



Using Silicon to Suppress Hemp Powdery Mildew

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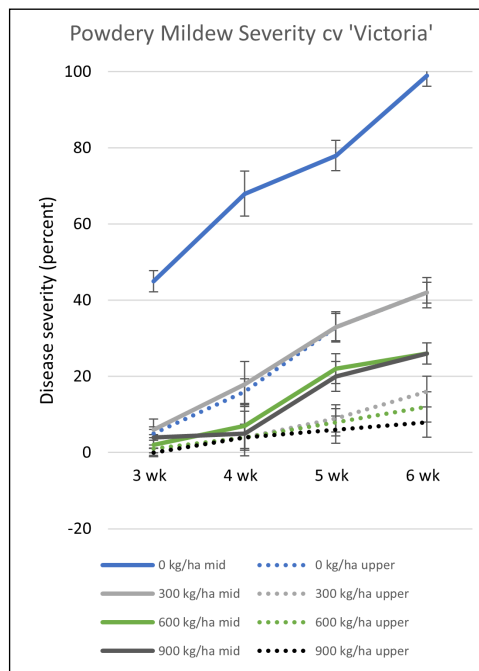
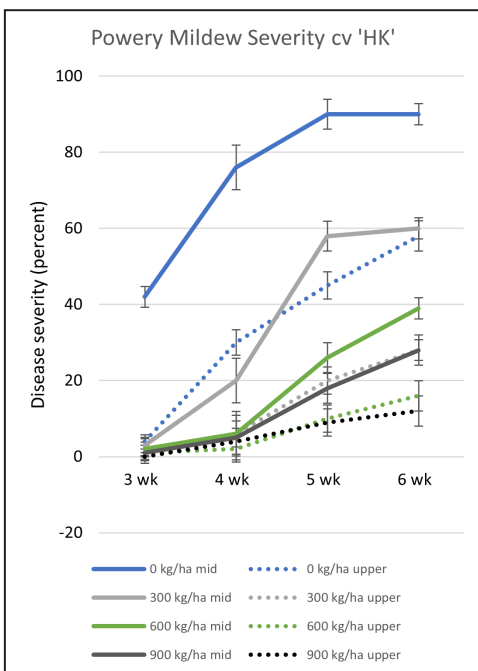
Powdery mildew is a major disease of *Cannabis sativa*, particularly in controlled systems such as greenhouses and indoor operations. This disease has also been observed under field conditions in temperate climates. There are limited management options for diseases of cannabis crops, including powdery mildew, especially since the EPA has only recently considered conventional products for labeling. Further, growers seek effective biological and cultural options for disease management as a result of market demand for organically grown or nonsprayed plant material.

Silicon has been documented to decrease a number of plant diseases, including powdery mildew on barley, cucumber, grape, pumpkin, and rose. Silicon has been reported to improve plant strength and cell rigidity as a result of polymerization of silicic acid in xylem tissues. Silicon has also been documented to change the plant's response against pathogen infection at the physiological, biochemical, and molecular levels. Research also has shown that root applications of silicon are more effective at reducing powdery mildew development than when applied to leaves.

This research examined the potential of root-applied silicon to accumulate in plant tissues and reduce powdery mildew development on hemp grown under greenhouse conditions.

To evaluate the effects of silicon on powdery mildew development, three rates of silicon (Si) were incorporated into the potting mix. Rates selected for these experiments, 300, 600, and 900 kg/ha Si (268, 535, 803 lbs/acre). Two hemp cultivars were used for all experiments: 'HK' a proprietary cultivar from Kentucky and 'Victoria' a commercially available cultivar from Canada. Hemp was planted into a peat-based potting mix (Pro-Mix MP, Premier Tech Home and Garden, Quebec, Canada) amended with wollastonite (calcium silicate, 24% Si, Vansil W-10 Wollastonite, Vanderbilt Minerals, Norwalk, CT). Plants were maintained per standard horticultural practices regarding fertility and insect management.

Plants were rated for powdery mildew severity based on percentage of affected leaf area. Ratings were taken weekly beginning at week 3 and ending on week 6.



POWDERY MILDEW SEVERITY SHOWN AS PERCENTAGE LEAF AREA FOR HEMP CULTIVARS 'HK' AND 'VICTORIA' AT UPPER-CANOPY AND MID-CANOPY FOR ROOT-APPLIED SILICON RATES OF 0, 300, 600, AND 900 KG/HA (268, 535, 803 LBS/ACRE). ERROR BARS INDICATE STANDARD ERROR OF THE MEAN.

This study confirmed that silicon can effectively reduce powdery mildew development for at least six weeks in hemp. In this study, root-applied silicon resulted in 82.7% and 82.0% reduction in disease severity for ‘HK’ and ‘Victoria’ cultivars, respectively,

While 300 kg/ha was sufficient to suppress disease in the upper canopy, the 600 kg/ha treatment was the most efficacious for the mid-canopy. The 900-kg/ha treatment did not provide disease suppression beyond that of the 600 kg/ha rate. **Thus, 600 kg/ha total Si (535 lbs/acre) is a good recommendation rate for applying to soilless mixes to suppress powdery mildew in the entire canopy.** Available Si in wollastonite is more than most other silicate products; growers should take note of amount of Si in different products.

Silicon can become a vital component of a disease management strategy for the hemp and marijuana industry, especially when growing plants in soilless mixes that are low or limiting in soluble silicon. This study showed that silicon may be a viable option in an integrated disease management strategy, whether used alone or in combination with other cultural practices or biopesticides.

In addition to powdery mildew, silicon has been reported to reduce or suppress a large number of fungal and bacterial diseases, including *Bipolaris* spp., *Cercospora* spp., *Fusarium* spp., and *Septoria* spp., all of which have been reported as important diseases of hemp. Thus, consideration of silicon as a disease management option in field-grown cannabis should be explored.

In conclusion, silicon accumulation in hemp leaves and suppression of powdery mildew in upper and mid-canopies was confirmed in this study. These findings suggest that silicon should be considered as part of a powdery mildew management program, particularly in greenhouse and indoor environments where powdery mildew is the most limiting factor, and where hemp is grown in soilless mixes that are low or limiting in soluble silicon. As hemp becomes more established in the U.S. and beyond, we expect increased demand for pesticide-free disease management, and silicon unquestionably fits in this strategy.

POWDERY MILDEW SEVERITY (PERCENT AFFECTED LEAF AREA) AND AUDPC FOR HEMP CULTIVARS ‘HK’ AND ‘VICTORIA’ (V) AT UPPER-CANOPY AND MID-CANOPY FOR ROOT-APPLIED SILICON.

	3 wk upper canopy	4 wk upper canopy	5 wk upper canopy	6 wk upper canopy	3 wk mid-canopy	4 wk mid-canopy	5 wk mid-canopy	6 wk mid-canopy
HK 0 kg/ha	4 a	30 a	45 a	58 a	42 a	76 a	90 a	90 a
V 0 kg/ha	5 a	16 b	33 a	42 ab	45 a	68 a	78 a	99 a
HK 300 kg/ha	1 b	6 c	20 b	28 b	3 cd	20 b	58 b	60 b
V 300 kg/ha	0 b	4 d	9 c	16 c	6 b	18 b	33 c	42 c
HK 600 kg/ha	1 b	2 d	10 bc	16 c	2 de	6 c	26 cd	39 cd
V 600 kg/ha	1 b	4 d	8 c	12 c	2 de	7 c	22 cd	26 d
HK 900 kg/ha	0 b	4 d	9 c	12 c	1 e	5 c	18 d	28 cd
V 900 kg/ha	0 b	4 d	6 c	8 c	4 bc	5 c	20 d	26 d

Severity ratings shown for weekly ratings beginning at week 3; disease severity was zero at week 1. Ratings with the same letter are not significantly different from each other. Data analyzed using the Waller Duncan *k*-test.

Complete research study can be found at

Dixon, E., Leonberger, K., Amsden, B., Szarka, D., Munir, M., Paye, W., Datnoff, L., Tubana, B., Gauthier, N. 2022. Suppression of Hemp Powdery Mildew Using Silicon as a Root-Applied Amendment. *Plant Health Progress* 10.1094/PHP-01-22-0005-SC.

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