Shallow Planting and Fungicide Application to Control Rhizoctonia Stalk Rot of Celery

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ABSTRACT

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Celery seedlings were transplanted in unridged rows with the crown at 0.0, 1.3, and 4.0 cm below or 1.3 cm above the soil line. Seedlings transplanted at a depth of 4.0 and 0.0 cm had 3.3 and 2.2 infected petioles per plant, respectively. Comparative plantings on ridged rows further reduced petiole infections in the plantings at 1.3 cm only. Spraying with chlorothalonil on a 4- to 5-day schedule starting 6 wk after transplanting significantly reduced petiole damage at all planting depths. The best control, an average of 0.2 or fewer infected petioles per plant, was achieved by spraying plants planted shallower than 4.0 cm. Stalk rot was equally suppressed when chlorothalonil was applied with or without drop nozzles.

Additional key words: cultural control

Stalk rot, a major disease of celery (*Apium graveolens* L.) that is incited by *Rhizoctonia solani* Kühn, is favored by high temperatures and moist conditions. Symptoms appear first as discrete lesions on the base of the petioles near the soil. Under favorable conditions, established lesions continue to expand and the fungus invades adjoining petioles at the base of the stalk. At harvest it thus becomes necessary to trim the infected petioles, resulting in grade reduction and yield loss.

Early reports (3,9) have described the symptoms and identified the fungus causing stalk rot on celery, but limited information is available for its control. Growers now rely on inefficient preventive fungicide spray programs to suppress the disease. Fungicides effective in controlling *Rhizoctonia* are available for use on celery; however, we lack information on timing and proper methods of application. The value and effectiveness of cultural control measures on this disease are not known. This study was designed to improve stalk rot control by testing the influence of planting depth, planting on ridged rows, timing of fungicide applications, and use of drop nozzles to obtain better coverage.

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MATERIALS AND METHODS

Three experiments were conducted from 1978 through 1980 in research plots on an organic soil having a history of severe stalk rot. Twelve-week-old, bare-root seedlings (pulled from seedbeds) were transplanted with the base of the crown at 1.3 or 4.0 cm below the soil surface. For shallower plantings, I used 7-wk-old, container-grown plants (Speedling Inc., Sun City, FL 33586 [1]) with the crown at or 1.3 cm above the soil surface. This depth is made possible by the support from the molded root system of these plants. All planting depth treatments were conducted on ridged and unridged rows. The ridges were mound shaped, 7.6 cm high and 21.0 cm wide at the base. Seedlings were transplanted in 7.6-m rows spaced 0.9 m apart. Treatments were replicated four times and arranged in a randomized complete block design.

Chlorothalonil (Bravo 500) was used at the rate of 2.0 kg a.i./ha in 935 L of water per hectare to test methods and timing of fungicide application for stalk rot control. Applications were made with a sprayer equipped with three over-the-row and two drop nozzles per row. The drop nozzles, one on each side of the row, were directed at the base of plants. Chlorothalonil applications were made on a 4- to 5-day schedule with or without drop nozzles and commenced either 1 or 6 wk after transplanting. The same amount of fungicide was applied with or without drop nozzles by altering the application pressure.

Chlorothalonil was not applied to treatments where the effect of planting depths and ridging alone were being examined. However, I applied mancozeb (Manzate 200, 1.8 kg a.i./ha) to these treatments every 4–5 days to control foliar disease. Mancozeb was also applied the first 5 wk after planting to treatments not receiving chlorothalonil until 6 wk after planting. Previous studies indicated that mancozeb does not satisfactorily control stalk rot (Pieczarka, *unpublished data*).

The experiments were harvested 13 wk after planting, and the infected petioles of marketable size on each stalk were counted. Severity of infection was rated on a six-point scale with 0 indicating no lesion and 6 the largest lesion. Yield loss was determined by weighing stalks before and after infected petioles were trimmed. Data were subjected to analysis of variance and means were separated by Duncan's multiple range test.

RESULTS

Stalk rot damage and yield losses were reduced by shallow planting in ridged rows (Table 1). Plants grown from depths of 0.0 and 1.3 cm produced only 1.5 and 1.4 infected petioles per stalk, for a weight reduction of about 10% when trimmed. By contrast, plants grown at depths of 4.0 and 1.3 cm in unridged rows produced 3.3 and 2.7 infected petioles per stalk, for a corresponding weight reduction of 28 and 19.2%. However, lesion severity ratings were not affected by planting depth or ridging.

Chlorothalonil provided excellent control of stalk rot by reducing the number of infected petioles, lesion size, and yield losses at all planting depths in ridged and unridged treatments (Table 1). At all depths except 4.0 cm, infected petioles averaged 0.2 or less per plant regardless of whether the celery was grown on ridged or unridged rows. Further, chlorothalonil applications begun 6 wk after transplanting controlled stalk rot as well as a spray program begun 1 wk after planting (Table 2). Supplementing over-the-row spray applications with drop nozzles directed at the base of the plants did not improve control (Table 2).

DISCUSSION

All commercial varieties of celery grown in south Florida are susceptible to stalk rot. Growers usually restrict losses from the disease by maintaining good field drainage and a preventive spray

Table 1. Effect of fungicide application, planting depth, and planting bed on severity of celery stalk rot caused by *Rhizoctonia solani*

Fungicide treatment[w]	Planting bed	Planting depth of crown (cm)[x]	Marketable petioles infected per stalk	Mean lesion rating per petiole[y]	Reduced stalk weight after trimming (%)
Control	Unridged	+1.3	2.5 abc[z]	2.4 ab	16.2 b
Chlorothalonil	Unridged	+1.3	0.2 e	1.5 abc	1.8 e
Control	Unridged	0.0	2.2 abc	2.6 ab	14.5 cb
Chlorothalonil	Unridged	0.0	0.1 e	1.9 abc	1.5 e
Control	Unridged	1.3	2.7 ab	2.5 ab	19.2 b
Chlorothalonil	Unridged	1.3	0.2 e	1.9 abc	2.5 e
Control	Unridged	4.0	3.3 a	2.7 a	28.0 a
Chlorothalonil	Unridged	4.0	1.1 d	2.5 ab	12.5 bcd
Control	Ridged	+1.3	1.7 bcd	2.3 ab	10.5 bcde
Chlorothalonil	Ridged	+1.3	0.04 e	1.5 bc	3.8 de
Control	Ridged	0.0	1.5 cd	2.1 abc	10.4 bcde
Chlorothalonil	Ridged	0.0	0.05 e	1.2 c	5.8 cde
Control	Ridged	1.3	1.4 cd	2.3 ab	9.8 bcde
Chlorothalonil	Ridged	1.3	0.1 e	1.8 abc	1.0 e

[w] Chlorothalonil was applied at 2.0 kg a.i./ha on a 4- to 5-day schedule.
[x] Seedlings were planted with the crown at 0.0, 1.3, or 4.0 cm below or 1.3 (+1.3) cm above the soil line.
[y] Lesion severity rating was based on a six-point scale with 0 = no lesion and 6 = largest lesion.
[z] Means followed by the same letters are not significantly different at $P = 0.05$.

Table 2. Effect of timing and method of fungicide application on celery stalk rot[v]

Treatment	Application period (wk)[w]	Drop nozzles[x]	Marketable petioles infected per stalk	Mean lesion rating per petiole[y]	Reduced stalk weight after trimming (%)
Control	...	...	2.7 a[z]	2.5 a	19.2 a
Chlorothalonil	1–12	+	0.2 b	1.7 a	4.8 b
Chlorothalonil	1–12	−	0.1 b	1.8 a	2.2 b
Chlorothalonil	6–12	+	0.2 b	1.9 a	2.5 b
Chlorothalonil	6–12	−	0.1 b	1.5 a	3.2 b

[v] Seedlings planted 1.3 cm deep in unridged rows.
[w] Chlorothalonil was applied at 2.0 kg a.i./ha on a 4- to 5-day schedule starting either 1 or 6 wk after transplanting and continuing until 1 wk before harvest.
[x] + = fungicide applied with drop nozzles, − = without drop nozzles.
[y] Lesion severity rating based on a six-point scale with 0 = no lesion and 6 = largest lesion.
[z] Means followed by the same letter are not significantly different at $P = 0.05$.

program. Preventive fungicides, however, are expensive and often unnecessary. Proper timing and methods of application, as well as the integration of cultural and chemical controls, influence the efficiency and economy of a disease control program.

Shallow planting has been reported to reduce *Rhizoctonia* damage on bean hypocotyls (4) and potato stems (8). The practice restricts disease development by limiting the amount of host tissue exposed to the pathogen in the soil. Planting on raised ridges reduces the severity of Rhizoctonia bottom rot on lettuce by providing drier conditions that limit development of the disease (6,7). In this study, I reduced celery stalk rot by restricting the planting depth of seedlings. Control was also improved without a protective fungicide by transplanting on raised ridges. As the ridge was eroded by wind and water, the celery crown eventually protruded above the soil line and was subject to fewer petiole infections. However, good control can be achieved without ridging when an effective fungicide is used in conjunction with shallow planting.

Although celery is susceptible to *Rhizoctonia* at all growth stages, studies of plant growth and stalk rot development indicate that fungicide applications begun at planting were no more effective than those begun 6 wk later. These results are associated with petiole development. Most of the petioles infected during the first 5 wk after transplanting are lost by natural senescence or are removed at harvest because they are small. The larger, marketable petioles start to develop 5–6 wk after transplanting (2). Therefore, preventive spraying begun 6 wk after transplanting can adequately control stalk rot at a reduced cost.

Studies in progress indicate that fungicide applications can be further reduced by using a threshold level of stalk rot damage to determine fungicide needs (5). The threshold level is based on the average number of infected petioles per stalk, as determined by a weekly survey of fields within an integrated pest management program for celery.

LITERATURE CITED

1. Anonymous. 1978. Caught Speedling. Am. Veg. Grow. Greenhouse Grow. 26(9):11.
2. Guzman, V. L., Genung, W. G., Gull, D. D., Janes, M. J., and Zitter, T. A. 1979. The first four years of integrated pest management in Everglades celery. Proc. Fl. State Hortic. Soc. 91:88-93.
3. Houston, B. R., and Kendrick, J. B. 1949. A crater spot of celery petioles caused by *Rhizoctonia solani*. Phytopathology 39:470-474.
4. Leach, L. D., and Garber, R. H. 1970. Control of *Rhizoctonia*. Pages 189-198 in: J. R. Parmeter, Jr., ed. *Rhizoctonia solani*, Biology and Pathology. University of California Press, Berkeley. 255 pp.
5. Pieczarka, D. J. 1980. Epidemiology and control of celery stalk rot caused by *Rhizoctonia solani*. (Abstr.) Phytopathology 70:570.
6. Pieczarka, D. J., and Lorbeer, J. W. 1974. Control of bottom rot of lettuce by ridging and fungicide application. Plant Dis. Rep. 58:837-840.
7. Townsend, G. H. 1932. Bottom rot of lettuce. Ph.D. thesis. Cornell University, Ithaca, NY. 120 pp.
8. Walker, J. C. 1969. Plant Pathology. McGraw-Hill Book Co., New York. 819 pp.
9. Weber, G. F. 1949. Bottom-rot of celery caused by *Corticium vagum* B&C. (Abstr.) Phytopathology 39:500.