

FRELIMINARY STUDIES ON THE FACTORS AFFECTING THE DEVELOPMENT OF
BACTERIAL WILT ON CARNATIONS

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The presence of bacterial wilt on carnations became evident in several Denver greenhouses in 1947. However, the disease was not considered of importance until an epidemic arose in several ranges in 1949. Although some reports had indicated that at least 45 days were required for symptoms of bacterial wilt to develop in carnations, there were several cases in Denver in 1949 which suggested that this disease may develop even more rapidly under some conditions. Consequently, a preliminary experiment was designed to determine what factors may affect the length of time required for wilt symptoms to develop on carnations in Colorado ranges.

White Patrician carnations, established 3 months in 4-inch pots, were placed under different conditions of air temperature, soil moisture, and soil pH. Three plants were used for each treatment in triplicated series. The temperatures in the greenhouses were approximately $65^{\circ} \pm 3^{\circ}$ F., $75^{\circ} \pm 3^{\circ}$ F., and $85^{\circ} \pm 3^{\circ}$ F. Soil moisture was maintained as dry, medium, and wet, determined by the visible appearance of the soil. Soil pH conditions were pH 6.0, pH 7.0, and pH 8.0. This was the original pH of the soil, determined by means of a Beckman Model H2 glass electrode pH meter. The soil with a pH 8.0 reaction was that used in the plant pathology greenhouses at Colorado A & M College. Soils with pH 6.0 and pH 7.0 reaction were obtained from cooperators in Denver.¹ All pH values were for steam-sterilized soils.

The test plants were from indexed mother stock, free from infection by the bacterial-wilt organism (Phytoplasma caryophylli) as determined by previous isolations from the mother blocks. An equal number of uninoculated check plants were maintained for each treatment. After all the plants were placed under the conditions indicated in Table 1, they were inoculated with 3 ml. each of a suspension of isolate C187 of P. caryophylli which had been determined previously to be a very pathogenic isolate of the pathogen. The number of days required for incipient symptoms of wilt to appear on the test plants was recorded. No wilt developed on plants exposed to temperatures of approximately 65° F. after 9 weeks (Table 1). Some wilt occurred on plants exposed to approximately 75° F. between 52 and 63 days. However, at temperatures of approximately 85° F. wilt symptoms became increasingly evident. This was true especially in dry and medium-moist soils. The time required for symptoms to develop in wet soils at this temperature was about the same as that required at 75° F. In this case wet soil apparently retarded the manifestation of bacterial-wilt symptoms. The soil pH became a factor retarding the development of symptoms in dry soils at pH 6.0, and in wet soils at pH 8.0, under which conditions no symptoms developed whatsoever. None of the uninoculated check plants developed symptoms of bacterial wilt. The pathogen was re-isolated from all test plants expressing bacterial-wilt symptoms.

It must be realized that these results are purely preliminary in nature, and repeated experiments under more finely controlled conditions must be conducted before the conditions enhancing the development of bacterial wilt can be determined accurately. However, it is evident from these tests that bacterial wilt will develop in Colorado ranges at temperatures of approximately 85° F. in dry soils at a pH range of 7.0 to 8.0. In well-watered soils at this temperature a pH range of 8.0 will apparently retard development of symptoms. Therefore, if greenhouse temperatures could be kept as low as possible, some bacterial wilt may be avoided.

¹The soil with pH 6.0 was originally from Table Mountain, near Golden, Colorado.

This work is being continued and progress will be reported periodically. However, it must be kept in mind that no manipulation of such environmental conditions can substitute for the strictest sanitation measures and the use of clean stock.

Table 1.--THE EFFECT OF DIFFERENT AIR TEMPERATURES, SOIL pH AND SOIL MOISTURE ON THE OCCURRENCE OF BACTERIAL WILT IN CARNATIONS.

Temperature and pH conditions	Average No. days required for symptoms to occur ¹		
	Dry soil	Medium-moist soil	Wet soil
<u>°F - pH</u>			
65 - 6.0	- ²	-	-
65 - 7.0	-	-	-
65 - 8.0	-	-	-
75 - 6.0	-	52	57
75 - 7.0	63	52	-
75 - 8.0	52	-	-
85 - 6.0	46	47	52
85 - 7.0	39	45	54
85 - 8.0	39	51	-

¹Average of 3 replications of 3 plants each. No uninoculated check plants developed symptoms.

²No symptoms developed after 9 weeks.

The total production figures represent the production on twenty-one square feet of bench area. Pink Patrician produced over twenty-six flowers per square foot, and Donna Lee twenty-seven and one-half flowers per square foot, for the period.

Conclusions: On the basis of these treatments alone the following is indicated:

1. Mulches of peat, hay and beet pulp, produced consistently better quality on both varieties.
2. Leafmold, manure and straw, gave better quality on Pink Patrician, but the difference caused by these mulches over unmulched plots of Donna Lee was not significant.
3. Plots mulched with finely ground corn cobs and shaving were no better than unmulched plots.
4. The frequency of watering is reduced by maintaining a surface mulch.

Corn cobs, shavings and beet pulp, have been eliminated from next year's trials. The latter apparently has value, but it is disagreeable to handle and difficult to get. Cottonseed hulls have been added to the group of mulches.