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Fusarium Roseum and the Carnation Shoot Tip

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Control of soil pathogens capable of inciting root or stem rots is commonly aimed at the saprophytic phase of growth in the soil. Greenhouses utilizing steamed raised benches find this to be a highly successful means of control; however, the control of carnation stem rot in clean stock programs utilizing mother blocks is not achieved by this method alone. This report indicates a higher degree of control may be observed by the eradication of all spores from the cuttings by obtaining mother plants by shoot tip culture.

Captan sprays have been successful in providing a protection from fungal spores which are splashed on the cutting; however, the steamed raised benches may be recontaminated, so these methods are not altogether effective.

Where does the contamination originate? It appears necessary that in order to infect a plant an isolate must not only possess the ability to rot, but must also have the means for dissemination, or spreading from one plant to another. Many types of *Fusarium* with capabilities for inciting stem rot thrive in the walks and under steamed benches in the greenhouse. However, they are not the organisms which are normally isolated from rotted cuttings, which indicates that they perhaps lack the means of dissemination necessary for widespread infection.

A fungus which meets this requirement is *Fusarium roseum* 56-2, an isolate commonly found in diseased carnations in the Denver area. This particular strain produces spores at the soil line of mother plants not showing any marked symptoms of disease. The spores, disseminated by splashing water, lodge on the branches of carnations used for cutting production. They are thus available as inoculum during propagation, which is the period when the young plants are most susceptible to this fungus (1). The infected cuttings which survive may go back to the mother block, and the cycle is repeated (2). The best evidence for this method of contamination is the success of Captan sprays which reduce the amount of viable inoculum carried on the cuttings.

Since carnation stem rot is spread from plant to plant by water-disseminated spores, it would seem that an effective method of control would be one in which the cycle is completely broken by the eradication of all spores from the cuttings. Shoot tip culture provides such a means of obtaining clean cuttings.

Does shoot tip culture actually control the disease under commercial conditions? Evidence would indicate it does indeed reduce loss from *Fusarium roseum*. Two examples of control are cited as evidence: (1) A variety, Orchid Beauty

(not from CSU clean stock), was observed in a mother block to be nearly 100% infected and showing symptoms at the end of 1 year. This variety was propagated by the technique of shoot tip culture, and the following year cuttings were available to replant the mother block entirely from the shoot tipped plants. At the end of one year, no loss was seen in this new mother block. Thus, complete control resulted from application of the shoot tip technique. (2) A second test compared Red Gayety cuttings derived from shoot tip plants with the loss from non-shoot tipped plants from the CSU clean stock program. The plants were grown in nucleus blocks, increased to provide cuttings for wholesale mother blocks, and sent to growers. The growers flowered the plants in commercial ranges. Records of loss were carefully recorded. The results of this study showed no losses occurring due to disease prior to planting in commercial ranges. These plants were observed in flower-producing benches from June 1963, until termination of the test in 1964. Of 2,940 plants grown from shoot tips, only seven were lost at the grower. Of 2,360 plants not derived from shoot tips, 18 were lost (Table 1). Three subgroups of the shoot tip plants were found essentially free from loss.

Table 1.--1964 loss of plants in the flower producing benches which were produced from shoot tips in 1962 compared with the loss of plants produced from 1962 clean stock (not shoot tips).

Shoot tip group			Non-shoot tip group		
Sub-group	No. of plants	Loss 1964	Sub-group	No. of plants	Loss 1964
1	260	0	1	260	7
2	900	0	2	750	6
3	800	9	3	1,350	11
4	980	1			

In summary, cuttings play a primary role in the transportation of spores and dissemination of Fusarium roseum in mother blocks. While contamination from other sources is important in some losses within clean stock, the evidence obtained indicates that the shoot tip technique of providing clean stock significantly minimizes loss from Fusarium roseum infection in carnations.

1. Baker, R. R., 1965. Dynamics of Inoculum. In K. F. Baker and W. C. Snyder (ed.) Ecology of Soil-Borne Plant Pathogens. Univ. of Calif. Press, Berkeley.
2. Holley, W. D., and Ralph Baker. 1963. Carnation Production. Holley and Baker, Fort Collins, Colorado. p. 142.