Chemical Thinning of 'Conference' Pears

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Abstract

The increasing difference in the market value of small and larger sized 'Conference' pears (>65 mm) and the high labour costs for hand thinning, makes it interesting for growers to find a cheaper and reliable method for thinning pear trees. In 2007, 2008 and 2009 trials were carried out to test the thinning efficacy of several chemicals. Fruit set was only significantly reduced by a two-fold application of ammonium thiosulphate (ATS) or by a tankmix application of 6-benzyladenine (BA) and 1-naphtalene acetic acid (NAA). Unfortunately, russeting of 'Conference' pears was augmented by the treatments with ATS during bloom. Tankmix applications of NAA + BA, applied at an average fruit diameter of 8.8 mm, resulted in a severe overthinning of the trees in 2008. However, the same treatments applied at an average fruit diameter of 14.7 mm had much less of a thinning effect. In 2009 adequate thinning was obtained with lower concentrations of BA+NAA applied at 8-10 mm fruit diameter. Surprisingly, the reduction in fruit set by BA+NAA did not result in a proptional increase in the average fruit weight at harvest. In some treatments average fruit weight was even reduced compared to that of the hand-thinned trees, a size-reducing effect that was attributed to NAA. In conclusion, BA+NAA seems to thin 'Conference' pears more strongly than BA alone. However, the addition of NAA to BA has the disadvantage of a diminishing effect on the increment of fruit size, i.e. fruit size increased less than expected on basis of the reduction in crop load. Additional research will be carried out to further optimise the developmental stage, weather conditions, and concentrations at which a BA and NAA must be applied to obtain the desired level of thinning and gain in yield percentage of fruits over 65 mm in diameter.

INTRODUCTION

Adequate control of crop load of 'Conference' pear trees is a necessity to obtain a pack out of fruits within the commercial desirable size range of 65 to 80 mm fruit diameter and to obtain regular yields from one year to the other. Depending on blooming intensity and fruit set conditions, thinning requirement of 'Conference' trees may amount up to more than 100 fruits/tree (Maas, 2008). At present, thinning by hand is the only option for Dutch growers since no chemical compounds are registered for thinning pear trees in the Netherlands. The increasing labour costs for hand thinning and the decreasing value of pears with a diameter make less than 65 mm in diameter, makes it more and more interesting for growers to find a cheaper and reliable method for thinning pear trees.

Previous trials indicated that NAA, BA and Ethephon may thin 'Conference', but the thinning effects were not consistent and were thought to be strongly dependent on the development stage of the fruitlets and temperature (Wertheim, 2000). In a Romanian trial a two-fold application of 5 kg/ha potassium sulphate during bloom and one month after bloom thinned 'Conference' and increased the yield percentage of fruits >65 mm in diameter from 29 to 80% (Mitre et al., 2002).

This paper presents a series of trials on chemical thinning of 'Conference' pear trees carried out in the Netherlands with chemical compounds with widely proven thinning efficacy in apple and promising initial results in pears (Mirte et al., 2002;

Wertheim, 2000).

MATERIALS AND METHODS

Plant Material and Trial Setup

Trial 1. This trial was carried out in 2007 in the experimental orchard of the fruit research station at Randwijk, the Netherlands (5°42'08.23" East, 51°56'20.06" North). 'Conference' trees on rootstock quince MC and interstem Doyenné du Comice were planted in 1999 in single rows in fresh soil consisting of river clay with 30% silt. Planting distances were 3.0 × 1.09 m. The trees were trained as a Y-hedge made out of trees with 4 slant, upwardly growing leader branches per tree (mini-tatura or V-quad system). 'Verdi' trees (2 trees in between every 9 'Conference' trees) were planted within the row for pollination. Trees were pruned, fertilized, irrigated and protected from pests and diseases according to local commercial practice. The thinning trial consisted of 11 treatments, including an untreated control and a hand thinning treatment. The chemical compounds used in the trial, the timing of their application, the concentrations of the products and the conditions during application are summarized in Tables 1 and 2. Application of chemical thinning agents was performed using a knapsack sprayer. Trees were sprayed till run off. Each treatment was replicated 8 times, using a single tree per plot.

Trial 2. The second trial was carried out in 2008 at a commercial fruit farm in Harmelen, the Netherlands (4°57'20.62" East, 52°05'43.01" North) on 'Conference'/quince MC trees planted in 1998 in single rows at 3.5 × 1.0 m in a six row block without pollinator trees within the rows, but aligning 4 rows of 'Doyenné du Comice' at five to two rows distance from the 'Conference' trial rows. The trial consisted of 8 treatments, including an untreated control and a hand thinning treatment. The chemical compounds used in the trial, the timing of their application, the concentrations of the products and the conditions during application are summarized in Tables 3 and 4. Application of chemical thinning agents was performed using a knapsack sprayer. Trees were sprayed till run off. Each treatment was replicated 4 times, using plots of 7 trees with 3 observation trees each.

Trial 3. The third trial was carried out in 2009 in the experimental orchard of the fruit research station at Randwijk, the Netherlands in the same orchard as used in trial 1. The thinning trial consisted of 8 treatments, including an untreated control and a hand thinning treatment. The chemical compounds used in the trial, the timing of their application, the concentrations of the products and the conditions during application are summarized in Tables 5 and 6. Application of chemical thinning agents was performed using a knapsack sprayer. Trees were sprayed till run off. Each treatment was replicated 8 times, using a single tree per plot.

Observations and Statistical Analysis

Trees used for the experiment were selected for uniformity of flowering and representing the average blooming intensity and tree size of the orchard. At the beginning of the experiment the number of flower clusters per tree was counted. At the time of application of the thinning compounds, the average fruit diameter of all untreated control trees was determined. Fruit diameter of 25 randomly chosen fruitlets per tree was measured at the widest point of the fruit using digital callipers. At harvest the number of fruits and kg of fruits per tree was determined and used to calculate average fruit weight. Fruit size distribution of the fruits of trials 1 and 2 was made in 5 mm diameter classes from 45 mm upward.

Statistical analysis was carried out using the Anova variance analysis of the Genstat statistical program (VSN International Ltd, Hemel Hempstead, United Kingdom). In case of significant differences ($p<0.05$), LSD values were calculated and used for comparing treatment means in pairs.

RESULTS AND DISCUSSION

Trial 1

Tables 7 and 8 summarize the results of this trial. The average number of flower clusters per tree was 90. Fruit set in 2007 was high and resulted in a crop load of 169 fruits/tree for the untreated control trees, i.e. a fruit set of 246 fruits per 100 flower clusters. Untreated trees yielded on average 29.4 kg of fruits with an average fruit weight of 176 g. In the hand-thinned trees 60 fruits were removed per tree on average, which reduced the yield to 25.8 kg per tree and increased the average fruit weight to 202 g. Fruit set was reduced to 148 fruits per 100 flower clusters by hand thinning. Variability between the eight replicate trees per treatment was high in all treatments. Of all chemical thinning treatments only the two-fold application of ATS (treatment 5) and the tankmix application of NAA and BA (treatment 9) resulted in a statistically significant reduction in fruit set (fruits/100 flower clusters). However, yield and average fruit weight were neither significantly affected by these treatments, nor by any of the other treatments. Return bloom in 2008 was similar for all treatments and amounted to 65 flowers per tree, i.e. 72% of the number of flowers in the previous year. Fruit firmness, sugar and starch content, and background colour of the pears was similar for all treatments (data not shown). Fruits of the trees treated once or twice with ATS during bloom showed more fruit skin rusetting (data not shown). Fruit size distribution was only determined for the untreated controls, hand-thinned trees, trees treated twice with 1.2% ATS during bloom, and trees treated with a tankmix of 20 mg/L NAA and 150 mg/L BA, i.e. only the chemical treatments which affected fruit set. Compared to the untreated controls the tankmix of NAA and BA (treatment 9) significantly reduced the yield percentage of fruits <45 mm and increased that of fruits >65 mm in diameter (Table 8). Size distribution and the size index calculated on basis of the size distribution of the harvest of trees treated with the NAA+BA tankmix was similar to that of the hand thinned trees. The yield percentage of fruits >65 mm were increased from 47 to 67% and 71% by NAA+BAA and hand thinning, respectively (Table 8). Although the two-fold application of ATS during bloom had significantly reduced fruit set, average fruit weight and size distribution remained almost similar to that of the untreated trees. This may possibly be explained by the slightly higher flower number of the trees used for this treatment which, despite the significant reduction in fruit set per 100 flower clusters, caused an almost similar crop load and yield to that of the untreated trees. Contrary, the NAA+BA tankmix both reduced fruit set and crop load. Apparently, crop load needs to be substantially reduced before significant increases in average fruit weight can be obtained. Figure 1, showing the relationship between fruit number and average fruit weight at harvest of Conference trees (data obtained previously for a large number of untreated trees with different crop loads in the same orchard as used for thinning trial 1), demonstrates a clear negative linear relation between crop load and fruit weight and the importance of adequate thinning in case of a too high crop load. At a crop load of 100 fruits average fruit weight was about 200 g. For each 10 fruits more or less, there was a 7 g reduction or increase in fruit weight, respectively.

Trial 2

In this trial carried out in 2008, the thinning efficacy of NAA+BA observed in trial 1 in 2007 was studied in more detail. The NAA concentration of the tankmix was maintained at 20 mg/L while the BA concentration was varied (150, 200 or 250 mg/L). Further, NAA+BA was applied at two different moments during fruitlet development, one set of treatments at 8.8 mm and the other set of treatments at 14.6 mm fruitlet diameter. The average number of flower clusters of the trees used in this trial was 109 (Table 9). Contrary to trial 1, fruit set in 2008 was not very high. Untreated control trees produced 117 fruits per 100 flower clusters, yielding 123 fruits and 27.5 kg/tree, resulting in an average fruit weight of 227 g. Cleary, natural regulation of fruit set and fruit drop had sufficiently controlled crop load and, in retrospective, there was no need for chemical

thinning this orchard in 2008. Indeed, in treatment 2 (hand thinning) only 4 fruits on average had to be removed from the trees to attain the target fruit load of about 119 fruits. Since natural fruit drop had not yet occurred at the times the applications of NAA+BA were scheduled, the treatments were carried out before natural fruit set was known. In this trial the applications of all three combinations of NAA+BA at 8.8 mm fruitlet diameter resulted in severe overthinning. Fruit number and yield per tree were reduced to 16-29 fruits and 5.2 to 9.1 kg (Table 9). However, when the same treatments were delayed until the fruits had grown to 14.6 mm in diameter, NAA+BA thinning effect was much less to insignificant (treatments 6 to 8). At the highest concentration of BA (treatment 8), the tankmix of NAA+BA reduced fruit set from 117 to 85 fruits/100 flowers clusters. Despite this 25% reduction in fruit set, average fruit weight remained similar to that of the untreated trees. Fruit size distribution revealed the treatments NAA+BA applied at 14.6 mm fruit diameter resulted in higher yield percentages of fruits smaller than 55 mm (Table 10) compared to the other treatments. In addition, it was observed that in these NAA+BA treatments many very small fruitlets, predestined to abscise and abscising in the other treatments during June drop, remained on the trees until harvest. These 'pygmee' fruits were not included in the yield data of the trial. Not surprisingly, the severe overthinning caused by NAA+BA when applied at 8.8 mm fruit size resulted in significant and very large increases in yield percentages of fruits >65 mm. When applied at 8.8 mm fruit size, the yield percentage of fruits >65 mm increased from 67% in the untreated trees to 95 to 99% in the NAA+BA treated trees. When applied at 14.6 mm NAA+BA this yield percentage remained as low as 53 to 59%.

Trial 3

In this trial lower concentrations of NAA and BA were used compared to those of trial 2. About 100 fruits were removed in the hand-thinned trees to reach the target crop load of ca. 100 fruits/tree. This hand thinning reduced yield from 27 kg in the untreated control trees to 21 kg and increased average fruit weight from 134 to 204 g. All NAA+BA treatments significantly thinned 'Conference' trees, with 10 mg/L NAA + 100 mg/L BA having a lower thinning effect than 20 mg/L NAA + 150 or 200 mg/L BA. The two latter treatments showed a tendency to slight overthinning. Average fruit weight was significantly increased to about the same extent by all NAA+BA treatments. However the increase in fruit weight was only about 50% of that resulting from the same amount of hand thinning.

In conclusion, based on the results of the three trials carried out since 2007, NAA+BA seem to thin 'Conference' pears more strongly than BA alone. However, just as observed in apple, the addition of NAA to BA has the disadvantage of a diminishing effect on the increment of fruit size, i.e. fruit size increased less than expected on basis of the reduction in crop load. Further experiments are planned to find out if concentrations less than 10 mg/L NAA will still enhance thinning in combination with BA, but without having a negative effect on fruit size development.

ACKNOWLEDGEMENTS

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Tables

Table 1. Treatments of thinning trial 1 on 'Conference' in 2007.

1	Untreated control
2	Hand thinning after June drop (July 2nd)
3	1.2% ATS[1] at 20% open flowers, surfactant 0.1% Agral Gold
4	1.2% ATS bij 50% open flowers, surfactant 0.1% Agral Gold
5	Treatments 3 and 4
6	0.5 % K_2SO_4 at full bloom and at 4 weeks after full bloom
7	20 mg/L NAA[2] at 10-12 mm fruitlet diameter[3]
8	150 mg/L BA[4] bij 10-12 mm fruitlet diameter
9	Treatments 7 and 8 (tankmix)
10	10% (100 g/L) $Ca(OH)_2$ (slaked lime) at full bloom and 4 weeks after full bloom
11	200 mg/L ethephon[5] at full bloom

[1]Ammoniumthiosulphate; [2]1-naphtalene-acetic acid (Late-val vloeibaar, Certis Europe b.v.); [3]Average of 25 fruitlets; [4]6-benzyladenine (MaxCel, Certis Europe b.v.); [5]Ethrel-A (Bayer CropScience b.v.).

Table 2. Spraying conditions of thinning trial 1 on 'Conference' in 2007.

Treatment	Date	Stage	Time (h)	Temp. (°C)	R.H. (%)	Wind direction, speed (m/s)	Sky cloudiness	Litre/tree
3, 5	April 9	20% OF[1]	13-14	13-15	69	Variable, 4	Moderate	0.38
4, 5	April 12	50% OF	13-14	20	81	East, 3-4	Clear	0.63
6	April 14	1 DBFB[2]	10-11	20-22	64	East, <3	Light	0.50
10	April 14	1 DBFB	12-13	23-25	52	East, <3	Light	0.31
11	April 14	1 DBFB	11-12	21-23	55	East, <3	Light	0.44
7, 8	April 27	10.4 mm[3]	13-14	21-23	31	North-East, 4	Light	-
9	April 27	10.4 mm	14-15	23-25	30	North-East, 4	Light	-
6	May 14	4 WAFB[4]	11-12	14-15	66	South-West, 4	Strong	0.50
10	May 14	4 WAFB	12-13	13-15	67	South-West, 4	Strong	0.44

[1]Open flowers; [2]Day(s) before full bloom, full bloom occurred at April 15; [3]Average diameter of the fruits of the untreated control trees determined on day of treatment; [4]Weeks after full bloom.

Table 3. Treatments of thinning trial 2 on 'Conference' in 2008.

1	Untreated control
2	Hand thinning after June drop (July 4th)
3	20 mg/L NAA[1] + 150 mg/L BA[2] at 8-10 mm
4	20 mg/L NAA + 200 mg/L BA at 8-10 mm
5	20 mg/L NAA + 250 mg/L BA at 8-10 mm
6	20 mg/L NAA + 150 mg/L BA at 14-16 mm
7	20 mg/L NAA + 200 mg/L BA at 14-16 mm
8	20 mg/L NAA + 250 mg/L BA at 14-16 mm

[1]1-naphtalene-acetic acid (Late-val, Certis Europe b.v.); [2]6-benzyladenine (MaxCel, Certis Europe b.v.).

Table 4. Spraying conditions of thinning trial 2 on 'Conference' in 2008.

Treatment	Date	Stage[1] (mm)	Time (h)	Temp. (°C)	R.H. (%)	Wind direction, speed (m/s)	Sky cloudiness (%)	Litre/tree
3, 4, 5	May 3	8.8	12-14	19-20	65	East North East, 2-3	10	0.39
6, 7, 8	May 13	14.7	8-10	18-22	70	East, 3-4	20	0.39

[1]Average diameter of the fruits of the untreated control trees determined on day of treatment.

Table 5. Treatments of thinning trial 2 on 'Conference' in 2008.

1	Untreated control
2	Hand thinning after June drop (July 4th)
3	10 mg/L NAA[1] + 100 mg/L BA[2] at 8-10 mm
4	10 mg/L NAA + 150 mg/L BA at 8-10 mm
5	10 mg/L NAA + 200 mg/L BA at 8-10 mm
6	20 mg/L NAA + 100 mg/L BA at 8-10 mm
7	20 mg/L NAA + 150 mg/L BA at 8-10 mm
8	20 mg/L NAA + 200 mg/L BA at 8-10 mm

[1]1-naphtalene-acetic acid (Late-val, Certis Europe b.v.); [2]6-benzyladenine (MaxCel, Certis Europe b.v.).

Table 6. Spraying conditions of thinning trial 3 on 'Conference' in 2009.

Treatment	Date	Stage[1] (mm)	Time (h)	Temp. (°C)	R.H. (%)	Wind direction, speed (m/s)	Sky cloudiness (%)	Litre/tree
3, 6	May 1	9.2	11:00-11:45	20	53	North West, 3	3	0.49
4, 7	May 1	9.2	11:50-12:30	20.5	50	North West, 3	3	0.49
5, 8	May 1	9.2	12:35-13:20	22.2	47	North West, 3	3	0.49

[1]Average diameter of the fruits of the untreated control trees determined on day of treatment.

Table 7. Flower clusters, fruit set (fruits/100 flower clusters), yield, average fruit weight, and return bloom of the 'Conference' thinning trial in 2007.

Treatment	Flower clusters 2007	Fruits/tree	Yield/tree (kg)	Fruit weight (g)	Fruits/100 flower clusters	Return bloom 2008
1. Untreated control	84	169 abc	29.4 ab	176	246 b	63
2. Hand thinning	94	130 a	25.8 a	202	148 a	70
3. ATS 20% open flowers	79	146 abc	26.1 a	182	214 ab	63
4. ATS 50% open flowers	89	165 abc	28.3 ab	175	195 ab	63
5. Treatments 3 + 4	101	161 abc	29.0 ab	186	167 a	68
6. K_2SO_4 FB + 4 WAFB	89	193 c	33.1 b	173	219 ab	68
7. 20 mg/L NAA 10-12 mm	87	174 abc	30.8 ab	183	214 ab	60
8. 150 mg/L BA 10-12 mm	90	165 abc	30.1 ab	186	190 ab	73
9. Treatments 7 + 8	94	138 ab	26.2 a	202	153 a	70
10. $Ca(OH)_2$ FB + 4 WAFB	96	168 abc	29.9 ab	179	200 ab	49
11. 200 mg/L ethephon FB	91	181 bc	29.8 ab	167	203 ab	72
F-test	NS	P<0.05	P<0.05	0.080	P<0.05	NS
$LSD_{0.01}$	-	49.3	5.5	30.7	75.5	-

FB = full boom; WAFB = weeks after full bloom; NS = not significant. Values within a column followed by the same letter(s) are not statistically different.

Table 8. Fruit size distribution (% yield) of 'Conference' thinning trial in 2007.

Treatment	<45 mm	45-50 mm	50-55 mm	55-60 mm	60-65 mm	65-70 mm	70-75 mm	75-80 mm	80-85 mm	>85 mm	>65 mm	Size index[1]
1. Untreated	0.67 b	1.9 bc	8.5 c	14.1 b	27.5 a	29.3 ab	14.1 a	3.5	0.5	0.0	47.4 a	332 a
2. Hand thinning	0.30 a	0.7 a	1.8 a	5.8 a	20.7 a	38.3 c	25.1 bc	6.3	0.6	0.3	70.7 b	399 b
5. 2x ATS	0.55 ab	2.3 c	6.3 bc	16.2 b	28.8 a	25.0 a	15.2 ab	5.0	0.5	0.0	45.8 a	337 a
9. NAA + BA	0.21 a	1.0 ab	2.8 ab	6.7 a	22.3 a	31.6 b	25.5 c	7.9	2.0	0.0	67.0 b	399 b
F-test	P=0.05	P=0.01	P<0.05	P<0.01	NS	P<0.01	P<0.05	NS	NS	NS	P<0.05	P<0.05
$LSD_{0.05}$	0.36	1.0	4.2	5.8	-	6.4	10.3	-	-	-	17.5	55.2

[1]Size index = (% <45*0.1) + (% 45-50*0.5)+(%50-55*1)+ ….. +(%80-85*7) + (%>85*8).

NS is not significant. Values within a column followed by the same letter(s) are not statistically different.

Table 9. Flower clusters, fruit set (fruits/100 flower clusters), yield, average fruit weight, and return bloom of the 'Conference' thinning trial in 2008.

Treatment	Flower clusters 2008	Fruits/tree	Yield/tree (kg)	Fruit weight (g)	Fruits/100 flower clusters	Return bloom 2009
1. Untreated control	108	123 e	27.5 d	227 bc	117 d	108
2. Hand thinning	109	119 de	28.6 d	239 c	111 c	109
Applied at 8.8 mm						
3. 20 mg/L NAA + 150 mg/L BA	110	29 a	9.1 b	310 d	28 a	110
4. 20 mg/L NAA + 200 mg/L BA	110	16 a	5.5 a	336 e	16 a	110
5. 20 mg/L NAA + 250 mg/L BA	109	16 a	5.2 a	321 de	16 a	109
Applied at 14.6 mm						
6. 20 mg/L NAA + 150 mg/L BA	108	101 bc	21.8 c	215 ab	96 bc	108
7. 20 mg/L NAA + 200 mg/L BA	107	106 cd	21.7 c	206 a	101 bcd	107
8. 20 mg/L NAA + 250 mg/L BA	107	88 b	18.8 c	214 ab	85 b	107
F-test	NS	P<0.001	P<0.001	P<0.001	P<0.001	NS
$LSD_{0.05}$	-	16	3.2	21	19	-

NS is not significant. Values within a column followed by the same letter(s) are not statistically different.

Table 10. Fruit size distribution (% yield) of 'Conference' thinning trial in 2008.

Treatment	<45 mm	45-50 mm	50-55 mm	55-60 mm	60-65 mm	65-70 mm
1. Untreated control	0.0 a	0.2 a	2.5 b	7.8 cde	22.0 cd	42.5 g
2. Hand thinning	0.5 a	0.8 ab	1.0 ab	5.0 bc	20.0 cd	42.0 fg
Applied at 8.8 mm						
3. 20 mg/L NAA + 150 mg/L BA	0.5 a	0.2 a	1.0 ab	0.2 a	4.5 a	15.5 b
4. 20 mg/L NAA + 200 mg/L BA	0.0 a	0.0 a	0.2 a	1.8 ab	2.2 a	6.5 a
5. 20 mg/L NAA + 250 mg/L BA	0.0 a	0.0 a	0.0 a	0.0 a	1.5 a	8.5 a
Applied at 14.6 mm						
6. 20 mg/L NAA + 150 mg/L BA	1.5 bc	1.5 b	4.2 c	10.8 ef	23.2 cd	35.5 cde
7. 20 mg/L NAA + 200 mg/L BA	1.5 bc	2.5 c	5.8 c	13.5 f	24.2 d	31.5 c
8. 20 mg/L NAA + 250 mg/L BA	2.0 c	3.0 c	4.5 c	10.2 def	21.5 cd	30.0 c
F-test	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001
$LSD_{0.05}$	0.8	0.9	2.0	4.1	5.5	6.0

Treatment	70-75 mm	75-80 mm	80-85 mm	>85 mm	>65 mm	Size index[1]
1. Untreated control	23.0 ab	1.2 a	0.5 a	0.0 a	67.2 bc	380 abc
2. Hand thinning	27.5 ab	2.8 a	0.2 a	0.0 a	72.5 c	395 bc
Applied at 8.8 mm						
3. 20 mg/L NAA + 150 mg/L BA	42.0 c	25.5 b	5.8 b	4.5 ab	93.2 d	516 d
4. 20 mg/L NAA + 200 mg/L BA	22.0 a	32.2 b	19.5 c	15.0 c	95.2 d	597 e
5. 20 mg/L NAA + 250 mg/L BA	28.0 ab	44.8 c	7.5 b	10.0 bc	98.8 d	580 e
Applied at 14.6 mm						
6. 20 mg/L NAA + 150 mg/L BA	19.2 a	2.2 a	0.5 a	0.8 a	58.2 ab	358 ab
7. 20 mg/L NAA + 200 mg/L BA	18.5 a	2.8 a	0.5 a	0.0 a	53.2 a	345 a
8. 20 mg/L NAA + 250 mg/L BA	22.0 a	6.0 a	1.0 a	0.0 a	59.0 ab	364 ab
F-test	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001	P<0.001
$LSD_{0.05}$	10.9	8.1	2.9	8.9	10.0	42

[1]Size index = (% <45*0.1) + (% 45-50*0.5)+(%50-55*1)+ ….. +(%80-85*7) + (%>85*8).

NS is not significant. Values within a column followed by the same letter(s) are not statistically different.

Table 11. Flower clusters, fruit set (fruits/100 flower clusters), yield, average fruit weight, and return bloom of the 'Conference' thinning trial in 2009.

Treatment	Flower clusters 2008	Fruits/tree	Yield/tree (kg)	Fruit weight	Fruits/100 flower clusters
1. Untreated control	107	203 a	27.0 c	134 a	190.8 e
2. Hand thinning	111	104 ac	21.1 bc	204 c	97.6 ab
3. 10 mg/L NAA + 100 mg/L BA	104	135 cg	22.8 bc	173 b	160.3 de
4. 10 mg/L NAA + 150 mg/L BA	109	100 ac	18.0 a	185 b	116.7 ac
5. 10 mg/L NAA + 200 mg/L BA	108	114 ad	20.6 b	183 b	147.8 cd
6. 20 mg/L NAA + 100 mg/L BA	108	114 ad	19.3 ab	171 b	108.1 ab
7. 20 mg/L NAA + 150 mg/L BA	103	83 a	13.8 a	168 b	128.5 bd
8. 20 mg/L NAA + 200 mg/L BA	113	85 a	14.7 a	175 b	92.5 a
F-test	NS	P<0.001	P<0.001	P<0.001	P<0.001
$LSD_{0.05}$	-	37	5.5	18	35.1

NS is not significant. Values within a column followed by the same letter(s) are not statistically different.

Figures

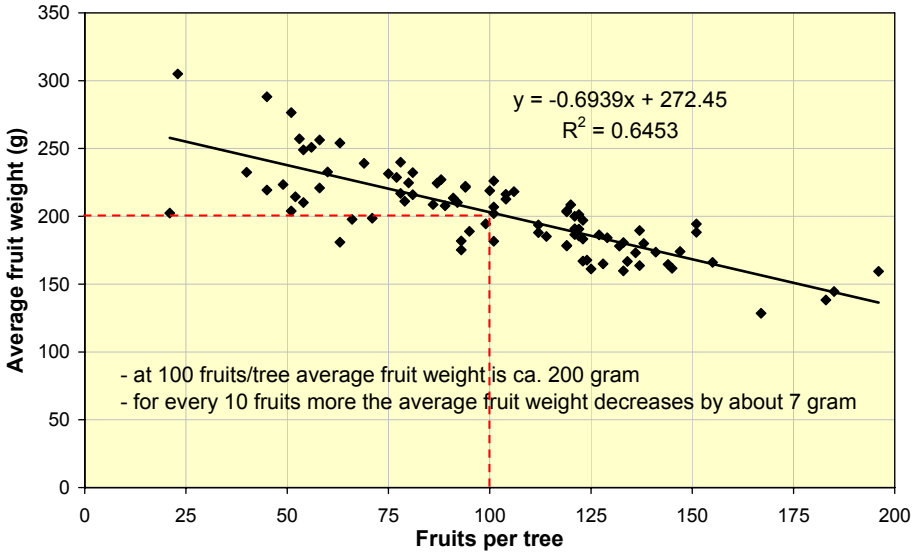

Fig. 1. Relationship between number of fruits per tree and average fruit weight at harvest for 'Conference' pear trees grown in an orchard at Randwijk, the Netherlands (3058 trees/ha).