. 'Kubanskaya Kometa' on *Prunus* St. Julien A and *Prunus* Pixy gave the largest fruits.

The data presented here should be considered as a first presentation of results that should be confirmed and completed in years to come.

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REFERENCES

Bite, A., Kviklis, D., Haak, E. & Lukut, F. 1999. International Project "Baltic Fruit Rootstock Studies". *Proceedings of the International Seminar Warszaw-Ursynow, August 18–21, 1999,* 17–18. Warszawa.

Grzyb, Z. S., Sitarek, M. & Koziński, B. 1998. Effect of different rootstocks on growth, yield and fruit quality of four plum cultivars (in central of Poland). *Acta Horticulturae*, **478**, 239–242.

Hartmann, W. 1995. Unterlagen bei Pflaumen und Zwetschen. *Obstbau*, **8**, 390–394.

Palk, J. 1960. Ploomipuu alustest. *Sotsialistlik Põllumajandus*, **10**, 451–454 (in Estonian).

Palk, J. 1984. *Ploomi- ja kirsipuude kasvatamine*. Valgus, Tallinn (in Estonian).

Renaud, R., Salesses, G., Roy, M. & Bonnet, A. 1991. Development and selection of new rootstocks of *Prunus domestica*. *Acta Horticulturae*, **283**, 253–259.

Webster, A. D. 1981. Dwarfing rootstocks for plums and cherries. *Acta Horticulturae,* **114**, 201–207.

Wertheim, S. J. 1991. Results of plum rootstock trials in the Netherlands. *Acta Horticulturae,* **283***,* 213–222.

Ystaas, J., Mage, F., Husabo, P. & Froynes, E. 1994. Performance of Eruni and Pixy as rootstocks for European plum cultivars in a northern climate. *Norwegian J. Agric. Sci*., **8**, 115–126.