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VERTICILLIUM WILT OF SHRUB AND TREE NURSERY STOCK

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In Oregon nurseries a soil-inhabiting fungus belonging to the genus VERTICILLIUM is the usual cause of wilt disease in certain shrub and deciduous trees. The wilt produced by this fungus is called "Verticillium Wilt" regardless of which one of its numerous hosts may be concerned. Under Oregon conditions the following are frequently infected: apricot, barberry, box, raspberries (especially all black varieties, all purple cane varieties and the Ranere and Lloyd George red varieties) and maple. Very heavy losses of maple nursery stock have been recorded in Oregon. The Verticillium fungus may attack these plants during any age or stage of growth; in fact, it is the usual cause of wilting of elms and wilting and death of maples in parkings. The dreaded Dutch elm disease produces a somewhat similar wilt but this European disease has not been observed on the Pacific coast.

The Verticillium fungus produces similar symptoms in all of its woody hosts. Usually one side, branch or portion of the plant exhibits signs of premature wilting while the remainder of the plant appears normal or nearly so. The entire plant may wilt, turn yellow and die. If wilted portions are cut off so that a smooth cut-face is exposed and the cut-surface examined for bluish or brownish stains or discolorations within the wood immediately beneath the bark, the presence of such stains is reasonable proof that the trouble is Verticillium wilt. Final proof can only be obtained by careful laboratory examination and culture.\*

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\*The Plant Pathology laboratory at this Experiment Station offers examination of such material as one of its services.

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Wilted individuals differ greatly in their final response to this disease. Sometimes they die shortly after symptoms are well developed; sometimes they linger on, a part of the tree or shrub growing almost normally; sometimes they seem to recover. The younger the tree or shrub when attacked, the more likely it is to die from the attack. This fact makes it all the more important that nurserymen try to eliminate this wilt from their plantings, and reduce the chances of marketing plants with incipient infections which cannot be detected at time of digging.

CONSIDERATIONS WHICH AFFECT SUGGESTIONS FOR CONTROL

1. The fungus usually enters the plant through the root system. Unfortunately it can gain entrance through perfectly healthy unbroken roots and therefore the disease cannot be eliminated by extreme care in handling stocks. It is true, however, that the more the wounding of roots during planting operations, the more likely the fungus to enter the roots.

2. It can infect cuttings especially if they are not fully caloused when planted.

3. Cuttings from any part of an infected plant are likely to transmit the disease to the new plant. Cuttings from visibly infected parts are almost certain to transmit it.

4. The fungus readily becomes established in the soil. The more the organic matter present, the more likely it is to spread for considerable distances in the soil. The fungus is able to vegetate on such organic matter-- a condition which facilitates overwintering or oversummering of the fungus.

5. Verticillium may be considered a low temperature fungus. It is able to infect and induce disease at temperatures lower than most wilt producing fungi.

6. The ability of the fungus to infect and produce disease is not materially affected by:

- a. Type of soil.
- b. Amount of soil moisture.
- c. Alkalinity or acidity of the soil.
- d. Source of nitrogen--except that the humus from organic fertilizers are thought to favor the disease.

7. The fungus has a very large number of hosts, including herbaceous plants and weeds. Hence our sanitation suggestions.

8. Fungi develop strains somewhat comparable to "varieties" in nursery stock. There are several strains of the Verticillium fungus. These vary in infectivity and severity and show considerable variation in their relative ability to infect different hosts. These strains can only be determined by laboratory analysis but their determination is sometimes important in determining the choice of plants for crop rotation.

#### SUGGESTIONS FOR CONTROL

1. Elimination of the disease by roguing.

- a. Nursery stock: The removal of diseased individuals and adjoining plants whose proximity permits intermingling of roots, is of obvious importance. We recommend the removal of the adjoining plants since if this is not done the fungus will soon grow from the infected root remnants of the obviously sick individual into position to attack the healthy neighboring ones.
- b. Trees in parkings, yards or other permanent locations: Since relatively large trees will often develop this wilt, it is of primary importance to decide what to do with individuals whose size and location lends specific value. Sometimes large trees will develop serious wilt symptoms one year and appear healthy the next, or show a few dead limbs but no new wilt symptoms. For this reason we do not recommend immediate removal of such trees. It seems better to try to improve their general growing condition, stimulate them by trench fertilization, using

nitrate and potash fertilizers, and give them plenty of water so that the injury from wilting effects will be minimized. Then if in the second or third year after first signs of disease they do not show signs of recovery, we would recommend their removal.

2. Time of planting: Since temperatures above 75° F. are unfavorable to the disease, it may be feasible to plant certain troublesome nursery stocks at a time of year which could take advantage of warmer soils.

3. Care in transplanting and lining out: The fewer the broken roots and the better the callous area on cuttings, the less likelihood of infection. This consideration will not eliminate the disease but it will help control it.

4. Sanitation: Clean culture reduces the abundance of the fungus in the soil. Possible Oregon weed hosts include: pigweed, lamb's quarter, night shade, and cocklebur.

5. Crop Rotation: This is very important. For our nursery conditions we make the following general recommendations:

a. That susceptible stock (box, raspberry, maple, etc.) never be planted in land recently (4 year limit at least) planted to potato, tomato, eggplant or black raspberry.

b. That susceptible stock be followed by coniferous stock. The following lists of susceptible plants is not complete but includes those which are frequently infected in Oregon or other states.

#### HERBACEOUS

Potato, tomato, eggplant (extremely susceptible), aster, chrysanthemum, cucumber, beets, phlox, lupine, ginseng, snapdragon, and sweet pea.

#### SHRUBS AND CANE PLANTS

Black raspberries, box, daphne, blackberry, and currants, and probably lilac.

#### TREES

Maple, elm, almond, apricot, cherry, peach, plum, and walnut.

Some of the above have not been observed infected under Oregon conditions but they should all be considered possible hosts and certainly important in deciding a rotation program.

6. Cuttings must be taken from healthy plants, and of course planted in uncontaminated soil. They should be well calloused. Treating cuttings with protecting antiseptics (for example, Bordeaux mixtures) may be feasible in very special instances.

7. Pruning: Pruning of infected trees is more efficient in improving the appearance of such trees than it is in controlling the disease. In pruning large maples it is well to remember that a mildly infected limb (one showing only slight wilting) may entirely recover.

8. Use of disinfectants: At present impracticable. Some of the new, very potent organic mercuries may prove efficient on a cost basis. This point deserves investigation by nurserymen.

9. Fertilization: There is some evidence that the use of fertilizers high in potash produce a condition unfavorable to the disease. Heavy organic mulches are favorable to the disease.

10. Heat treatment of valuable infected stocks: Experiments in England indicate that the fungus can be killed in potatoes by subjecting them to dry heat. Potatoes will stand 112 F. degrees for 20 hours. It is possible that nursery stocks (especially valuable individual plants) might be so treated successfully. We cannot make this as a recommendation since we do not know how much heat the various nursery stock hosts will stand and whether it would prove efficient for various strains of the fungus found in Oregon. This idea is worthy of experimentation.

11. Resistant varieties: With the exception of eggplant most of the Verticillium hosts show great varietal variation in susceptibility. This is especially true of chrysanthemum under greenhouse conditions. We would recommend that nurserymen take advantage of the presence of the disease to initiate varietal selection against it.