

SOIL TREATMENT OF CARNATIONS, 1950-51

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Numerous fungicides and antibiotic agents have been tested as soil treatments since 1946 for the control of carnation *Fusarium* diseases at Colorado A&M College and in the Denver area. Five materials have shown promise. Application rates for these materials were determined in 1950-51 at the Kintzele Brothers Greenhouse, Denver²; larger plots were established in other greenhouses to test the best rates of application.³

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² The authors are grateful to Leland T. Kintzele, without whose assistance these data would have been unavailable.

³ Alenius', Harmon's, Dick Braun's, Skyline, and Davis Brothers' greenhouses.

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At the Kintzele Brothers Greenhouse Crag 531 (cadmium copper zinc calcium chromate) and Crag 658 (copper zinc chromate) were used at the rate of 2 oz. per 100 sq. ft. bench surface; Dithane Z-78 (zinc ethylene bis dithiocarbamate) and Goodrite z.a.c. (zinc dimethyl dithiocarbamate) were applied at 2 oz. and 4 oz. per 100 sq. ft.; and Tri-lig 74 (an eluate of isolate 74 of Trichoderma lignorum) was tested at the rates of 1 oz. and 2 oz. per 100 sq. ft.

All treatments, including uninoculated and inoculated, untreated checks, were randomized among 5 replicated plots, each comprising an area of 80 sq. ft. In each block were 4 rows of 7 plants each, the outside rows being buffers.

All but Tri-lig 74 were applied as dusts mixed with equal parts of sand as a carrier, and were worked into the soil and watered well. The Tri-lig 74 was a 7 percent solution used as a soil drench. All materials were applied to a bench of Frosted Pink Patrician carnations on July 1, 1950, one month after the plants had been planted in steam-sterilized soil. Three successive applications were made on August 1, September 1, and January 5.

Two weeks after the first treatment the bench was inoculated by working a mixed culture of Fusarium oxysporum f. dianthi and F. culmorum into the soil. Isolations were made from heel cuttings from each plant at the time of treatment to detect the presence of carrier plants. All plants showing the presence of Fusarium infection were rogued at the time of inoculation.

In the larger tests 5 benches of each treatment were used, irregardless of variety, with Dithane Z-78 and Crag 531 being applied at the rate of 4 oz. per 100 sq. ft., and Tri-lig 74 at 2 oz. The conditions prevailing for each test were those commonly existing in the respective greenhouses. None of the benches were inoculated as it was desired to test the materials under normal conditions, the Fusarium inoculum originating either from chance contamination of the soil or from carrier plants within the benches. Untreated check blocks of 100 plants were included at the ends and in the middle of the benches. An average of 1150 plants were treated in each test covering approximately 500 sq. ft.

The results of the tests at Kintzele Brothers are shown in table 1. Although the total average yields and peak yields (Fig. 1) were highest on plots treated with Dithane Z-78 (4 oz.) and Tri-lig 74 (2 oz.), the differences were not significant. Nor were there significant differences in the number of splits produced by any treatment, although there were fewer splits among plants treated with Tri-lig 74 (1 oz.), Crag 531, and in the uninoculated check.

After the second treatment Goodrite z.a.c. and Crag 658 were discontinued because of severe foliage injury resulting when the treatments were applied at high temperatures (above 100°F.). Further tests with these materials are being made at lower temperatures. Plants treated with Dithane Z-78 became yellow and soft, often lodging, with long internodes. Later tests have indicated that this condition can be avoided by applying the material at temperatures less than 75°F., and by making only one application every three months.

Isolations from the soil at the end of the test on March 6, 1951, failed to yield any trace of Fusarium spp. in soil treated with Tri-lig 74 (2 oz.), Crag 531, or Crag 658. Traces of infestation were observed in soils treated with the other materials and in the uninoculated check.

It was interesting to note that 20 percent of the plants in the uninoculated

Table 1. Results of soil treatment tests at Kintzele Brothers Greenhouse, Denver, Colo., in 1950-51.

Treatment	Rate of application (oz./100 sq.ft.)	Ave. no. blossoms	Ave. No. splits	Av. no. Fusarium colonies isolated	Ave. pct. infection	Pct. control
Dithane Z-78	4	98.8	4.4	0.2	10.0	86.1
do	2	100.4	4.8	0.4	34.0	48.7
Tri-lig 74	2	101.2	2.2	0.0	20.0	72.3
do	1	100.4	0.6	1.4	22.0	69.4
Crag 531	2	81.8	0.8	0.0	42.0	41.7
Inoculated Check		89.8	4.6	32.0	72.0	--
Uninoculated Check		95.4	1.0	1.2	20.0	--
Diff. required for significance (odds 19:1)		N.S.	N.S.	1.8	6.3	--
(odds 99:1)				2.3	8.5	--

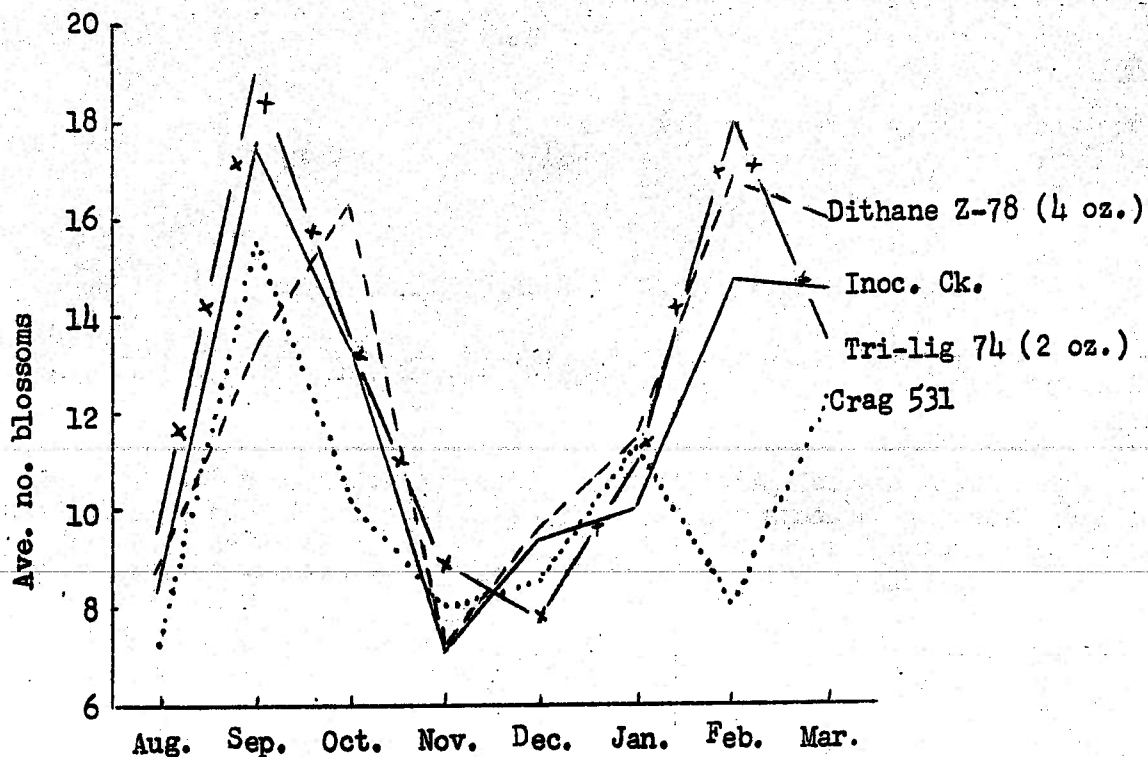


Fig. 1. Monthly effect of leading soil treatments on production of Frosted Pink Patrician carnations at Kintzele Brothers Greenhouse, Denver, Colo., 1950-51

check were infected by Fusarium, although the preliminary isolations from these plants indicated no infection. This was due to characteristic one-sided infection which may not be present in heel cuttings. Since that time all isolations from indexed mother-block plants have been made from the root crown.

As indicated in the table, treatment with Dithane Z-78 (4 oz.) gave 86.1 percent control of Fusarium wilt and root rot. Differences between the rates of application of Tri-lig 74 were not significant, both treatments providing satisfactory control. Applications with Dithane Z-78 (2 oz.) and Crag 531 did not quite provide 50 percent control. The performance of these materials, however, warrants consideration as means for control.

Results of the larger tests supported the foregoing results from the standpoint of effective disease control. Crag 531 was the leading material with an average control of 78.2 percent. Tri-lig 74 (2 oz.) rated second with 69.0 percent control, and Dithane Z-78 (4 oz.) third with 65.4 percent.

On the basis of these experiments and those of previous years, it is believed advisable to recommend the use of Tri-lig 74 (2 oz. of 7 percent solution), Dithane Z-78 (4 oz.), and Crag 531 (2 oz.) for the control of Fusarium wilt and root rot of carnations. These materials should be applied as described earlier, with one application every 3 months. Recent tests have indicated that it is best to apply the initial treatment, if general treatment is desired, just prior to planting. These materials also may serve to neutralize infestation of the soil in the vicinity of infected plants following rogueing. It is questionable, however, whether such treatments may yet replace steam-sterilization of soil. Further tests are in progress to effect even better control of these diseases.