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Rhizoctonia Stem Rot of Poinsettia: Sequential Application of Biocontrol Agents for Control of Stem Rot in Propagation and Finishing

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BACKGROUND

Rhizoctonia solani causes stem rot in propagation of poinsettia as well as root rot during the finishing stage of production. Rhizoctonia stem rot is a recurring disease in the greenhouse because the pathogen can survive on crop debris left after a production cycle ends. The disease is managed primarily by fungicides, although growers must avoid any fungicide that might limit root initiation and development in cuttings.

Rhizoctonia stem rot

Our objective was to evaluate the use of two biocontrol agents, the bacterium *Burkholderia cepacia,* and the fungus binucleate *Rhizoctonia* sp. (BNR) in sequential application for biocontrol of stem and root rot of poinsettia in propagation and finishing.

MATERIALS AND METHODS

Cultures of *B. cepacia* were centrifuged, and the bacterial cells were re-suspended in water for use in saturating dry rooting cubes. Wheat bran cultures of BNR isolates were mixed with semolina and kaolin to make a granular Pesta formulation.

Pesta formulation of BNR

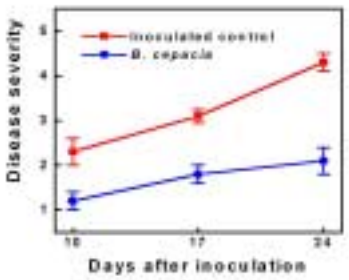
Propagation. Cuttings were taken from V-14 Glory stock plants and stuck into rooting cubes saturated with cells of *B. cepacia.* The pathogen was introduced by placing 0.5-inch-segments of petioles infected with *R. solani* on either side of the cutting.

Finishing. Rooted cuttings that were protected from Rhizoctonia stem rot during propagation were selected for transplanting to a Fafard No. 4 mix for finishing. Pesta granules of BNR (4.5 g/L, 0.6% volume basis) were amended to the mix and incubated in plastic bags one day prior to filling pots and transplanting rooted cuttings. After transplanting, plants were inoculated by inserting petioles infected with *R. solani* one inch deep in the mix around the root system. At the end of the experiment, plants were rated (1-5) for extent of Rhizoctonia stem and root rot where 1 was healthy, 3 was 11 to 25% of root system infected, and 5 was greater than 50% root infection or plant collapsed.

RESULTS

Propagation. Application of *B. cepacia* to rooting cubes at propagation resulted in significantly less *Rhizoctonia* stem rot (blue line in graph) than for untreated cuttings (red line) Stem rot averaged only 2.1 (less than 10% infection) and some cuttings were completely disease free.

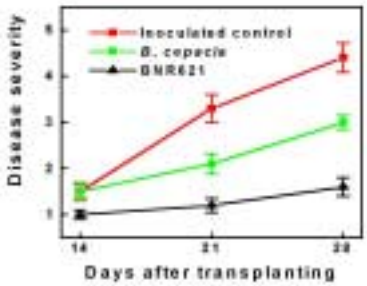
However, when rooting cubes were treated with the Pesta formulation of BNR alone no control of stem rot was observed (data not shown).



Stem rot severity

Also, the combination of both biocontrol agents to the rooting cubes was ineffective. Only the biocontrol agent *B. cepacia* gave control in the rooting cube environment.

Finishing. Only apparently healthy rooted cuttings protected by *B. cepacia* were transplanted for finishing. At 28 days after transplanting and re-inoculation, poinsettia in mix amended with the Pesta formulation of BNR had significantly less rot (1.5 rating, black line in graph below) compared to the untreated control (4.3 rating red line).



Stem and root rot severity

Poinsettias protected by the BNR treatment were highly marketable.

When the potting mix was drenched with cells of *B. cepacia* at transplanting, root rot ratings on poinsettias were 3.0 at 28 days (green line), and poinsettias were unmarketable.

BNR protected poinsettia (left), untreated (right)

CONCLUSIONS

Biocontrol of *Rhizoctonia* stem rot in propagation and stem and root rot in the finishing stage of poinsettia production is an alternative management strategy for disease control. The bacterial biocontrol agent *B. cepacia* was most effective for control of stem rot in propagation. The rooting cube environment favors *B. cepacia* because our strain of the bacterium produces an antibiotic pyrrolnitrin that is very inhibitory toward *R. solani*. On the other hand, the fungal biocontrol agent BNR was only effective after transplanting because this agent must be able to colonize plant roots to induce resistance in poinsettia against *R. solani*, and cuttings initially lack roots.

Thus, sequential use of the two different biocontrol agents at propagation and finishing of poinsettia was ideal for disease control because each biocontrol agent was most active under a different production environment i.e., propagation vs. finishing.

INDUSTRY IMPACT

(1) Our results illustrate how biocontrol agents can be used in production of poinsettia and ultimately other greenhouse crops as an alternative IPM strategy. 2) By understanding how biocontrol agents thrive in specific crop production environments, we can tailor the use of these beneficial microorganisms for disease control. 3) In situations where available fungicides may inhibit rooting or seed germination, biocontrol agents that provide disease control similar to fungicides may have an advantage.

Authors' note. The next step in the development of the biocontrol agents described here is commercialization including EPA registration before growers can use them.

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