

INCORPORATION OF CRUCIFER GREEN MANURES
TO REDUCE APHANOMYCES ROOT ROT OF SNAP BEANS

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Aphanomyces root rot of bean, caused by the soilborne fungus Aphanomyces euteiches f. sp. phaseoli, is severe in the irrigated Central Sands area of Wisconsin. Previous research indicates that incorporation of crucifer green manures is useful in reducing the severity of Aphanomyces root rot of peas (Muehlchen and Parke, in press). Disease suppression is believed to result from the effects of crucifer glucosinolates which break down in soil to form isothiocyanates, volatiles which are toxic to many soilborne fungi (Papavizas, 1966). Volatiles released by decomposing crucifers were shown to directly inhibit the growth of Aphanomyces euteiches f. sp. pisi in vitro and were also involved in disease suppression (Muehlchen, 1988). This experiment was designed to determine if crucifers incorporated as green manures would reduce the severity of Aphanomyces root rot of snap beans as compared to a standard rotation crop, sweet corn.

The experiment was conducted at the Hancock Experimental Farm in the Central Sands area of Wisconsin in a field naturally infested with Aphanomyces root rot. In May, 1987, four crops were planted in plots (41 m²) arranged in a randomized complete block design, with four replicate blocks per crop. The crops were: snap beans 'Evergreen', sweet corn 'Natural Sweet 9000', curled mustard greens 'Southern Giant Curled', and cabbage 'Brunswick'. Snap beans and corn were sown in rows 0.91 m apart. The crucifers were planted with a grain drill in rows 17.8 cm apart and thinned by hand. In September, 1987, after corn and snap beans were harvested, plant residues from each of the four crops were chopped and disked.

In June, 1988, snap beans 'Evergreen' were sown in each plot. At planting, soil was also collected from each plot for determination of Aphanomyces propagule numbers using the "most probable number" method (Pfender et al., 1981). Disease severity was determined 5 wk after planting by rating 25 plants per plot according to a 0-4 rating scale, where 0=healthy plant and 4=dead plant (Pfender and Hagedorn, 1982). Four center rows, 4.6 m in length, were harvested from each plot with a 2-row bean harvester. The fresh weight of commercial grade snap beans was then determined.

Results of this experiment are shown in Table 1. All comparisons are made against the standard rotation crop, sweet corn. The soil population of Aphanomyces, and disease severity of 1988 snap beans, was significantly higher in the plots where snap beans had been grown in 1987. There were no significant differences among the crucifer and sweet corn treatments with regard to Aphanomyces populations or disease severity. Snap bean yield in 1988 was

significantly reduced in plots where snap beans had been grown the year before. However, snap bean yield in 1988 was significantly greater in plots where cabbage was grown in 1987 as compared to plots where sweet corn was grown as the 1987 crop. These results suggest that crucifer green manures could be useful in reducing *Aphanomyces* root rot of snap beans when grown as a full-season crop. Experiments are underway to determine if crucifers could be planted as a fall or spring crop to reduce *Aphanomyces* root rot of snap beans planted subsequently.

Table 1. Effect of 1987 crop or crucifer green manure on *Aphanomyces* root rot of snap beans in 1988.

1987 crop	1988 Snap Beans		
	<i>Aphanomyces</i> population (ppg) ¹	disease severity rating ²	yield (kg/18.3 m row)
sweet corn	1.2	1.35	11.3
snap beans	67.4*	2.38*	6.0*
curled mustard	1.1	1.22	12.4
cabbage	1.2	1.38	15.0*

* Significantly different from corn; P=0.05 Dunnett's Test

¹ Propagules per gram soil, estimated by the "most probable number method"

² 0-4 scale, 0=healthy plant and 4=dead plant

References

- Muehlchen, A. M. 1988. Evaluation of the potential to control *Aphanomyces* root rot of peas with incorporated crucifer green manures. 94 p. M.S. thesis, University of Wisconsin-Madison.
- Muehlchen, A. M. and J. L. Parke. Evaluation of crucifer green manures for controlling *Aphanomyces* root rot of peas. Plant Disease (in press).
- Papavizas, G. C. 1966. Suppression of *Aphanomyces* root rot of peas by cruciferous soil amendments. *Phytopathology* 56:1071-1075.
- Pfender, W. F. and D. J. Hagedorn. 1982. *Aphanomyces euteiches* f. sp. *phaseoli*, a causal agent of bean root rot and hypocotyl rot. *Phytopathology* 72:306-310.
- Pfender, W. F., D. I. Rouse, and D. J. Hagedorn. 1981. A "most probable number" method for estimating inoculum density of *Aphanomyces euteiches* in naturally infested soil. *Phytopathology* 71:1169-1172.