CHEMICAL PEAR FRUIT THINNING

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A B S T R A C T

The experiment was conducted at the Experimental Station near Krakow in 2008 and 2009. The objects of the experiment were twelve-year-old pear trees cv. 'Conference'. The aim of the experiment was to evaluate the effect of three commercial preparations, containing two forms of the auxin NAA and the cytokinin BA, on the fruit set, total yield, fruit weight and the firmness, acidity and soluble solids content of the flesh. Treatments were carried out when fruitlets were 12 mm in diameter. Control trees were not treated. All the combinations used decreased fruit set and total yield, but increased fruit weight. The applied preparations had no clear effect on the acidity and soluble solids content of the fruit juice. None of the treatments affected fruit firmness, acidity and soluble solids content of the fruit juice after harvest and after storage.

Key words: pear fruit thinning, auxin, cytokinin

INTRODUCTION

An appropriate number of fruitlets on the tree makes it possible to obtain fruit of fine quality (Burge et al., 1991). Thinning large numbers of trees by hand is neither practical nor economical. The fastest method of regulating the intensity of fruiting is chemical thinning. Among the many agents used for thinning, the most frequently used are ethephon and auxin (NAA) (Jones et al., 2000; Webster and Spencer, 2000). The greatest

problem with chemical thinning is the inconsistency of response (Wertheim, 2000), especially after treatment with ethephon (Bound et al., 1991; McArtney and Wells, 1995). The first thinners discovered were NAA and its amide. It was found that the amide of NAA had a positive effect on fruit size and marketable yield (Burge et al., 1991; Basak et al., 2006). The effectiveness of all chemical products for thinning depends on the weather and also on the tree species. The cultivar 'Conference' is one of the main pear cultivars in Europe (Deckers and Schoofs, 2008). The objective of this experiment was to compare the effectiveness of new chemical products in thinning 'Conference' pear fruitlets.

MATERIAL AND METHODS

The subjects of the experiment were twelve-year-old 'Conference' pear trees. The objective was to compare the effectiveness of three products, two of which contained two different forms of the auxin NAA and the (Tab. 1).

Table 1 presents the contents of active components and the concentrations of the products used. Spraying was conducted when fruitlets had reached a diameter of 12 mm. Each experimental combination consisted of 10 replications (one tree per replication). During harvest, the fruits from each tree were put into separate boxes. Total yield was determined by weighing the boxes, and the average weight of one pear was determined based on the weight of 100 pears. In order to test flesh firmness, soluble solids content and the titratable acidity of the juice, a random sample of 25 fruits from the whole combination was taken and divided into 5 replications. Two boxes containing fruit randomly selected from the whole combination were left in storage for 120 days at a temperature of 0-0.5 °C and humidity of 90-92%, in an ordinary cold store (normal atmosphere). After storage, flesh firmness, soluble solids content and titratable acidity of the juice (expressed in equivalents of malic acid) were determined.

Table 1. Preparations used in the experiment

Preparation	Active substance	Working concentration
Pomonit 050 SL	1-naphthalene acetic acid triethanolamine salt, 50 g l^{-1}	20 mg $\cdot l^{-1}$
Diramid	1-naphthalene acetic amide, 8%	80 mg l^{-1}
Bioprzerzedzacz 060 SL	50 g l^{-1} benzyladenine 10 g l^{-1} 1-naphthalene acetic acid	37.5 mg l^{-1} 7.5 mg l^{-1}

RESULTS AND DISCUSSION

All the products used reduced the number of fruitlets (Tab. 2). During the first year of the experiment, both Pomonit 050 SL and Diramid, containing triethanolamine salt of NAA and naphthylacetic amide, respectively, were more effective in reducing fruit set than Bioprzerzedzacz 060 SL containing NAA and BA. However, no differences were observed in the effectiveness of these two forms of auxin. The percentage values of fruit set in both combinations were not significantly different. In spite of using auxin in the amide form (Diramid) at a concentration four times higher than the triethanolamine salt (Pomonit 050 SL), the results for those combinations did not differ significantly. This proves lower effectiveness of the amide form of auxin and the necessity of using it at higher concentrations. A reduction in fruit set caused a reduction in yield, especially in the case of Diramid (Tab. 2). All the treatments had an influence on the average fruit weight, but the largest fruits were observed after treatment with Pomonit 050 SL (Tab. 2). The results suggest that this is the best form of auxin to be used for fruit thinning. Slightly different results were obtained by Bonghi et al. (2002). The results of an experiment conducted by those authors show that the best effects of thinning can be obtained using the amide form of auxin. A positive influence of Diramid on pear fruit quality has also been observed by Basak et al. (2006). Improvements in fruit size and total yield were also obtained as a result of using Bioprzerzedzacz 060 SL. The cytokinin present in this product reduced fruit set and improved the average fruit weight, while the total yield obtained was better than after the treatment with auxin. A positive influence of cytokinin has also been observed during experiments conducted by other authors (Stern, 2002; Stern and Flaishman, 2003). The tests conducted immediately after the harvest revealed a negative influence of all the products on flesh firmness (Tab. 3). However, the same tests conducted after the storage period revealed quite the opposite effect. The lowest fruit flesh firmness was observed in the control combination (Tab. 3). The results suggest that the products used to thin pear fruitlets do not have a negative influence on fruit storability. The results of the experiment show a small positive influence of the chemical fruit thinning agents on the soluble solids content of the fruit juice (Tab. 4). As in the experiments conducted by Pietranek et al. (2000), cytokinin had the strongest influence on the increase in the amount of soluble solids in the fruit juice. However, the results of the tests conducted after the storage period show a lower percentage of extract in all three combinations than in the control. Higher titratable acidity of the fruit juice in comparison with the control, both after harvest and after storage, was observed only during the first year of the experiment after using the auxin-containing products (Tab. 5). In the case of the

Table 2. Fruit setting, total yield and fruit weight

Treatment	Fruit set [%]		Yield per tree [kg]		Mean fruit weight [g]	
	2008	2009	2008	2009	2008	2009
Bioprzerzedzacz	37.5 b*	14.7 a	36.0 b	29.7 b	150 b	121 b
Diramid	33.5 a	15.2 a	16.2 a	18.5 a	150 b	122 b
Pomonit	32.0 a	13.2 a	20.2 a	20.7 a	165 c	133 c
Control	47.2 c	20.0 b	33.5 b	36.5 c	139 a	113 a

*Values marked with the same letter do not differ at p = 0.05

Table 3. Flesh firmness [kG]

Treatment	After harvest		After storage	
	2008	2009	2008	2009
Bioprzerzedzacz	6.6 a*	6.1 a	4.1 b	3.9 b
Diramid	6.9 a	6.5 a	4.3 c	3.9 b
Pomonit	6.3 a	6.3 a	4.2 bc	3.3 a
Control	7.4 b	7.4 b	3.8 a	3.2 a

*Explanation: see Table 2

Table . 4. Soluble solids [Brix %]

Treatment	After harvest		After storage	
	2008	2009	2008	2009
Bioprzerzedzacz	14.8 b*	12.6 b	12.9 a	13.9 ab
Diramid	14.7 b	11.6 ab	13.6 ab	13.1 a
Pomonit	13.9 ab	11.0 a	13.3 ab	13.1 a
Control	13.4 a	12.6 b	14.4 b	15.0 b

*Explanation: see Table 2

Table . 5. Acidity [% of malic acid]

Treatment	After harvest		After storage	
	2008	2009	2008	2009
Bioprzerzedzacz	0.24 ab*	0.22 a	0.15 a	0.18 a
Diramid	0.27 b	0.22 a	0.18 b	0.18 a
Pomonit	0.28 b	0.21 a	0.18 b	0.18 a
Control	0.20 a	0.22 a	0.16 a	0.19 a

*Explanation: see Table 2

other combinations, the chemical products did not have a significant influence on the titratable acidity of the fruit juice.

CONCLUSIONS

1. Thinning results show higher effectiveness of auxin in the form of a triethanolamine salt (Pomonit 050 SL) than in the amide form (Diramid) and than the mixture of the cytokinin BA with the auxin NAA (Bioprzerzedzacz 060 SL).
2. Pomonit 050 SL was the most effective in improving the average fruit weight and the total yield.
3. All three products had a similar effect on flesh firmness, soluble solids content and titratable acidity of pear fruit, both after harvest and after storage.

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CHEMICZNE PRZERZEDZANIE OWOCÓW GRUSZY

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

Doświadczenie przeprowadzono w latach 2008-2009 w Stacji Doświadczalnej koło Krakowa. Obiektem badań były dwunastoletnie drzewa gruszy odmiany ‘Konferencja’. Celem doświadczenia była ocena dwóch form auksyny NAA oraz cytokininy BA i ich wpływ na procent zawiązanych owoców, plon ogólny, masę owoców oraz ich jędrność, kwasowość i zawartość ekstraktu. Zabieg wykonano, gdy zawiązki osiągnęły średnicę 12 mm. Drzewa kontrolne nie były traktowane. Wszystkie zastosowane preparaty obniżyły procent zawiązanych owoców i plon ogólny, ale wpłynęły na wzrost średniej masy owoców. Zastosowane preparaty nie miały jednoznacznego wpływu na kwasowość oraz zawartość ekstraktu w soku owoców. Żaden z zastosowanych preparatów nie miał wpływu na zdolność przechowalniczą owoców ocenianą na podstawie jędrności, kwasowości oraz ekstraktu soku owoców.

Słowa kluczowe: przerzedzanie zawiązków gruszy, auksyny, cytokininy