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Organic growing of apple in Denmark, 1987 to 1991

Through 5 years 11 apple varieties planted in 1987 were grown organic and integrated.

1989

Copper (0,25%) were sprayed at green cluster against twig scab and preventive treatment against scab was done with sulphur (0,4%) before flowering and (0,2%) after flowering. 1,6% of the organic grown apples got scab and 98,7% of the apples were first class in regard to scab (Table 1), (0,25 cm² scab on each fruit is accepted in first class).

4,5% of the apples were damaged by leafrollers (Table 2).

1990

Copper and sulphur were used as in 1989.

The damages caused by scab were acceptable. In average 2,6% of the fruits got scab and 99% fruits were first class in regard to scab (Table 1). In the integrated trial, there was no scab infection at the leaves when the ascospore spread stopped.

Therefore spraying were stopped, at the 6th of June.

At autumn, just before leafdrop, a spray with urea (2,0%) was done to get a better destruction of the leaves and less primary infection by scab.

In 1990 there were problems with rot in the calyx especially in the varieties 'Spartan' and 'Summerred' where 9% of the fruits were infected.

Pests were counted several times during the summer. Leafrollers

exceeded the economic threshold before flowering and were controlled with *Bacillus thuringiensis* (0,05%). Fruit tree spider mites exceeded the economic threshold in June and August (Table 3).

Late in the season there was an attack on 8,8% of the fruits caused by different species of leafrollers (Table 2). To find out which species caused the damage. In 1991 feromon traps for 8 relevant species were used to detect which species caused the damage.

1991

Copper and sulphur were used as in 1990, but the flowering period was very long due to cold weather and scab infection was heavy. We do not spray with sulphur during flowering, because sulphur has a thinning effect. In average 36,5% of the fruits were infected with scab and only 69,8% were accepted as first class fruits in regard to scab (Table 1).

Brown rot (*Sclerotinia fructigena*) attacked many of the fruits, specially fruits with scab or other wounds.

The number of eggs from the fruit tree spider mite exceeded the economic threshold, at the egg counting in March, so the trees were sprayed with 30 l mineral oil.

No pests were exceeding the limit in this season, but 8% of the fruits were damaged by leafrollers, and the apple sawfly (*Hoplocampa testudinea*) damaged 7,5% of Discovery and 14,5% of the Summerred fruits at harvest (Table 2).

1991 was a year with damage by night frost in the flowers. Therefore, many fruits got stripes caused by the frost.

Table 1.

Percent apples in first class in regard to fruitscab 1989-1991 at harvest on 11 apple varieties planted in 1987.

Variety	1989		1990		1991	
	Organic	IP	Organic	IP	Organic	IP
Aroma	100	100	100	100	98.0	99.5
Cox's Orange	98	100	100	100	71.5	95.5
Discovery	100	100	100	100	93.5	100.0
Elstar	99	100	100	100	75.0	97.5
Gloster	100	100	97	100	56.5	99.0
Jonagold	97	100	98.5	97	56.0	100.0
Mutsu*	-	-	94.5	99	51.08	99.5
Red Boskoop	98	100	99.5	99.5	94.5	99.5
Red Ingrid Marie	100	100	100	100	87.5	96.0
Spartan	99	100	100	100	72.0	98.5
Summerred	96	99	99.5	100	12	91.5
Average	98.7	99.9	99.0	99.6	69.8	97.9

* planted in 1988.

Table 2

Percent apples at harvest damaged by insects 1989 to 1991 average of 11 varieties.

	1989		1990		1991	
	Organic	IP	Organic	IP	Organic	IP
Capsid (Miridae)	0,9	0,7	1,9	1,7	0,1	0,4
Dock sawfly (Ametastegia glabrata)	0,2	0	0,3	0,5	0,0	0,2
Apple sawfly (Hoplocampa testudinea)	0,8	0,6	1,0	0,9	2,9	5,2
Codling moth (Cydia pomonella)	0,7	1,8	1,2	2,3	0,6	1,0
Moths and Noctuid (Geometridae and Noctuidae)	1,1	0,9	3,9	3,8	0,9	1,9
Tortrix moths (Tortricidae)	4,5	6,1	8,8	11,6	8,0	10,6

In 1990 the Fruittree spidermite (*Panonychus ulmi*) exceeded the economic threshold in the organic part of the trial, and not in the integrated part. Spraying with sulphur against scab didn't keep the mites under the threshold. Therefore, in the beginning of September, branch tendrils from trees with predatormites (phytoseiidae) were laid into each tree in both the organic and the Integrated treatment.

Branch sample in marts 1991 showed that the economic threshold for winter eggs from the fruit tree spider mite was exceeded. Therefore, we sprayed with mineraloil (2,0%). In 1991 there were no problems with fruit tree spider mites or apple rustmites (*Aculus Schlechtendali*). There was a good population of predator mites, 0,5 mites in average per leaf (Table 3). A spraying with 0.4% sulphur before flowering and 0,2% after flowering didn't harm the predatormites essential.

Table 3

Number of predatormites (phytoseiidae) per leaf and fruit tree spider mite (*Panonychus ulmi*) in organic and integrated apple trials in 1990 and 1991. Average of 11 apple varieties.

Predatormites

Fruittree spidermite

	Mites per leaf		Percent of leaves with more than 5 imago mites					
	1990	1991	1990		1991			
Organic	11/7 0,0	15/9 0,6	20/6 42	28/8 80	4/7 6	29/7 2	19/8 0	
Integrated	0,1	0,5	0	20	0	0	0	

102 Spraying plan 1989

ORGANIC

14/3	Copper	0,25%
12/4	Sulphur	0,40%
25/4	Sulphur	0,40%
8/5	Sulphur	0,20%
29/5	Sulphur	0,20%
16/6	Sulphur	0,20%
27/6	Sulphur	0,20%
11/7	Sulphur	0,20%
25/7	Sulphur	0,20%
10/8	Sulphur	0,20%
30/8	Sulphur	0,20%

INTEGRATED

14/3	Copper	0,25%
12/4	Baycor	0,025%, Euparen 0,05%
24/4	Baycor	0,025%, Euparen 0,05%
16/5	Baycor	0,025%, Euparen 0,05%
6/6	Baycor	0,025%, Euparen 0,05%
30/6	Baycor	0,025%, Euparen 0,05%
27/7	Baycor	0,025%, Euparen 0,05%
11/8	Baycor	0,025%, Euparen 0,05%
18/8	Baycor	0,025%, Euparen 0,05%
30/8	Baycor	0,025%, Euparen 0,05%

Spraying plan 1990

ORGANIC

20/3	Copper	0,25%
9/4	Sulphur	0,40%
17/4	Sulphur	0,40%
27/4	Sulphur	0,20%
7/5	Bacillus Thuringiensis	0,05%
14/5	Sulphur	0,20%
6/6	Sulphur	0,20%
15/6	Sulphur	0,20%
28/6	Sulphur	0,20%
13/7	Sulphur	0,20%
11/8	Sulphur	0,20%
3/11	Urea	1,70%
28/11	Cubber	0,25%

INTEGRATED

20/3	Copper	0,25%
17/4	Baycor	0,025% + Euparen 0,05%
7/5	Bacillus Thuringiensis	
10/5	Baycor	0,025% + Euparen 0,05%
	÷ Discovery	
14/5	Baycor	0,025% + Euparen 0,05%
6/6	Baycor	0,025% + Euparen 0,05%
3/11	Urea	1,7%
28/11	Cubber	0,25%

Spraying plan 1991

ORGANIC

18/3	OilemulSION	
8/4	Bordeauxliquid	(2,0%)
23/4	Sulphur	(0,4%)
6/5	Sulphur	(0,4%)
17/5	Sulphur	(0,4%)
18/6:	Sulphur	(0,2%)
25/6:	Sulphur	(0,2%)
11/7:	Sulphur	(0,2%)
25/7:	Sulphur	(0,2%)

INTEGRATED

4/4	2.25 kg Captan 83 + 0.75 kg Baycor
25/4	0.2 l Rubigan + 0.75 kg Euparen M (skurv).
6/5	0.2 l Rubigan + 2.25 kg Cadol (Gloster, Mutsu, Jonagold, Summerred)
17/5	0.2 l Rubigan + 2.25 kg Cadol (Gloster, Mutsu, Jonagold, Summerred)
27/5	1.0 kg Topsin
6/6	0.75 kg Baycor + 1.8 kg Euparen
14/6	0.75 kg Baycor + 1.2 kg Euparen
5/7	1.2 kg Baycor (KUR)
10/7	0.75 kg Baycor
15/7	0.75 kg Baycor
25/7	2.25 kg Captan 83 + 0.75 kg Torque
7/8	2.25 kg Captan

Yield kg per tree 1991 og 1988-91.

Planted 1987, distance 4 x 2 m

Variety/root stock	1991		1988-1991	
	Organic	Integrated	Organic	Integrated
'Aroma'/M26	39.3	37.5	58.5	57.4
'Cox's Orange'/M26	5.1	5.5	10.3	10.1
'Discovery'/MM106	14.9	18.1	29.7	32.8
'Elstar'/M26	22.3	23.3	47.9	48.0
'Gloster'/M26	19.7	27.2	53.3	58.9
'Jonagold'/M26	25.0	35.8	48.9	57.4
'Mutsu'/M9*	18.4	18.9	36.0	33.9
'Red Belle de Boskoop'/M26	19.8	28.4	35.8	49.4
'Red Ingrid Marie'/M26	18.2	22.5	39.8	36.2
'Spartan'/M26	24.3	22.9	46.2	46.9
'Summerred'/M26	16.1	31.5	37.6	53.2

* plantet 1988.

Summary

Organic and integrated growing of 11 apples varieties in 5 years. Scab was reduced to a acceptable level by cupper and sulphur in 1989 and 1990. In 1991 36,5% of the fruits were infected by scab. A long wet and cold flowering period caused heavy attacks. In the integrated trial only 2,1% of the fruits got scab in 1991. Damaged caused by leafrollers on the harvested fruits increased from 4,5 to 8% over the years. The populations of Apple rustmites and fruittree spidermites were controlled by predatormites in the integrated trial. In the organic trial trees were attacked by fruittree spidermites in 1990, and controlled by mineraloil and predatormites in 1991.