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Control of Fusarium Stem Rot of Carnations With Cutting Dips and Drenches

by L. J. Petersen

A series of experiments were conducted during 1956 and 1957 utilizing chemical dip treatments for controlling Fusarium stem rot of carnations, caused by Fusarium roseum f. cerealis (Cke.) Snyder and Hansen (3,4,5). These experiments were later extended to include cutting drenches and combinations of cutting dips plus cutting drenches.

A recent summary of the Fusarium stem rot problem (1) has underscored 3 important considerations with regard to control of this disease. They may be listed as:

1. Timing of control measures.-- The Sim and Miller's Yellow varieties of carnations are very susceptible to F. roseum f. cerealis in the propagative operation and to a lesser extent immediately thereafter. In one test, 100 times as much inoculum was necessary to cause disease in rooted cuttings than in non-rooted cuttings (1). Thus, since steaming of nursery beds is a common practice, it appears that the period of greatest danger can be limited to the propagative stage. Therefore, control measures should be most effective when applied immediately before or during the propagative period.

2. Carry-over of inoculum.--The presence of inoculum on mother block cuttings has been postulated as an important means of carrying-over macrospores of F. roseum to the propagative bench (2). Generally speaking, Fusarium stem rot has been observed more frequently on cuttings and plants derived from mother blocks than from other sources. Therefore, the conventional sanitation practices are not the complete answer to the stem rot problem.

3. Cultured cuttings.--The cultured cutting technique (6) was designed to facilitate detection of vascular pathogens in carnation tissue. This it does very efficiently. However, the Fusarium stem rot organism is not a vascular pathogen, therefore, the use of cultured cuttings does not detect this pathogen.

Tests recently completed

In attempting to control Fusarium stem rot of carnations this phase of the problem was centered about the eradication of spores from cuttings by means of cutting dips, dips plus drenches, and drenches only. Carnation cuttings were immersed for 5 seconds in a spore suspension containing 100,000 macroconidia/ml.

of Fusarium roseum f. cerealis, removed, and dried. These inoculated cuttings were treated by dipping in test solutions and agitating thoroughly for 10 minutes. Drenches were applied to cuttings and propagating media by means of a sprinkling can. Cuttings were rooted under mist and transplanted to nursery beds 21 days after striking. Two varieties of carnations were used in all experiments; 12 cuttings replicated 3 times per treatment. Data were taken in the form of rooting indices (cuttings were rated from 0 to 3 according to root development) and disease incidence (no. of cuttings infected expressed as a per cent). After 60 days in the nursery bed data were taken to determine the number of dead plants in each treatment. Table 1 represents a summation of these data.

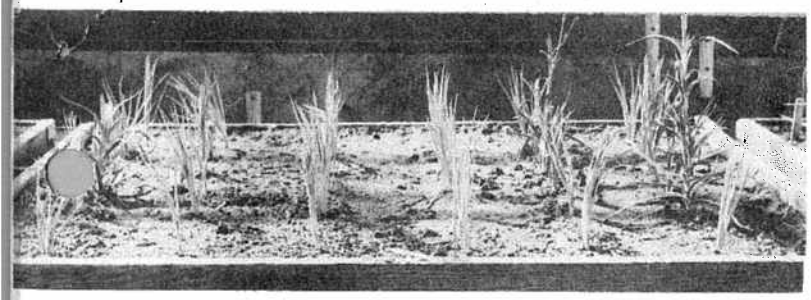
Table 1. Severity of disease and rooting indices after treating 2 varieties of carnation cuttings with various fungicidal solutions. (All solutions had 5-6 drops Tween 20 added.) Twelve cuttings of each variety were replicated 3 times in each treatment.

Material	Treatment	Concentration of active ingredients	Disease rating 5. at end of 21-day rooting period		Rooting indices 6. at end of 21-day rooting period		No.of plants dead after 60 days in nursery beds	
		1.	Red Sim	Millers Yellow	Red Sim	Millers Yellow	Red Sim	Millers Yellow
FERMATE	Dip	1000 ppm	5%	0	2.6	3.0	4	2
"	Dip + drench	"	0	0	2.2	2.3	3	3
"	Drench	"	8%	0	1.9	1.3	3	5
		2.						
Pan O Drench-4	Dip	2.6 ppm	0	8%	2.8	2.3	0	4
"	Dip + Drench	"	0	2.3%	2.3	1.8	1	1
"	Drench	"	0	1%	2.0	2.0	0	1
		3.						
13849	Dip	3.0 ppm	1%	1%	2.4	2.7	2	2
"	Dip + Drench	"	2.3%	2.3%	2.3	1.0	1	1
"	Drench		5%	8%	2.0	1.3	4	5
		4.						
Glyodin	Dip	1000 ppm	8%	16%	1.3	1.3	3	6
"	Dip + Drench	"	(Phytotoxic, no further evaluation)					
"	Drench	"	(" " " ")					
.	Inoc CK	--------	100%	97%	0	0.1	27	33
-	Non-I Ck	--------	0	5%	2.3	2.2	0	0

1. Two tablespoons 50% WP gallon of H_2O.
2. Two teaspoons per 3 gallons H_2O.
3. One teaspoon per 3 gallons H_2O.
4. One tablespoon per 3 gallons H_2O.
5. Disease rating: no. of cuttings with lesions expressed as a per cent.
6. Rooting index: o, no roots; 1, poor; 2, good; 3, excellent.

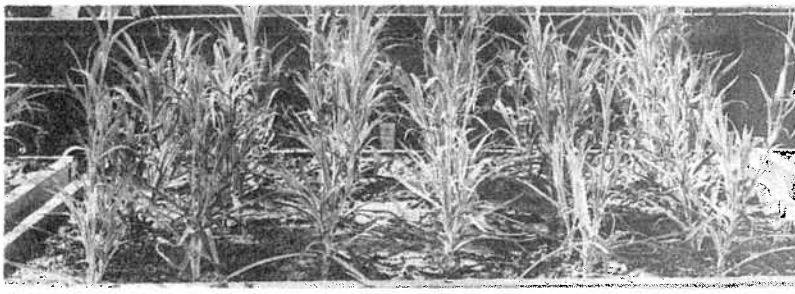
Results indicated that Panogen (experimental material no. 13849) and Pano-drench 4 were effective in controlling the disease when used as cutting dips and drenches (Figs. 3, 4, and 5). Experimental material No. 13849 was used at 1 tsp. per 3 gallons of water and Pano-drench 4 at 2 tsp. per 3 gallons of water. In most trials the combination dip + drench was slightly phytotoxic but, nevertheless, more effective against the pathogen than the dip or drench treatments alone. Greater phytotoxicity resulted when these compounds were used at concentrations exceeding 5 ppm active ingredient. Fermate was very effective at 2 tblsps./ gal. H_2O. It was less phytotoxic than Panogen when used as a dip and combination dip + drench but more phytotoxic when used as a drench only. However, this phytotoxicity which showed up in the rooting indices was not evident (Fig. 8) 60 days after transplanting in the nursery bed. Glyodin was ineffective in controlling Fusarium stem rot and phytotoxic in all treatments.

Other compounds tested were rimocidin, catechol, 2, 6-dichloroquinone, 2, 5-dimethylquinone and P-benzoquinone. These were all ineffective in controlling Fusarium stem rot under the conditions tested.



INOCULATED CONTROL

1. WILLIAM SIM VAR.



NON-INOCULATED CONTROL

2. WILLIAM SIM VAR.

PANO-DRENCH 4

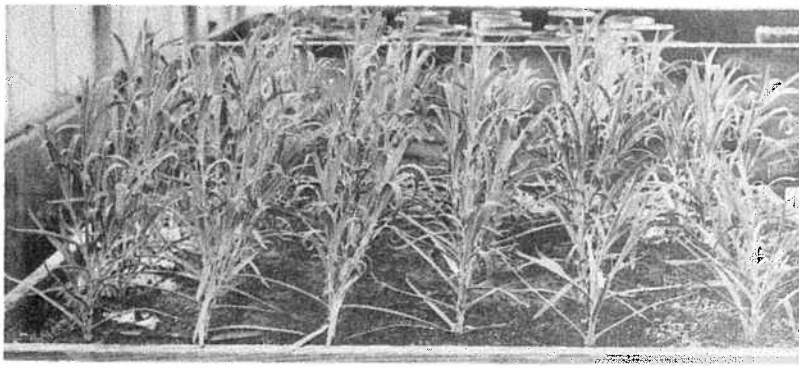
3. DIP ONLY

PANO-DRENCH 4

4. DIP + DRENCH

PANO-DRENCH 4

5. DRENCH ONLY

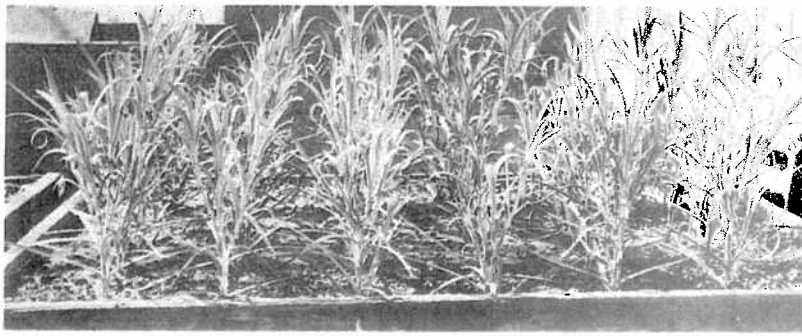


FERMATE

6. DIP ONLY

FERMATE

7. DIP + DRENCH



FERMATE

8. DRENCH ONLY

Summary and Recommendations

In summarizing the chemical dip and drench experiments designed to control Fusarium stem rot, 5 requisites were found necessary to achieve best results: (1) Use fresh, turgid cuttings, (2) concentrations of materials for dips and drenches should be as follows:

Panogen
a. 2 tsp. Pano-drench 4 per 3 gallons H_2O.

Compounds;
b. 1 tsp. Panogen experimental material #13849 per 3 gallons H_2O.
c. $\frac{1}{2}$ tsp. Panogen 15 per 3 gallons H_2O.

Fermate;
a. 2 tablespoons per gallon H_2O.

(3) add Tween 20 (or other suitable wetting agent) to solutions, (4) when dipping, dip for 10 minutes and agitate as thoroughly as possible while cuttings are submerged in the fungicidal solution, and (5) apply cutting drenches at the rate of approximately 1 gallon of solution per 2-3 sq.ft. of propagating media. Agrimycin 100 at the rate of 200 ppm. may be incorporated, as a precautionary measure, to check bacteria when using Fermate.

Literature Cited

1. Baker, Ralph. 1957. Thinking about carnation diseases. Colo. Flo. Gro. Assoc. Bul. 90:1-5.

2. _____1955. Resistance of carnations to Fusarium stem rot in the nurse bed. Colo.Flo.Gro.Assoc. Bul. 73:1-3.

3. _____1956. Control of Fusarium stem rot with cutting dips. Colo. Flo. Gro. Assoc. Bul. 76:1-3.

4. _____1956. More about the clorox dip. Colo.Flo.Gro. Assoc. Bul. 79:3-4.

5. Petersen, L. J. 1956. Control of Fusarium stem rot of carnations with fungicidal cutting dips. Colo.Flo. Gro. Assoc.Bul. 84:1-3.

6. Tammen, J., R. R. Baker, and W. D. Holley. 1956. Control of carnation diseases through the cultured cutting technique. Plant Dis. Reptr. Supplement 238:72-76.

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