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PREVENTION OF SUN-BLOTCH DISEASE OF AVOCADOS IN NEW PLANTINGS

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In a detailed account of the history, symptoms, and causal nature of the sun-blotch disease, Horne, Parker, and Rounds[1] reported that the disease is caused by a virus. They stated further that, because of the nature of the disease and the fact that there is no apparent spread of it from tree to tree in field plantings, the obvious method of control is that of prevention. Briefly, their conclusions were that sun-blotch could be prevented in new plantings by the use of disease-free nursery trees.

In the case of a virus disease of a vegetatively propagated plant, such as sun-blotch of the avocado, which is not passed on from diseased to healthy trees by natural agencies or by cultural operations, it might appear at first that prevention would be a relatively simple matter of using disease-free propagative parts. With avocado, this would mean the use of disease-free buds and disease-free seedling rootstocks for the growing of new trees.

The authors cited above pointed out that avocado trees infected with sun-blotch sometimes tend to recover from symptoms to the extent that there are no obvious signs of the disease. They mentioned, also, that some affected trees may show no injury, and that much of their growth may appear normal. Additional observations by these investigators and others in recent years have made it evident that the absence of sun-blotch symptoms on avocado trees at a given time does not prove that such trees are free of the disease-producing virus.

The need for some additional measure or test of the "health" of parent trees is apparent, and it is chiefly along this line that the sun-blotch investigations at the University of California Citrus Experiment Station have proceeded in recent years. The primary object of the studies has been to develop a practical means of determining whether or not a given avocado tree carries the virus of sun-blotch, so as to enable the grower of avocado nursery stock to produce sun-blotch-free trees.

The surest method of determining whether or not a given plant carries a virus is by an inoculation or transmission test. With woody plants the procedure is to graft tissues from the plant under question into healthy plants of the same or related species which are known to develop symptoms after inoculation with the particular virus. At the same time similar healthy test plants are grafted with tissues from known disease sources to serve as check plants. After sufficient time has elapsed for the disease symptoms to develop

on the check plants, absence of symptoms on the other plants may be accepted as evidence that the plant from which they were "inoculated" was free of virus. With some plant viruses, results of such inoculation tests can be obtained in a short time; with others a relatively long time is required for the appearance of symptoms. The sun-blotch disease is one of the latter type.

Most plant viruses induce characteristic leaf symptoms on susceptible host plants, but this is not true of the sun-blotch virus. Many different inoculation techniques have been used in an attempt to induce young avocado seedlings to show a consistent, dependable leaf symptom that could be used as an index of infection. Up to the present no such symptom has been found. The only consistent symptoms of sun-blotch are the yellow or lighter-colored streaks that develop on the bark, chiefly of the younger green limbs and shoots. Consequently, additional studies have been made with the aim of discovering means of hastening the development of the stem-streaking symptom. Some progress has been made in that direction.

Young avocado seedlings can be infected with the virus of sun-blotch by the insertion of buds from diseased trees. Seedlings 10 to 12 inches in height are preferred, but larger plants may be used. A wedge-shaped piece of tissue bearing a bud at the upper end is removed from a sun-blotch-diseased tree, or from a tree to be tested for the virus, and is placed in a diagonal cut in the stem of the test seedling. The inoculum tissue is then wrapped with the bud eye exposed. (Figure 1)

At the time of inoculation the top of the seedling is removed, leaving only one or two axillary buds above the place of inoculation. If the seedling becomes infected from virus carried by the inoculation bud, the new shoots will sooner or later begin to show typical sun-blotch streaks on the bark. The time required for the appearance of symptoms varies considerably, but some inoculated seedlings have shown stem streaks within two months.

In one experiment in which either 3 or 4 seedlings, each, of 22 different varieties were inoculated, sun-blotch symptoms had appeared on 60 out of a total of 86 seedling trees after 330 days. Symptoms had not appeared on any of the inoculated trees of 3 varieties. Apparently, these particular varieties are slow to develop sun-blotch symptoms and are therefore not satisfactory indicators of sun-blotch. If the 12 trees of the 3 resistant varieties are not considered, the results show that 60 out of 74 seedlings developed sun-blotch symptoms within 330 days after inoculation. This shows that the inoculation technique resulted in a high percentage of infection. More than half of the total number of inoculated seedlings showed symptoms in less than 4 months. In these tests the Guatemalan and West Indian varieties, as a group, developed sun-blotch symptoms earlier and more consistently than the Mexican varieties.

Because of the inconsistencies and peculiar characteristics of the causal virus of sun-blotch, and the fact that plant viruses commonly are found to exist as strains which differ in virulence, it must be recognized that transmission tests such as those described above may not always disclose the presence of the disease-producing virus. In the opinion of the writer, however, properly conducted tests will usually determine whether or not a particular avocado tree will supply disease-free progeny.

Fig. 1. *Sun-blotch inoculation technique; Left, untreated avocado seedling, Right, seedling with inoculum bud in stem and top removed to force axillary shoot growth.*

In testing a given parent avocado tree for sun-blotch disease, the buds used for inoculum should be taken from several locations on the tree, since the virus might be unevenly distributed. For this type of test, relatively "soft" buds from recently developed shoots should be used. Two inoculum buds can be placed in each seedling, thus enlarging the sample and increasing the chances of infection if any of the buds carry the virus. The larger the number of seedlings inoculated, the more conclusive the results will be. At present it is thought that a total of 20 seedlings inoculated by means of two buds to each seedling provides a satisfactory test. The inoculated test seedlings should be kept under close observation until they show symptoms or otherwise for at least 6 to 8 months, and preferably longer. The tests should be made under glasshouse conditions, where there is no difficulty in getting the soft buds to "take," and where growth conditions are more favorable for development of sun-blotch symptoms than in the field. A further advantage of the glasshouse is protection from sunburn and from winter injury.

Young avocado seedlings are sometimes infected with the virus of sun-blotch, either by the passage of the virus through the seeds or by some insect vector. Present evidence suggests that such plants are infected from virus carried in the seeds, although experimental plantings of seeds from known sun-blotch trees have, so far, failed to give a single diseased plant. It seems, therefore, that if it is desirable to test for the virus in the rootstock parents, the same procedure should be followed for them as described above for testing for virus in the budwood parents. However, the testing of rootstock parents does not seem so important as the testing of budwood parents. In the first place, it is well established that natural infection of seedlings occurs rarely, and apparently only under some special, unknown environment. Secondly, it is believed that for the most part the plants that become infected through the seeds will develop

symptoms early enough to permit experienced nurserymen to detect and eradicate them. It is, of course, advisable to avoid the use of seeds from avocado trees showing symptoms of sun-blotch. If this procedure is followed, and if all sun-blotch and off-type seedlings are carefully rogued from nursery rootstock plantings, the number of sun-blotch trees arising through the use of naturally infected rootstocks will no doubt be insignificant.

Greenhouse space and facilities for conducting extensive tests of parent avocado trees are not available at the Citrus Experiment Station at Riverside. Such service can be given only to the extent necessary for determining the commercial value of such tests, and for increasing our knowledge of the sun-blotch disease from a research viewpoint. Should the officers and members of the California Avocado Society wish to establish within their Society a service for testing parent avocado trees for sun-blotch, the full cooperation of the University may be anticipated.

[1]*Horne, W. T., E. R. Parker, and M. B. Rounds. The nature of sunblotch and its practical control. Calif. Avocado Soc. Yearbook, 1941, pp. 35-38.*