COLORADO FLOWER GROWERS ASSOCIATION, INC.

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# Biological Control of Fusarium Stem Rot

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Significant control of Fusarium stem rot of carnations has been obtained by use of an antagonistic microorganism, *Bacillus subtilis* (Fig. 1).

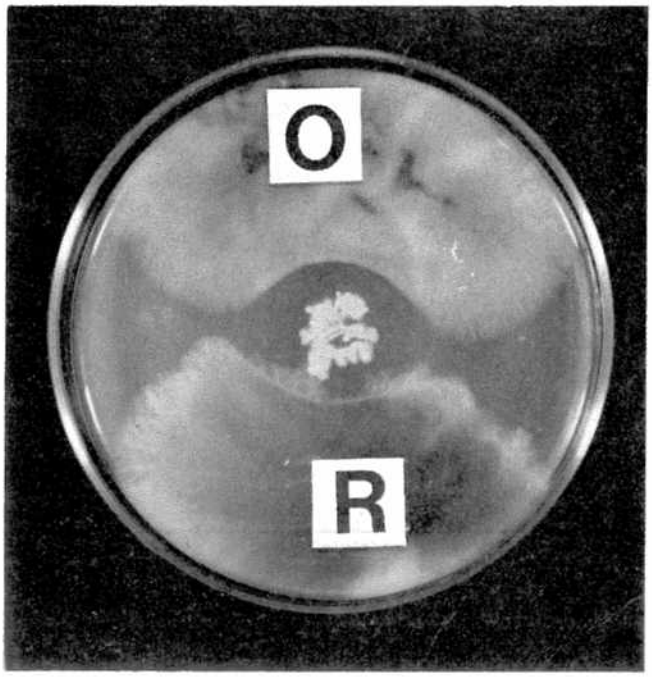


Fig. 1. Antagonism of *Bacillus subtilis* (center) to *Fusarium oxysporum* (0) and *F. roseum* (R).

*Fusarium roseum*, causal agent of Fusarium stem rot, typically invades the host through wounds. Major losses are a result of attack by the pathogen

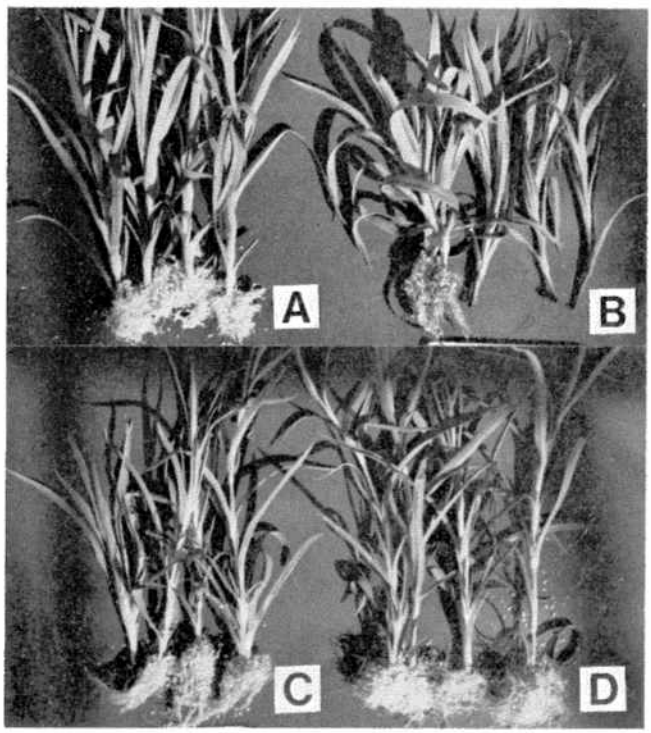


Fig. 2. Biological control and growth regulative effects of *B. subtilis:* A) noninoculated control; B) inoculated control; C) cuttings dipped into cell suspension of *B. subtilis* and exposed to *F. roseum;* and D) cuttings dipped in *B. subtilis* suspension and propagated without inoculating with *F. roseum.* Note increase in height of cuttings in C) and D) as compared with noninoculated cuttings in A).

through the broken ends of cuttings during propagation. Thus control measures are most effective when treatment occurs during this period. *B. subtilis* is antagonistic in culture to the pathogen, so attempts were made to introduce this bacterium during propagation to induce biological control.

In one experiment, four flats containing perlite were infested with conidia of *F. roseum* (100 conidia/cc). Four others were not infested to provide controls. Twenty-four cuttings of CSU Pink were struck in each flat. Half had previously been dipped in a suspension of *B. subtilis* for 10 minutes. The cuttings were propagated under mist for one month and observed for symptoms. Significant control was achieved (Table 1). Increased height and rooting was noted also in cuttings treated with the bacterium (Fig. 2).

In another experiment, plastic boxes instead of flats were used and racks (supplied with bottom heat) used to prevent cross contamination between treatments (Fig. 3). Six treatments containing 10 cuttings/box were used. In one treatment cuttings were dipped in *B. subtilis* suspension as before. In other treatments cell *(B. subtilis)* to conidium *(F. roseum)* suspensions of 0.5:1, 5:1, 50:1, and 500:1 were uniformly mixed with the perlite. This ratio was computed with a uniform inoculum density of *F. roseum* of 100 conidia/cc of perlite. Symptoms were noted as before (Table 2 and Fig. 4). Incorporation of the antagonist in the perlite resulted in better control than when cuttings were dipped in the suspension. All concentrations of the antagonist were effective in control.

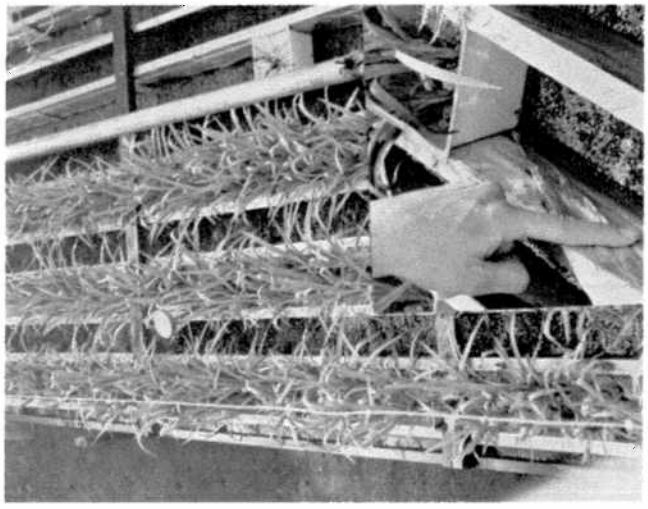

Fig. 3. Mist propagation arrangement. Insert shows heating cable (finger points to cable) adjacent to box. The pots are hanging such that drainage from each will not flow into the next pot.

These experiments provide evidence that biological control of Fusarium stem rot is possible. The ease of application of this type of treatment should make it a practical control under commercial conditions.

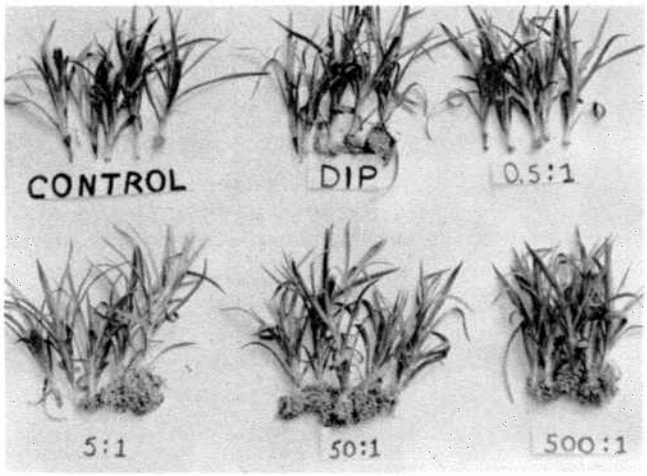


Fig. 4. Biological control of Fusarium stem rot of carnations by dipping cuttings or infesting the propagative medium with various ratios of cell suspensions of *B. subtilis* to conidium densities of *F. roseum*.

Table 1. Control of Fusarium stem rot by dipping cuttings into a suspension of *B. subtilis* cells.

| Treatments | Cuttings with symptoms[a] |
|---|---|
| | Percent |
| Inoculated-infested | 16.7 |
| Infested | 0.0 |
| Inoculated control | 54.2 |
| Noninoculated control | 0.0 |

[a]Numbers are percentage of cuttings with symptoms out of a total of 48.

Table 2. Control of Fusarium stem rot by infesting rooting medium with cells of *B. subtilis.*

| Treatments | Cuttings with symptoms[a] |
|---|---|
| | Percent |
| Dip | 27.5 |
| 0.5:1 cell to conidium ratio | 7.5 |
| 5:1 cell to conidium ratio | 0.0 |
| 50:1 cell to conidium ratio | 12.5 |
| 500:1 cell to conidium ratio | 2.4 |
| Inoculated control | 47.5 |

[a]Numbers are percentages of cuttings with symptoms out of a total of 40.