Screening of agents for thinning blossoms of apple trees

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Abstract

In May 2001 different plant oils, lime sulfur, starch, Na-bicarbonate and three concentrations of salt were proofed for their suitability for thinning blossoms at the apple variety Pinova. The trees grew in a conventionally treated part of the experimental orchard in Heuchlingen. The experiment had the character of a screening. Side effects like russeting and damages of blossoms or leaves were registered too.

Keywords

Malus domestica (Borkh.), blossom thinning, vegetable oils, lime sulfur, Na-hydrogenbicarbonate, oxalic acid, sodium salt

Introduction

Organic fruit-growers have to thin blossoms at special cultivars like 'Elstar' to avoid alternate bearing. Other cultivars tend to bear so many apples, that the average fruit-size is too low at harvest. Thinning by hand needs a lot of man-power during a few weeks (up to 200 hours per ha). In the past preparations like Telmion or different soaps showed thinning-effects, but the apples were russeted severely (Strimmer et al. 1997, Pfeiffer 2000). At the moment lime sulfur is one of the possible thinning agents, but the weather circumstances have a big influence (see review from Bloksma, Jansonius 2001). The effect cannot be predicted surely and needs much empathy of the fruit grower.
To find alternative solutions a screening of different agents, that could have a thinning effect, took place in cooperation with the conventional fruit-research at the LVWO Weinsberg.

Material and Methods

The experiment took place on the conventionally managed experimental orchard Heuchlingen at the LVWO Weinsberg. 8 years old apple trees of the variety Pinova were at the disposal. Per treatment 5 trees with a high number of flower buds were chosen.
One group of agents were **vegetable oils** to find alternatives to Telmion, which causes problems with russeting. Within **caustic agents** lime sulfur and ATS served as comparisons for organic respectively conventional growers. **Pasting the stigmata** was the idea behind the impact of wheaten flour, potato starch and similar substances. To **repel insects** from the flowers menthol and tea from walnut leaves were sprayed.
At the beginning of blossom (30th April 2001) and at full blossom (May 2nd 2001) the trees were treated by a portable sprayer with hand-pump dripping wet. Per

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tree were used 400 ml according to 1000 l/ha. Both times the weather was warm (20 to 25 C) and sunny, the temperature did not change during the next few days. All vegetable oils except for Telmion were formulated with Rimulgan (4 l per ha).

Table 1: Preparations, kg or l/ha, phytotoxicity at leaves (L) and flowers (F)

Preparation	Abbreviation	Per ha	Phytotoxicity
Lime sulfur	LS	30 l	L: residues, F: petals orange-brown
ATS 58 %	ATS	18 l	L: rims black-necrotic, F: petals often brown
Thistle oil	TH	26 l	F: damages middle
Telmion	TEL	30 l	L: pointed necroses, F: more than at TH
Control	CON	-	-
Sunflower oil	SF	26 l	L: shining, rims vaulted, F: middle
Olive oil	OL	26 l	L: rims necrotic at young L, F: middle
Rimulgan	RIM	4 l	L: small, F: clear to see, but only small
Nufilm	NU	20 l	L: -, F: petals sticky, small necrotic points
Vinegar + SF	V+SF	26 l +26 l	L: shining, F: petals clearly brown, middle
Potato Starch	PS	50 kg	L: fine residues, F: -
Wheaten Flour	W	50 kg	L: residues middle
W+Milk	W+M	50 kg + 50 l	L: residues middle
Menthol	MEN	< 1kg	-
Walnut Leaves-Tea	WAL	3 kg (dried)	L: - F: very small residues
Oxalic acid	OX	20 kg	L: severe necrotic, F: severe damages
Na-hydrogen-bicarbonate	NHC	10 kg	L: necrotic rims, F: petals dark orange-brown, stigmata partly attacked
Sodium salt	S 5	5 kg	L: little necrotic, F: petals weak
Sodium salt	S 10	10 kg	L: clear necrotic, F: petals middle
Sodium salt	S 15	15 kg	L: severe necrotic, F: petals middle

The number of clusters at the whole tree, the fruit setting after blossom and the fruit setting after june-fall were counted. The thinning effect was calculated by the difference in apples/100 inflorescences. In October every tree was picked separately for the calibration of size and colour with an AWETA-sorting-machine. Size was classified in 5 mm grades, colour in 5 classes. A spot check of 100 fruits was evaluated on russeting in 4 classes to get an estimation of the russeting-potential.

Results and discussion

For the initiation of flower-buds for the next year it is decisive, how many apples the tree is bearing at the beginning of June. The sheding prior to june-fall was strong at Sodiumhydrogencarbonate, oxalic acid and at all sodium-salt-variants. In some treatments a negative thinning effect could be watched, that means the fruit setting was higher than in the control (see table 2).

Table 2: Preparations, %thinning effect after blossom, yield (kg) per tree, average fruit weight in g

Preparation	% thinning	kg/tree	fruit weight (g)
Lime sulfur	–11,5	19,54	108,8
ATS 58 %	7,2	18,95	126,9
Thistle oil	22,3	23,50	116,6
Telmion	27,2	26,44	129,9
Control		24,03	113,5
Sunflower oil	30,3	18,95	112,8
Olive oil	35,2	25,38	109,3
Rimulgan	10,5	24,44	113,5
Nufilm	9,9	28,39	121,4
Vinegar + SF	–3,0	28,78	112,5
Potato Starch	–9,3	29,40	103,4
Wheaten Flour	–8,6	22,69	105,7
W+Milk	–5,1	27,77	107,5
Menthol	–11,7	26,05	107,7
Walnut Leaves-Tea	–4,8	27,03	107,1
Oxalic acid	30,3	19,31	133,3
Na-hydrogenbicarbonate	10,1	25,19	122,8
Sodium salt 5	8,2	25,36	120,7
Sodium salt 10	36,0	20,31	141,7
Sodium salt 15	52,4	25,53	139,6

A tree of that age and height needs about 120 apples per tree with a size of 75 to 80 mm for a balanced relation between leaves, fruits and reserves for the flower-buds for the next year. Trees of some treatments showed up to 250 apples at harvest, so that these were too small and green. In August the weather was very hot and dry, so conditions for the growing of the fruits were unfavourable.
Weak thinning effects of spraying treatments in organic orchards are the reason for a lot of thinning work by hand to regulate the bearing of the trees before junefall. To calculate the working hours a simple rule of thumb can be used: When 2200 tree/ha are planted and 1 apple per tree has to be removed, then per ha 1 hour is necessary. In diagram 1 the percentages of small (< 60 mm, red or green) or green (>60 mm, < 20 % colour) apples are stacked for a selection of variants.

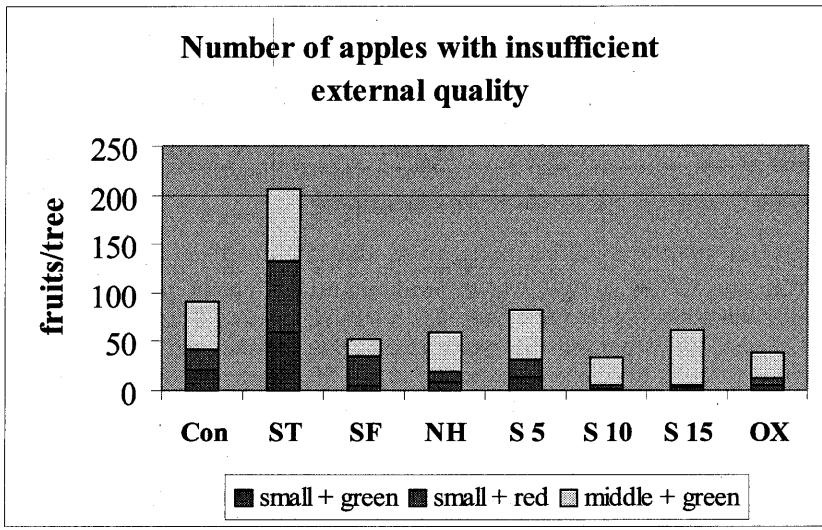

Diagram 1: number of apples per tree with insufficient external quality

Principally the difference in russeting of the fruits were low, categories 3 and 4 (10–30 % or >30 % russeted skin) were very seldom. Telmion and the oil treatments from thistles, olives and sunflowers had a little bit more apples in category 2 (>10 % russeted). More russeting was caused by sodium salt (15 kg/ha) and oxalic acid, but it was still so weak, that the fruits could be sold. The treatments with a higher proportion of acceptable external quality are shown in diagram 2.

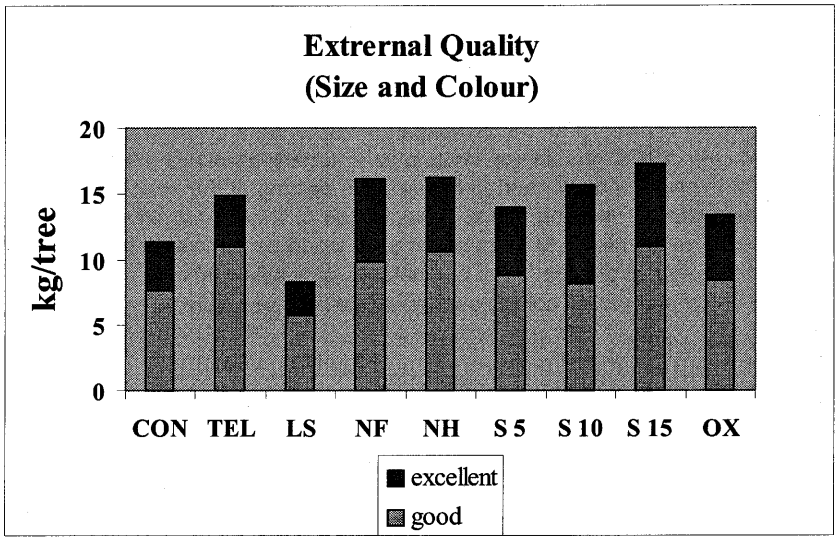

Diagram 2: kg per tree with good/excellent external quality

Sodium salt 15 has a high yield of good quality, but the leaves are damaged heavily, the growing of the branches was a little bit reduced. From the results of the harvest the treatments Na-hydrogencarbonate, sodium salt 10 and Nufilm seem to be worth to pursue in the season 2002. The concentrations of oxalic acid was very high and the leaves suffered very much. Depending on the natural content of oxalic acid, that could be dissolved from leaves of rhubarb, e. g., the concentration should be lower.

For the final judgement the number of flowers in the spring 2002 has to be considered, especially on the aspect, if the sodium salt or oxalic acid did not harm the assimilation capacity of the leaves.

Treatments during the blossom are not the single tool the organic fruit growers has to regulate the bearing of the trees. For 2002 experiments are planned, where whole rows shall be treated and the working hours left for thinning by hand shall be evaluated.

The described experiment has the character of a **screening** with a small number of trees per treatment. No statements can be done about interactions with sulfur or Mycosin or other organic sprayings, that are usually done in organic orchards round the blossom. Consequences towards russeting of the fruits cannot be excluded.

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