

## WHITEPAPER

# Effective mildew suppression without adverse effects with Intra Eco Shield

Bio-stimulant to trigger the plant's defence mechanism

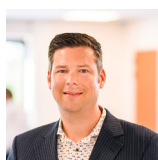


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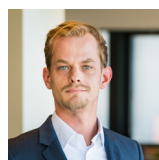
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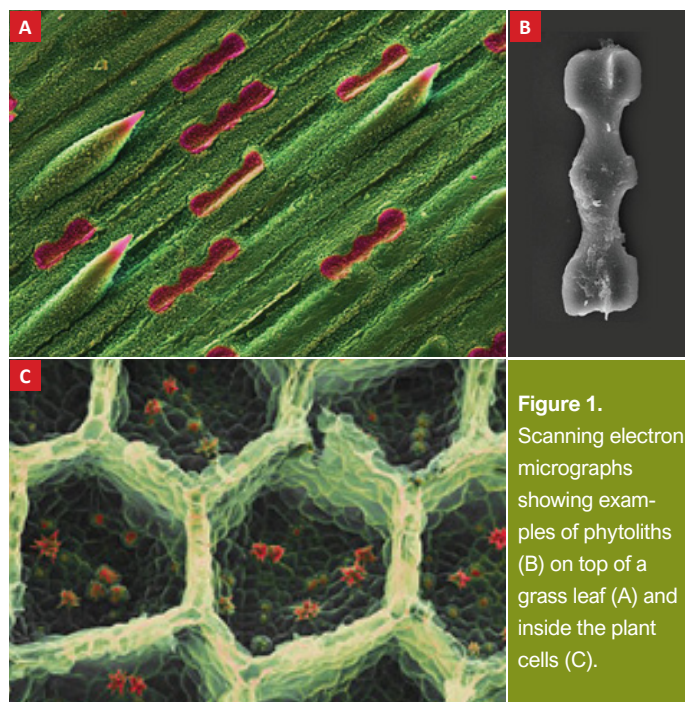
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**Figure 1.**  
Scanning electron  
micrographs  
showing exam-  
ples of phytoliths  
(B) on top of a  
grass leaf (A) and  
inside the plant  
cells (C).

Plant pathogens are traditionally controlled using pesticides, but a more sustainable approach is to make use of the plant's own defence mechanisms. Bio-stimulants are substances that boost the plant immune system and thereby prevent the spread and severity of diseases. The natural element silicon (Si) is such a biostimulant. Silicon is not essential for plant nutrition, but a wide range of beneficial effects of silicon has been reported when plants are exposed to abiotic stress situations (heat, drought, salt, etc.) or biotic stress situations (bacteria, fungi, insects, etc.).

One of these beneficial effects is thought to be caused by anatomical changes in plant tissues due to silica deposition in cell walls (biomineralisation to form phytoliths, see **Figure 1**).

Silicon-containing products are commercially available, but only the small soluble, non-polymerised fraction of these mixtures is bio-available for plants. Intracare has now invented a method to formulate an exceptional high concentration of bio-available orthosilicic acid (Intra Eco Shield). The toxic effect on plant growth (phytotoxicity) of this innovative formulation was evaluated on an active (cucumber) and a passive (tomato) silicon accumulator, and its efficacy against powdery mildew infection was assessed in cucumbers.

### Test set-up and evaluation

Tomato (*Solanum lycopersicum*) and cucumber (*Cucumis sativus*) plants were grown in gutters with drippers on rockwool slabs under LED lights 18 h on/6 h off, mimicking commercial greenhouse conditions. Water pH was maintained between 5.5 and 6.5 and standard commercial plant nutrients were added.

Phytotoxicity test: Two gutters with tomato plants and two gutters with cucumber plants were used to assess the phytotoxicity of the formulation. For each species, one gutter received one day per week application of 1,000 ppm Intra Eco Shield for the duration of 43 days. The other gutter received water treatment and served as control group.

### No phytotoxicity observed

The application of 1,000 ppm Intra Eco Shield at 1 day per week for the duration of 43 days did not result in any statistical differences in height between treatment and control for both tomatoes and cucumbers. The plant condition score remained very close to 1 indicating no negative effect of Intra Eco Shield treatment on plant health.

The cucumber fruit yield at the end of the phytotoxicity test period is provided in **Table 1**. The differences in weight and density were not significant between the two groups, the increase in volume for the test group was statistically significant. This implicates that the high dose Intra Eco Shield application did not have any negative effect on the cucumbers, and even may have been positive on the fruit yield.

**Table 1** Fruit yield

PARAMETER	N	WEIGHT (G)	VOLUME (CM3)	DENSITY (G/CM3)
Untreated controls	20	219	217	1.027
Intra Eco Shield	20	229	243	0.968
Difference		10	26*	-0.059

\*p<0.05

### Mildew infection:

Two other gutters with cucumber plants were experimentally infected by spraying a suspension with powdery mildew spores onto them. One week after infection, treatment with 500 ppm Intra Eco Shield one day per week was started in one gutter, the other gutter received water treatment and served as control group.

#### Assessment of phytotoxicity:

**Condition score** = *wilting x chlorosis x necrosis* - 1, where condition score 0 indicates a healthy plant.

- *Wilting* was scored as 1 (none), 2 (hanging leaves), or 3 (both hanging leaves and stem).
- *Chlorosis* was scored on a scale from 1 (none) to 10 (very severe).
- *Necrosis* was scored on the affected leaf area as 1 (0-10%), 2 (10-20%) up to 10 (90-100%).

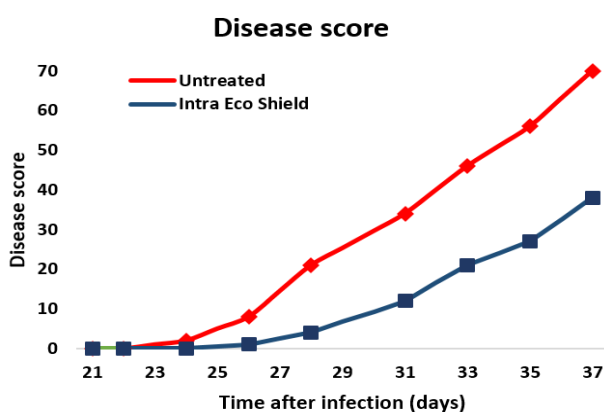
#### Assessment of infection:

**Disease score** = *wilting x chlorosis x necrosis x disease severity* - 1

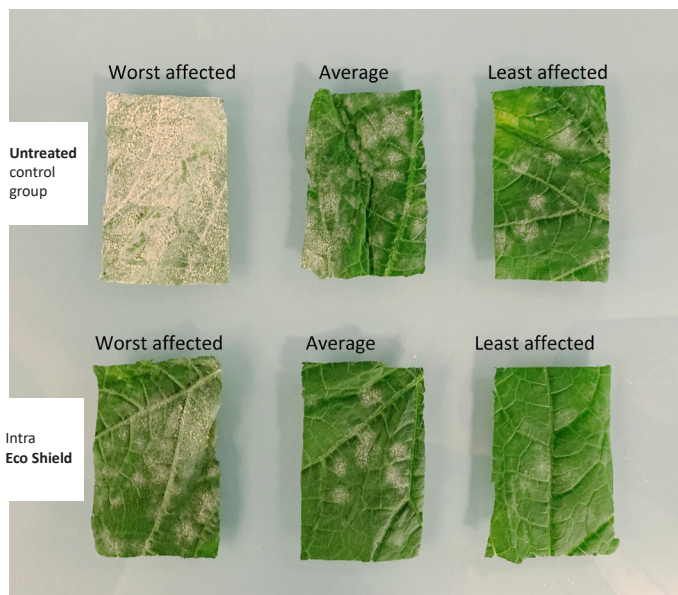
- *Disease severity* of infection with powdery mildew was scored on a scale from 1 (0-10%) to 10 (90-100%) based on the percentage of the leaf coverage with powdery mildew.

### Effectivity against powdery mildew infection

The disease score of infected cucumbers that were treated with Intra Eco Shield showed a later onset of disease of approximately four days and disease progression increased slower than that of the untreated cucumbers (**Figures 2 and 3**). This later disease onset gives the plant the opportunity to grow stronger and the slower progression provides the grower with more time to intervene.



**Figure 2** Development of the disease score in time of treated and untreated cucumber plants that were experimentally infected with powdery mildew.



**Figure 3** Representative example picture of cucumber leaves of the untreated control group (top row) and Intra Eco Shield treated test group (bottom row) on day 31. Examples are provided of the worst affected (left), average (middle) and least affected (right) leaves. The average control leaves in this example (top middle) are covered with powdery mildew for approximately 30%, the treated leaves (bottom middle) for approximately 10%.

Intra Eco Shield is a safe and effective bio-stimulant

The unique formulation of Intra Eco Shield is high in soluble bioavailable silicon. No signs of phytotoxicity were observed after the weekly addition of 1,000 ppm Intra Eco Shield for the duration of 6 weeks. The observed positive trend on fruit yield will be further investigated. This demonstrates that the intended working concentration of 500 ppm is safe to use. The weekly application of 500 ppm Intra Eco Shield on cucumbers experimentally infected with powdery mildew resulted in a slower onset of disease symptoms and a decreased disease progression. Intra Eco Shield is thus a functional biostimulant able to effectively suppress and delay plant diseases.



Prevent fungal infections like **MILDEW** by creating an eco shield in the cell walls