

## **Alternative fungicides to control apple scab in organic apple production: results of an orchard trial in 2003**

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Apple scab, caused by the fungus *Venturia inaequalis*, is the disease that most often decreases yield and causes loss of fruit quality in organic apple production. Damage to the fruits consists of brown to black spots, but in some years and on some varieties attacks can result in small misshapen fruits, that are totally unsuitable for fresh consumption.

### **Scab control in organic apples**

Some, but not all organic apple producers use elemental sulphur to control apple scab. Sulphur is the only fungicide with an effect against the disease that is permitted for use in organic growing in Denmark. In contrast, in most other European countries, other compounds are allowed including copper and copper is very effective against scab and several other diseases. In fact the use of copper as a fungicide has been withdrawn from the Danish market for nearly ten years. Both in Denmark and throughout Europe there is an urgent need for effective alternatives to control apple scab as sulphur is not very effective and the use of copper in the EU will be phased out from 2006.

In the DARCOF-project "StopScab" (<http://www.darcof.dk/research/darcofii/i14.html>) the effects of plant extracts, essential oils and resistance inducers <sup>(1)</sup> on apple scab are under investigation. The project is a collaborative effort between The Royal Veterinary and Agricultural University (KVL) and The Danish Institute of Agricultural Sciences (DIAS).

The selection of potential alternative compounds with efficacy against the apple scab fungus is carried out on apple seedlings in growth-rooms at KVL. The most promising of these compounds are tested in orchards at DIAS under natural infection levels. The first of the promising alternatives were tested in the orchard in 2003.

### **Potential new compounds.**

Three new compounds were tested on apple trees of the variety 'Delorina'. The trees had been growing under unsprayed organic conditions since 1998. The new materials were 'Bion<sup>TM</sup>', 'Quiponin<sup>TM</sup>' and C-pro <sup>(2)</sup> and timing of application was decided by using the apple scab-warning programme, RIMpro.

The three products have different modes of action. The main ingredient of 'Bion<sup>TM</sup>' is Acibenzolar S-methyl. Bion is a synthetic material and therefore unsuitable for use in commercial organic production systems. It was included in the trial because it is known to activate the natural defence mechanisms of the plant. 'Quiponin<sup>TM</sup>' is an extract of the plant *Quillaja saponaria* and has a potential natural fungicidal effect. 'C-pro' is an extract of grape fruit seeds. Elemental sulphur is a contact fungicide and was used as the standard treatment. The control treatment was unsprayed. Sulphur, Quiponin and Bion were used preventively while C-pro was used curatively, after apple scab infections had occurred.

### **Less effective than sulphur.**

2003 was a year with generally severe apple scab infections. Treatments with the materials stopped at the end of the primary infection period and infections were assessed 2 weeks later on July 2<sup>nd</sup>. Although the best disease control was achieved with sulphur (table 1), the three new potential compounds also reduced apple scab infections compared to the untreated trees. Bion showed a slightly better effect than Quiponin and C-pro, but it also increased the amount of russetting on the fruit skin.

The reduction of apple scab infections was greatest on the rosette leaves, which are the leaves that emerge first from the buds, close to the fruits. These leaves stop growing and become age-resistant to the apple scab fungus earlier than the leaves produced from the new shoots.

The importance of an effective apple scab control becomes very clear following a look at the yield figures (Table 1). Apple scab control using sulphur doubled the yield despite sulphur's less than 100 percent effective control of apple scab.

In 2004 we are repeating the orchard trial with the three potential compounds to control apple scab and also testing new compounds from the growth-room screenings.

Table 1. Control of apple scab on the variety 'Delorina' in 2003 with sulphur and alternative fungicides: Yield, number of treatments, percentage of non infected leaves on annual shoots, rosettes and fruits on 2<sup>nd</sup> July, two weeks after the end of the primary infection period.

<b>Alternative fungicides used*</b>	<b>Number treatments 2003</b>	<b>Annual shoots: % leaves without scab</b>	<b>Rosettes: % leaves without scab</b>	<b>% fruits<sup>(1)</sup> without scab</b>	<b>Yield Kg/tree</b>
<b>1. Control</b>	0	17,5 c**	28,4 d	20,8 c	6,2 b
<b>2. Sulphur</b>	8	51,8 a	87,8 a	71,7 a	12,7 a
<b>3. Quiponin<sup>TM</sup></b>	8	23,1 c	35,9 cd	35,0 bc	8,8 b
<b>4. C-pro.</b>	5	24,2 c	44,0 bc	26,7 c	8,2 b
<b>5. Bion<sup>TM</sup></b>	7	33,2 b	54,1 b	45,0 b	7,1 b

\* Quiponin<sup>TM</sup> was supplied by Nor-Natur ApS and Bion<sup>TM</sup> by Syngenta Crop Protection AG. In Denmark, only sulphur is currently allowed for use in organic apple production. \*\* Numbers followed by the same letters are not significantly different.

<sup>(1)</sup> For more information on inducers and induced resistance see the article "New ways to control apple scab: utilization of the plants' own defence mechanisms" elsewhere in this issue.

<sup>(2)</sup> Quiponin<sup>TM</sup> was supplied by Nor-Natur ApS and Bion<sup>TM</sup> by Syngenta Crop Protection AG.