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EFFECT OF HAND AND CHEMICAL THINNING ON YIELDING AND FRUIT QUALITY OF TWO LATE – RIPENING PLUM CULTIVARS

Ireneusz Sosna
Wrocław University of Environmental and Life Sciences

Abstract. Excessive amount of fruits on a tree results in loss of their weight. An advantageous way of improving the quality of e.g. plums is thinning their fruitlets. The experiment involving this problem was conducted in the years 2003–2005 at the Fruit Experimental Station in Samotwór near Wrocław. The subject of investigation were 10-year-old plum trees of two cultivars – 'Valor' and 'President', growing on a 'Myrobalan' rootstock (*Prunus divaricata)* in the spacing of 4 × 3 m (833 trees./ha). In the course of three subsequent years fruitlets were hand thinned one and two month after full blooming, as well as chemically treated, using the following preparations: Pomonit R-10 (NAA) + Ethrel (ethephon) and exclusively with Ethrel (14–10 days after trees blooming respectively). As a control there served trees which did not undergo fruitlets thinning. Hand thinning increased mean weight of 'President' fruits, while in 'Valor' cv. the same dependence was observed only when the treatment took place later. Chemical thinning did not significantly affect on fruit yield quality. In both plum cultivars, fruits obtained from not thinned trees characterized similar content of soluble solids and mineral components to those produced after application of hand and chemical thinning.

Key words: *Prunus domestica*, NAA, ethephon, chemical composition

INTRODUCTION

Plum is one of the most important fruit species in Poland. Recently, there has appeared a large choice of plum cultivars, highly tolerant to plum pox, highly productive, which also very early start to bear and have attractive, large and tasty fruit. More considerable chances for a profitable sale are provided by cultivars with early and late ripening fruits, which can be stored for even several weeks, for example 'Valor' or 'President'. The later ones often tend to overdose yielding and set too high number of small fruits.

Corresponding author – Adres do korespondencji: Ireneusz Sosna, Department of Horticulture, Wrocław University of Environmental and Life Sciences, pl. Grunwaldzki 24a, 50-363 Wrocław, Poland, e-mail: ireneusz.sosna@up.wroc.pl

Several techniques are used to improve fruit size of stone fruit, among them hand bloom and fruit thinning [Byers et al. 2003]. Experiments regarding hand thinning of fruitlets in different plum cultivars were carried out by a number of researchers [Plich and Lewandowski 2005, Drkenda et al. 2006, Lipecki and Janisz 2007]. That treatment did evidently improve the quality of harvested fruit, however the yields diminished according to postponing the term of thinning [Day and DeJong 1999]. Hand thinning of fruitlets proved to bring the most advantageous effects in the Czech Republic, in the case of improved mean weight of apricot fruit [Krška and Močička 2001]. Unfortunately, hand thinning is a very labour – consuming treatment and, therefore, expensive [Webster and Spencer 2000]. Chemical thinning of fruit trees to reduce or eliminate hand thinning could be of great economic help to growers [Johnson et al. 2002]. Fruitlets or flowers in plum trees can be thinned, among other, with such preparations as Pomonit (NAA), Ethrel (ethephon), ArmoThin (damper) or ATS (ammonium thiosulfate). Apparent improvement in mean plums weight after application of ATS during trees blossoming was recorded in Great Britain [Webster and Spencer 2000], Switzerland [Stadler et al. 2004], Norway [Meland 2004], Slovenia [Drkenda and Bertschinger 2006] and in Poland [Wieniarska et al. 2000]. Similar effects of thinning were reported after the use of ArmoThin preparation, introduced in the same term [Wieniarska et al. 2000, Meland 2004]. In study by Johnson et al. [2002] considerable effect of thinning was obtained after application of ArmoThin preparation of 3% concentration. Even lower, 2% concentration resulted in more effecient fruit setting as compared to not sprayed control trees. To thin plum trees fruitlets there are most commonly used preparations containing synthetic auxins (NAA) and ethephon [Basak et al. 1993, Harangozo et al. 1996, Jacob 1998, Wieniarska et al. 2000, Gupta and Kaur 2007, Meland and Birken 2010]. In experiment conducted by Stern et al. [2007] in Israel, application of NAA (0.3% Amigo^{TM}) at the beginning of pit-hardening stimulated cell enlargement in mesocarp of five Japanese plum cultivars, which in turn, caused a significant improvement in fruit size and total yield. Thus, NAA had the potential for increasing fruit size without thinning.

The aim of this experiment was comparing the effect of different fruit thinning methods on yielding and fruit quality of late ripening plum cultivars 'Valor' and 'President'.

MATERIAL AND METHODS

The experiment was conducted at the Fruit Experimental Station in Samotwór near Wrocław in 2003–2005. Testing material involved mature 10-year-old plum trees of 'Valor' and 'President' cultivars on 'Myrobalan' rootstock (*Prunus divaricata)*. The trees were planted in a spacing of 4 × 3 m (833 trees per hectare). In this experiment there were applied 5 treatments with fruitlets thinning: 1 – control without thinning; 2 – hand thinning one month after full blooming (the third decade of May); 3 – hand thinning two months after full blooming (the third decade of June); 4 – chemical thinning Pomonit R-10 (NAA) in dose 20 ml·100 l^{-1} + Ethrel (ethephon) in dose 15 ml·100 l^{-1} (two weeks after blooming) and 5 – chemical thinning Ethrel (ethephon) in dose 15 ml·100 l^{-1}

(ten days after blooming). The experiment was established in a randomised block design, in three replications, with two trees per plot. On sunny days, trees were evenly sprayed until the first drops of liquid started falling down, with the use of a backpack sprayer. The treatments took place on sunny days between 9–12 a.m., when air temperature reached at least 15°C and did not exceed 22°C. Hand thinning consisted in removing fruitlets with any kind of defects and leaving only single fruits, with 3–4 cm distance between them (so that they did not touch each other). All of the trees were trained in the form of a spindle canopy. Herbicide fallow was maintained in tree rows, with grassy strips between them. Plant protection was carried out in accordance to the current recommendations of the Orchard Protection Program. In 2003–2005, there were estimated the following parameters: blooming intensity, fruit set, yield and fruit quality. The measurements also involved the growth of trees. Trunk cross-sectional area (TCSA) was calculated on the basis of circumference measured 30 cm above the soil level. Apart from the mentioned parameters, there were recorded tree height and crown width in two directions. Crown volume was calculated using a formula for cone volume. Dividing the values of cumulative yields by the ones referring to tree trunk section area or tree crown volume in autumn 2005, density and crop efficiency coefficients were calculated. Blooming intensity was estimated visually according to 0–5 scale (0 – tree without flowers; 5 – exceptionally abundant flowering tree). Fruit size was estimated as mean weight of 25 fruits per tree. Soluble solids and vitamin C contents were determined immediately after harvest in fresh fruit matter. Chemical analyses of K, Ca, Mg and P contents were done after fruit drying.

The results of the experiment were analysed statistically, using the analysis of variance. Significant differences at $\alpha = 0.05$ were calculated using Duncan's multiple range t-test. Percentage data, regarding fruit setting were analyzed using transformed values according to Bliss function.

RESULTS AND DISCUSSION

In the years 2003–2005 weather conditions favoured good flowering and fruit setting in the examined plum cultivars (tab. 1). In the winter there were not recorded considerable temperature drops, nor the occurrence of frost. During the experiment all plum trees of 'President' and 'Valor' were blooming in a similar way, regardless the treatment of thinning (tab. 2). The only exception in 2004 was 'Valor', sprayed with ethephon, which produced more abundant blossom. Resembling the experiment by Grajkowski et al. [2004], hand and chemical thinning of fruitlets did not influence subsequent trees blooming. In research by Wieniarska et al. [2000] trees of 'Opal', chemically thinned, produced more advantageous blooming in the following year than both hand thinned and control trees. The improvement in trees blooming after ethephon application was also recorded by Basak et al. [1993], Meland [2004], as well as Meland and Birken [2010]. Rainy weather in May 2003 and 2005 brought about poorer fruit setting, especially in 'President' cultivar. Irrespective of the year and tree cultivar, chemically thinned trees characterized similar percentage of set fruits as compared to trees not subjected to this treatment. Only hand thinning did diminish the percentage of

set fruit in comparison to control trees. However, considerable decrease in set fruit after chemical thinning with NAA and ethephon was recorded in Norway [Meland 2004, Meland and Birken 2010]. In the experiment by Gonkiewicz and Nosal [2006], determined concentrations of NAA proved to be too low to efficiently decrease fruit setting.

Table 1. Temperatures and rainfalls in 2003–2005 at the Fruit Experimental Station in Samotwór near Wrocław against the background of the long-term data 1971–2000 from the meteorological station Wrocław–Strachowice

Tabela 1. Temperatury i opady w latach 2003–2005 w Stacji Badawczo-Dydaktycznej w Samotworze pod Wrocławiem na tle danych z wielolecia 1971–2000 ze stacji meteorologicznej Wrocław–Strachowice

	Month Miesiąc	I	II	III	IV	V	VI	VII	VIII	IX
Rainfall, mm Opad, mm	2003	37.2	3.2	11.0	13.3	118.7	20.5	61.3	31.3	27.4
	2004	21.4	40.4	63.4	21.7	33.1	38.7	60.0	52.4	19.9
	2005	25.9	44.8	2.9	26.2	122.8	28.8	100.8	56.2	18.6
	long-term wielolecie 1971–2000	28.2	24.1	30.5	36.9	57.1	78.7	90.8	64.0	50.6
Temperature, °C Temperatura, °C	2003	-1.1	-3.2	3.4	6.3	16.4	19.9	19.7	20.4	14.1
	2004	-2.9	2.0	4.6	9.8	13.1	16.7	18.4	19.6	14.7
	2005	2.2	-1.5	1.6	10.4	14.5	17.2	20.2	18.2	16.4
	long-term wielolecie 1971–2000	-0.9	0.2	3.9	8.2	13.5	16.3	18.1	17.8	13.6

In own investigation the effect of thinning on trees yielding was evident in all combinations in the case of 'President', which featured higher yield size according to the passing years (tab. 3). Significant effect of thinning was observed only in 2004, when trees yielded better without thinning. Hand thinning, as well as chemical one with the mixture of Pomonit and Ethrel decreased cumulative yield from the years 2003–2005. 'Valor' cultivar showed apparent tendency to alternate bearing in combinations 1, 2 and 5. Hand thinning introduced 2 months after full blooming and chemical thinning with the use of Pomonit + Ethrel preparations did evidently reduced the mentioned tendency. In comparison to control without thinning, in 2003 significantly lower yield was obtained only from hand thinned trees in both terms, while in 2005 higher number of fruits was harvested from trees sprayed with Pomonit + Ethrel mixture. Cumulative yield from 3 years of the experiment was the highest for that combination. Lower yields after hand thinning were recorded by Grajkowski et al. [2004] and Buler et al. [2006], while Wieniarska et al. [2000] reported lack of effect due to treatment. Chemical thinning with Pomonit, Ethrel or the mixture of those preparations resulted in diminished fruit yield [Harangozo et al. 1996, Zhang et al. 2002, Meland 2004, Meland and Birken 2010], while in research by Grajkowski et al. [2004]. Pomonit in different concentrations did not significantly affect on plum trees fruiting. In the experiment by Wieniarska

Table 2. Effect of fruit thinning on blooming and fruit setting of two plum cvs.
Tabela 2. Wpływ przerzedzania zawiązków na kwitnienie i zawiązanie owoców dwóch odmian śliwy

Cultivar Odmiana	Treatment Kombinacja	Blooming intensity (0–5 scale) Intensywność kwitnienia (skala 0–5)			Fruit setting (%) Zawiązanie owoców (%)			
		2003	2004	2005	2003	2004	2005	2003–2005
'Valor'	Control – without thinning Kontrola – bez przerzedzania	3.0 a*	3.2 a	2.3 a	47.9 b	54.3 a	44.5 bc	48.9 b
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	2.8 a	3.5 a	2.7 a	29.0 a	44.3 a	26.2 a	33.2 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	2.8 a	3.5 a	3.2 a	28.6 a	30.5 a	33.1 ab	30.7 a
	Pomonit R-10 (NAA) + Ethrel	3.3 a	3.2 a	3.7 a	46.5 b	48.6 a	52.1 c	49.1 b
	Ethrel (ethephon)	2.5 a	4.0 b	2.2 a	52.6 b	48.4 a	40.1 bc	47.0 b
'President'	Control – without thinning Kontrola – bez przerzedzania	3.5 a	3.5 a	3.0 a	21.4 a	50.3 c	35.1 bc	35.6 b
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	3.3 a	4.2 a	3.5 a	12.1 a	22.5 ab	23.2 ab	19.3 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	3.3 a	3.7 a	3.7 a	15.2 a	15.6 a	18.4 a	16.4 a
	Pomonit R-10 (NAA) + Ethrel	3.8 a	3.3 a	3.7 a	19.6 a	35.9 bc	37.3 c	30.9 b
	Ethrel (ethephon)	3.8 a	3.3 a	3.8 a	17.5 a	46.1 c	30.0 a-c	31.2 b

*Means marked by the same letter do not significantly differ at $P \leq 0.05$ according to Duncan's multiple range t-test; Statistical calculations for the cultivar were done separately
*Średnie oznaczone tą samą literą nie różnią się istotnie przy $P \leq 0,05$ wg testu t-Duncana; Obliczenia statystyczne wykonano oddzielnie dla odmiany

Table 3. Effect of fruit thinning on yielding, mean fruit weight, density and crop efficiency coefficients of two plum cvs.
Tabela 3. Wpływ przerzedzania zawiązków na owocowanie, średnią masę owocu, współczynniki gęstości i plenności dwóch odmian śliwy

Cultivar Odmiana	Treatment Kombinacja	Yield, kg tree^{-1} Plon, kg drzewo^{-1}			Cumulative yield Suma plonu, kg tree^{-1} 2003–2005	Mean fruit weight Średnia masa owocu, g				Density coefficient Współczynnik gęstości kg m^{-3} 2003–2005	CEC Współczynnik plenności kg cm^{-2} 2003–2005
		2003	2004	2005		2003	2004	2005	2003 –2005		
‘Valor’	Control – without thinning Kontrola – bez przerzedzania	46.4 bc	96.1 a*	41.3 a	183.8 a	48 a	37 a	52 a	46 a	16.3 a	1.29 a
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	31.0 a	86.1 a	39.8 a	156.9 a	56 b	41 a	54 a	50 ab	14.7 a	1.12 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	30.9 a	74.3 a	62.9 a	168.1 a	57 b	48 a	55 a	53 b	17.2 a	1.34 a
	Pomonit R-10 (NAA) + Ethrel	54.8 c	91.0 a	103.0 b	248.8 b	48 a	45 a	49 a	47 a	24.0 b	2.19 b
	Ethrel (ethephon)	38.4 ab	91.0 a	38.0 a	167.4 a	52 ab	37 a	60 a	50 ab	17.6 a	1.40 a
‘President’	Control – without thinning Kontrola – bez przerzedzania	54.2 a	91.9 c	109.8 a	255.9 b	54 ab	47 a	52 a	51 a	20.4 a	1.66 a
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	28.7 a	66.9 ab	80.4 a	176.0 a	60 c	53 a	69 b	61 b	18.9 a	1.38 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	30.6 a	55.0 a	96.6 a	182.2 a	57 bc	65 b	66 b	63 b	16.9 a	1.50 a
	Pomonit R-10 (NAA) + Ethrel	43.6 a	59.0 a	78.2 a	180.8 a	54 ab	51 a	55 a	53 a	19.8 a	1.76 a
	Ethrel (ethephon)	57.0 a	74.4 b	104.6 a	236.0 ab	50 a	51 a	54 a	51 a	20.3 a	1.89 a

*see Table 2 – patrz tabela 2

Table 4. Effect of fruit thinning on fruits chemical composition of 2 plum cultivars (mean 2003–2005)
Tabela 4. Wpływ przerzedzania zawiązków na skład chemiczny owoców dwóch odmian śliwy (średnia z lat 2003–2005)

Cultivar Odmiana	Treatment Kombinacja	Soluble solids Ekstrakt, %	Vitamin C mg 100 g^{-1} f.m. Witamina C mg·100 g^{-1} św.m.	K	Ca	Mg	P
				g kg^{-1} of dry matter g·kg^{-1} suchej masy			
'Valor'	Control – without thinning Kontrola – bez przerzedzania	15.2 ab*	4.48 b	14.50 a	7.84 a	1.58 a	4.39 a
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	15.3 ab	3.96 a	15.65 a	7.02 a	1.51 a	4.03 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	14.9 ab	4.36 b	15.23 a	8.52 a	1.65 a	4.33 a
	Pomonit R-10 (NAA) + Ethrel	13.4 a	3.74 a	15.83 a	8.46 a	1.62 a	4.32 a
	Ethrel (ethephon)	16.6 b	4.47 b	14.77 a	7.47 a	1.49 a	4.16 a
'President'	Control – without thinning Kontrola – bez przerzedzania	14.0 a	4.33 ab	12.13 a	8.85 a	1.67 a	3.78 a
	Hand thinning – month after full blooming Przerzedzanie ręczne – miesiąc po pełni kwitnienia	13.9 a	5.02 c	13.60 a	8.58 a	1.59 a	3.64 a
	Hand thinning – 2 months after full blooming Przerzedzanie ręczne – 2 miesiące po pełni kwitnienia	14.9 a	4.83 bc	12.07 a	8.62 a	1.81 a	3.65 a
	Pomonit R-10 (NAA) + Ethrel	14.3 a	3.85 a	12.12 a	8.65 a	1.77 a	3.76 a
	Ethrel (ethephon)	13.8 a	4.31 ab	12.08 a	8.91 a	1.78 a	3.68 a

*see Table 2 – patrz tabela 2

et al. [2000], spraying trees with Pomonit + Ethrel mixture decreased the yields of 'Opal' cv., although it did not influence fruiting of 'President'. According to Jacob [1998], exclusive use of ethephon 30–40 days after blooming caused even too intensive fruitlets fall. The above examples point to the fact, that hand and chemical thinning can bring about a highly diversified effect on plum trees fruiting since it depends on a number of factors, including, among others, local weather conditions, cultivar, rootstock, term of treatment or preparation concentration.

In own research mean weight of 1 fruit depended on the level of trees yielding in particular year (tab. 3). Only in 'President' in 2004, when it was very dry in May, at lower crops there were recorded smaller fruits in comparison to those from the following year. Significant improvement of mean fruit weight was recorded only after hand thinning. That treatment was of an advantageous, although not always significant effect as far as fruits size was concerned. The mentioned influence depended on the cultivar and the year fruitlets thinning was applied. In 'Valor' significant improvement of fruit size after hand – thinning of fruitlets was reported only in 2003. As far as 'President' was concerned, similar response to this treatment was recorded in 2005, while in the years 2003–2004 it depended on the term of thinning. Similar results were obtained by other researchers [Drkenda et al. 1998, Buler et al. 2006, Lipecki and Janisz 2007]. In my experiment chemical thinning using ethephon only or Pomonit and Ethrel mixture did not affect on the quality of harvested yield. Such a response of trees could result from, among others, too low concentration of an active substance, especially of NAA. Nearly the same results were recorded by Zhang et al. [2002] after spraying with ethephon, as well as by Grajkowski et al. [2004] and Gonkiewicz and Nosal [2006] after introduction of NAA in low concentrations. In turn, Harangozo et al. [1996], Wieniarska et al. [2000], and Gupta and Kaur [2007] reported a significant increase of mean plum weight after application of those preparations. Son [2004] proved a considerable increase in mean weight of apricots growing in New Zealand after the use of NAA in different concentrations. In Norwegian investigations [Meland 2004, Meland and Birken 2010], spraying trees with ethephon only or with NAA and ethephon mixture did improve the size of 'Victoria' and 'Jubileum'cvs. plums. Basak et al. [1993] recorded even higher quality of plums harvested from trees treated with ethephon than those obtained after the use of NAA. Worse efficiency of Ethrel in improving fruit quality, in relation to ATS or ArmoThin, was observed by Drkenda and Bertschinger [2006]. In this experiment, diversified ways of fruitlets thinning treatment did not significantly affect on calculated density coefficients as well as on CEC. Only with 'Valor' cultivar in combination with Pomonit + Ethrel those indices were significantly higher. In available literature there cannot be found records regarding this question.

As compared to control trees, fruitlets thinning did not influence on soluble solids concentration in the examined plum trees cultivars (tab. 4). However, there was observed a significant difference between combinations with chemical thinning of fruitlets of 'Valor'. Obtained results remain in disagreement with the reports by other researchers, who recorded increased amount of a soluble solids in fruits after hand thinning [Krška and Močička 2001, Drkenda et al. 2006, Gonkiewicz and Nosal 2006], or after a chemical one, involving the use of Ethrel preparation [Gupta and Kaur 2007], Pomonit [Son 2004], as well as Pomonit + Ethrel on 'President' cultivar [Wieniarska et al.

2000]. The same authors in the experiment with 'Opal' did not state any significant effect of chemical and hand thinning on soluble solids content. Similar results after application of ethephon were obtained by Zhang et al. [2002], and, after hand thinning, by Plich and Lewandowski [2005], Buler et al. [2006], as well as Lipecki and Janisz [2007]. In the experiment described, fruits from not thinned trees of 'Valor' cultivar did feature higher values of soluble solids content than 'President, which was also confirmed by Lipecki et al. [2001] in their research, where the content of that component was, however, respectively higher.

In comparison to control, hand thinning of fruitlets taking place one month after full blooming, as well as chemical thinning using Pomonit + Ethrel mixture, caused the decrease in vitamin C content in fruits of 'Valor' cultivar (tab. 4). However, elevated values of this vitamin content, after hand thinning, introduced in the same term, was observed in 'President'. Both hand and chemical thinning did not significantly affect on potassium, magnesium, calcium and phosphorus concentration in fruits of the examined plum trees cultivars. In available literature referring to plum trees there cannot be found records regarding this question.

CONCLUSIONS

1. On the basis of three – year – lasting research it is possible to state that assessed ways of fruitlets thinning did not affect blooming of both plum trees cultivars. Hand and chemical thinning with Pomonit + Ethrel preparations decreased cumulative yield of 'President' cultivar, while application of the mixture of those preparations increased yielding of 'Valor'.

2. Hand thinning in both terms did significantly diminish percentage of set fruits and increased their mean weight in 'President' cv. Plum tree 'Valor' responded with similar increase in mean fruit weight only after thinning introduced in later term.

3. The use of Ethrel preparation and Pomonit + Ethrel mixture at low concentration neither thinned fruitlets, nor improved the quality of harvested plums of both cultivars.

4. Diversified ways of thinning did not significantly affect the content of soluble solids, as well as mineral components in fruit. However, slight statistical differences were recorded for vitamin C content.

5. On the basis of this experiment it can be proved that the most advantageous effect on the quality of harvested fruit resulted from hand thinning applied 2 months after full blooming of trees. However, regarding its labour – consuming aspect, this way does not seem advantageous as far as a wide – scale usage in commercial plum orchards is concerned.

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WPŁYW RĘCZNEGO I CHEMICZNEGO PRZERZEDZANIA ZAWIĄZKÓW NA PLONOWANIE I JAKOŚĆ OWOCÓW DWÓCH PÓŹNYCH ODMIAN ŚLIWY

Streszczenie. Zbyt duża liczba owoców na drzewie powoduje spadek ich masy. Dobrym sposobem na poprawę jakości, np. śliwek, jest przerzedzanie zawiązków. Doświadczenie poświęcone temu zagadnieniu prowadzono w latach 2003–2005 w Stacji Badawczo-Dydaktycznej w Samotworze w okolicach Wrocławia. Przedmiotem badań były 10-letnie drzewa dwóch późnych odmian śliwy 'Valor' i 'President' na podkładce z ałyczy, posadzone w rozstawie 4 × 3 m (833 drz./ha). Przez 3 kolejne lata przerzedzano zawiązki ręcznie, miesiąc i dwa miesiące po pełni kwitnienia, oraz chemicznie preparatami Pomonit R-10 + Ethrel, a także samym preparatem Ethrel (odpowiednio 14 i 10 dni po kwitnieniu drzew). Kontrolę stanowiły drzewa, na których zawiązków nie przerzedzano. Przerzedzanie ręczne zwiększyło średnią masę owocu odmiany 'President', natomiast u 'Valor' taką zależność zaobserwowano tylko przy późniejszym wykonaniu tego zabiegu. Przerzedzanie chemiczne nie miało istotnego wpływu na jakość zebranego plonu. U obu odmian owoce z drzew nieprzerzedzanych charakteryzowały się podobną zawartością ekstraktu i składników mineralnych w porównaniu z przerzedzaniem ręcznym i chemicznym.

Słowa kluczowe: *Prunus domestica*, Pomonit, etefon, skład chemiczny

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