

## **Preventive and curative chemical treatment for control of black currant leaf spot (*Drepanopeziza ribis* (Kleb.) Höhnelt) and American mildew (*Sphaerotheca mors-uvae* (Schw.) Berk.) on black currant (*Ribes nigrum* L.).**

*Præventiv og kurativ bekæmpelse af skivesvamp (Drepanopeziza ribis (Kleb.) Höhnelt) og stikkelsbærdræber (Sphaerotheca mors-uvae (Schw.) Berk.) i solbær (Ribes nigrum L.).*

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### **Summary**

Two ergosterol biosynthesis inhibiting fungicides, penconazole/captan (Topas C 50 WP) and triadimefon (Bayleton 5 WP), were tested for their preventive and curative activity against black currant leaf spot (*Drepanopeziza ribis* (Kleb.) Höhnelt) and American mildew (*Sphaerotheca mors-uvae* (Schw.) Berk.) on black currant (*Ribes nigrum* L.) respectively. The preventive treatments for control of black currant leaf spot and American mildew were started at the growth stage three leaves unfolded and at all fruits set respectively. The onset of the curative treatments was when the first visible symptoms on the leaves were observed. With both diseases the curative treatment gave a significant lower control of the diseases than the preventive treatment probably because of a too large disparity between the period where the fungicides can perform their curative activity, and the period from infection to appearance of visible symptoms on the leaves.

In the black currant leaf spot experiment halving the dose of Topas C 50 WP by halving the spray volume in the first four sprayings of the preventive treatment before the foliage was dense and applying full dose and spray volume in the last six sprayings gave just as good a control of the leaf spot as applying full dose all the time.

**Key words:** Ergosterol biosynthesis inhibiting fungicides, preventive treatment, curative treatment, *Drepanopeziza ribis* (Kleb.) Höhnelt, *Sphaerotheca mors-uvae* (Schw.) Berk., *Ribes nigrum* L.

### **Resumé**

To ergosterol biosyntese inhiberende fungicider, penconazol/captan (Topas C 50 WP) og triadimefon (Bayleton 5 WP) blev afprøvet for deres præventive og kurative virkning mod skivesvamp (*Drepanopeziza ribis* (Kleb.) Höhnelt) og stikkelsbærdræber (*Sphaerotheca mors-uvae* (Schw.) Berk.) i solbær (*Ribes nigrum* L.). De præventive behandlinger mod skivesvamp og stikkelsbærdræber blev startet henholdsvis på vækststadiet tre blade udfoldede og alle frugter ansat. De kurative behandlinger blev startet, da de første synlige symptomer blev observeret på bladene. De kurative behandlinger gav en signifikant dårligere bekæmpelse af begge sygdomme end de præventive behandlinger. Det skyldes sandsynligvis, at perioden, hvori fungiciderne har en kurativ virkning, er for kort i forhold til perioden, fra infektionen sker, og til de første symptomer kan observeres på bladene.

Sprøjtning med halv dosering og væskemængde i de fire første sprøjtninger efterfulgt af sprøjtning

med fuld dosering og væskemængde i de resterende seks sprøjtninger gav en lige så god bekæmpelse af skivesvamp, som sprøjtning med fuld dosering og væskemængde i samtlige ti sprøjtninger.

**Nøgleord:** Ergosterol biosyntese inhiberende fungicider, præventiv og kurativ behandling, skivesvamp, stikkelsbærdræber, solbær.

## Introduction

Black currant leaf spot (*Drepanopeziza ribis* (Kleb.) Höhnelt) and American mildew (*Sphaerotheca mors-uvae* (Schw.) Berk.) are two important diseases on black currant (*Ribes nigrum* L.) in Denmark. Both diseases cause defoliation of the black currants which influences the crop the following year. Even a low level of infection will cause a loss of crop the following year (6, 7, 8, 19).

Black currant leaf spot perennate within the tissue of dead leaves on the ground. The primary infection is initiated by ascospores in the spring (6, 15). In the light of observations from a single plantation in one growth season Preece (15) found that the infection occurred during the grape stage.

American mildew perennate as perithecia formed on shoots on the bushes and on dead leaves on the ground besides as mycelium in the buds. The primary infection is initiated by ascospores in the spring (7, 10, 11, 13).

Observations by Jordan (10) from a single year showed that the discharge of ascospores started at the grape stage, had a top at full blossom and continued some days post blossom.

The traditional way to obtain control of the two diseases is by preventive fungicide treatments. However, the appearance of the ergosterol biosynthesis inhibiting fungicides which possess curative activity against a broad spectrum of fungi opens new approaches of disease control. Two such fungicides, penconazole and triadimefon were tested for their preventive and curative activity against black currant leaf spot and American mildew respectively.

## Materials and methods

### Leaf spot

The leaf spot experiment was carried out in 1986 and consisted of three treatments. The fungicide

penconazole/captan was used with 0.030/0.570 kg per ha (1.2 kg Topas C 50 WP per ha), which gives a very good control of black currant leaf spot according to Schadeegg and Rasmussen (16). One of the treatments was a standard preventive treatment with the first spraying applied 29 April at the growth stage 3 leaves unfolded. The subsequent sprayings were applied with an interval of 10–14 days with the last spraying applied post harvest 19 August, making a total of ten sprayings.

A second treatment was curative in the sense that the first spraying was applied when the first visible lesions on the leaves appeared. The subsequent sprayings were applied at the same times as the standard preventive treatment, i.e. every 10th–14th day. The first spraying was applied 4 July and the last one 19 August. It made a total of four sprayings. Compared to the standard preventive treatment the first six sprayings were omitted.

In a third treatment the dose and spray volume was varied proportionally to the density of the foliage, while the numbers and times of applications were identical to the standard preventive treatment. The first four sprayings were applied with half dose by halving the spray volume. From 13 June the foliage was estimated to be dense so the remaining six sprayings were applied with full dose.

The spray volume was fixed to 400 l per ha according to Nielsen and Kirknel (14). The spray equipment was a tractor-mounted mist sprayer »Holder« with an axial blower and three »Holder D-10« swivel spray nozzles with hollow cone Ø 1.5 mm at each side. Apart from this was the treatment with half dose, where a nozzle size of Ø 1.0 mm was used together with the same driving speed and a lower hydraulic pressure which ensured a halving of the spray volume to 200 l per ha. The experiment was performed in an experi-

mental orchard of black currants (*Ribes nigrum* L.) var. 'Greens Black' spaced at 1.25 × 4.00 m.

The experimental design was randomized blocks with four blocks and twelve bushes per plot. Beside the experimental treatments the black currants were sprayed twice with 0.051 kg fenarimol per ha (0.42 kg Rubigan per ha) for control of American mildew.

Assessment of the effect of the treatments was made according to the official guidelines (4) by estimating the proportion of laminas covered by necrosis of black currant leaf spot on 10 leaves from 10 shoots picked at random from every plot. Levels of infection were calculated according to *Townsend and Heuberger* (18). The dates of the assessments were 12 August just before harvest and 5 September post harvest.

#### American mildew

The mildew experiment was carried out in 1985 and consisted of two experimental treatments. A preventive treatment with four sprayings with 0.060 kg triadimefon per ha (1.2 kg Bayleton 5 WP per ha) at 3 and 21 June and 11 and 25 July and one spraying with 0.0051 kg fenarimol per ha (0.42 kg Rubigan per ha) 20 August. The four sprayings with triadimefon were applied at the growth stage all fruits set and the last spraying was applied post harvest. The second treatment was curative in the sense that the first spraying was applied when the first visible symptoms of infection appeared, which was 21 June. The sub-

sequent sprayings were applied at the same times as the preventive treatment and with the same fungicides. In comparison with the preventive treatment the first spraying was omitted.

Assessment of the effect of the treatments was made twice. First time 18 July after three and two applications respectively. The assessment was made according to the official guideline (3) by estimating the proportion of lamina covered with mildew on ten leaves from ten shoots picked at random from every plot. Levels of infection were calculated according to *Townsend and Heuberger* (18). The second assessment was made post harvest 2 September. At that time the infection of American mildew was so severe that some defoliation had occurred. The assessment therefore was made by sorting twenty shoots, picked at random per plot, infected or healthy.

The experiment was performed in the same experimental plantation as mentioned above in 'Greens Black' spaced at 1.25 × 4.00 m as randomized blocks with three blocks and eight bushes per plot.

No protective sprayings were applied to control other diseases or pests. The spray volume used was 1200 l per ha. The spray equipment was the same as described in the black currant leaf spot experiment and the nozzle size was Ø 1.0 mm.

#### Results

The results of the leaf spot experiment are shown in Table 1.

**Table 1.** The level of black currant leaf spot infection after three different treatments.  
*Angrebsgraden af skivesvamp på solbær efter tre forskellige behandlinger.*

Treatment <i>Behandling</i>	Dosage of <i>Dosering af</i> Topas C 50WP kg/ha	Spray volume <i>Væske-</i> <i>mængde</i> l/ha	Number of sprayings <i>Antal</i> <i>sprøjtninger</i>	Level of infection <i>Angrebs-</i> <i>grad</i>	
				12/8	5/9
1. Control / <i>Ubehandlet</i>	—	—	—	59c*	100c
2. Preventive / <i>Præventiv</i>	1.2	400	10	0a	3a
3. Curative / <i>Kurativ</i>	1.2	400	4	18b	50b
4. Preventive / <i>Præventiv</i> Before full leaf coverage <i>Før fuld løvfylde</i>	0.6	200	4		
After full leaf coverage <i>Efter fuld løvfylde</i>	1.2	400	6	1a	4a

\* Numbers followed by different letters within columns are significantly different ( $P < 0.05$ ).

*Tal efterfulgt af forskellige bogstaver i hver kolonne er signifikant forskellige ( $P < 0,05$ ).*

All the treatments significantly decreased the level of infection. The standard preventive treatment gave total control of the leaf spot which was significantly better than the curative treatment. Halving the dose before full leaf coverage also gave total control of the leaf spot infection.

The results of the mildew experiment are shown in Table 2.

**Table 2.** The level of American mildew infection on black currants after two different treatments.  
*Angrebsgraden af stikkelsbærdræber på solbær efter to forskellige behandlinger.*

Treatment <i>Behandling</i>	Number of sprayings <i>Antal sprøjtninger</i>		Level of infec. <i>Angrebsgrad</i>	
	18/7	2/9	18/7	2/9
1. Control <i>Ubehandlet</i>	—	—	71c*	71b
2. Preventive <i>Præventiv</i>	3	5	45a	57a
3. Curative <i>Kurativ</i>	2	4	53b	65b

\* See footnote Table 1 / *se fodnote tabel 1.*

The effect of triadimefon (Bayleton 5 WP) against American mildew was very unsatisfactory. Even though the preventive treatment gave a significantly better control of the mildew infection than the curative one.

### Discussion and conclusion

In both experiments the curative treatment gave a significantly lower control of the diseases than the preventive treatment. The explanation probably is a too large disparity between the period where the fungicides can performe their curative activity, and the interval from infection to appearance of visible symptoms on the leaves. For black currant leaf spot the interval from infection to appearance of visible lesions on the leaves is 7–14 days (6, 15).

The ergosterol biosynthesis inhibiting fungicides exhibit their activity after spore germination (12, 17). According to Eberle *et al.* (9) penconazole stops apple scab (*Venturia inaequalis* (Cooke) Wint.) development three to four days

after infection. The corresponding period for triadimefon is up to five days (17). If a corresponding period of biological activity of the fungicides comprises black currant leaf spot and American mildew the period of curative activity is exceeded when the first visible symptoms on the leaves can be observed. To obtain control of leaf spot and American mildew based on curative treatment, development of a disease prediction system is obviously necessary.

In the black currant leaf spot experiment both preventive treatments gave total control of the infection. From the experiment it is not possible to establish if this result is due to the dose of fungicide and the spray volume being adjusted to the development of the leaf coverage, or if the recommended dose of Topas C 50 WP is fixed too high. The absence of a difference between the effect of the full and the half dose certainly cannot be ascribed to low infection pressure. The conclusion must be that a considerable amount of Topas C 50 WP can be saved by halving the dose at least early in the growth season.

The efficiency of triadimefon (Bayleton 5 WP) against American mildew was very unsatisfactory although the dose used was twice the one approved by the Danish Research Service for Plant and Soil Science. Anonymous (5), Nielsen and Kirknel (14) and Schadeegg and Rasmussen (16) also obtained unsatisfactory control of American mildew on black currants by use of triadimefon in 1985. The low efficiency cannot be ascribed to too few sprayings or to a too late start of the applications, because in the experiment by Anonymous (5) the first spraying of a total of eight sprayings was applied before blossom. Experimental results from 1978 (1) and 1980 (2) on the other hand show a very good effect of triadimefon against American mildew. The results indicate that, for some reason, the effect of triadimefon against American mildew has been considerably reduced.

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