H. P. OLMO

Plant breeding program aided by

Radiation Treatment

Some of the most valuable fruit varieties that have been continuously propagated by budding or grafting for centuries are highly complicated in their genetic constitution. Even if the plant breeder grows thousands of seedlings from such extraordinary varieties, no two seedlings closely resemble each other, and the progeny is extremely disappointing. Equally difficult is production of a new variety equivalent to a widely accepted one, but incorporating only one or a few improvements.

For example, the Thompson Seedless grape is an excellent variety, but growers wish that the foliage were resistant to powdery mildew, thus eliminating need for costly dustings of sulfur throughout the growing season. A promising breeding method, in working on such problems, is production of mutations or heritable changes in the buds by wide-scale use of X-rays or other types of radiation, in the hope of recovering a single individual plant with the desired character.

The earliest grape to reach the market is the Perlette, a seedless variety introduced by the University in 1948 and now grown extensively in the desert areas of southern California. Its worst defect is that the berries are too compact or tight in the cluster, and many must be removed by hand-thinning before fruit begins to mature—which is a very expensive operation.

To breed a new Perlette variety with a loose cluster is all but hopeless by the conventional methods. Results with radiation treatment, however, are encouraging. When the vine was in the dormant stage, buds were cut off, and exposed to doses of X-ray of about 2,500r units. The treated buds were grafted onto older stocks for quick fruiting. In 1956, more than 300 treated buds were tested.

In the vineyard at Davis many changes appeared in the plants from treated buds. One mutant produced all very small, seedless berries; another produced very large berries with almost complete seed development. In the search for a type with looser clusters, some selections now appear promising enough for testing commercially. If they prove successful, a means will have been found to incorporate certain useful properties into standard varieties without changing the general features of the original variety.

The mutations produced appear to be the result of large alterations in the chromosomes, that interfere with normal pairing and separation. Hence the resulting sterile ovules and pollen produce a poorer set of the flowers and, finally, looser clusters. Under natural conditions, such mutations would be considered undesirable but under cultivation, they can be propagated without the use of seeds.

Methods have been developed to handle and test many thousands of buds in a short period of time. Selections are being planned for disease and insect resistant strains.

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JOHN C. LINGLE

Foliar absorption of zinc by

Tomato Plants

Foliar sprays for zinc deficiency in tomatoes are usually effective. Occasionally, however, plants fail to respond.

Following field trials, greenhouse studies are now under way to determine what factors affect foliar absorption of zinc by tomato plants.

Plants are grown in nutrient solutions with and without zinc, and are treated, at various stages of growth, with spray solutions containing different zinc salts. A very small amount of radioactive zinc is added to the spray so that the foliar-applied zinc can be traced inside the plant. Factors under study include the time of day the spray is applied, the effect of different types of wetting agents, effect of accompanying anions, the relative acidity-alkalinity of the spray solutions, and the age of the plant.

After sufficient time to allow for absorption and translocation of the zinc, the plants are removed from the nutrient solution and separated into roots, stems, leaves, and flowers. Zinc concentrations in the different plant parts are determined by chemical techniques, and radioactivity is assayed. Autoradiographs—pictures of the plant made by the effect of the radioactive particles on photographic film—are sometimes used to study the translocation and localization of the radioactive materials. By these techniques it is possible to determine not only the comparative efficiency of different foliar-applied zinc materials, but also what percentage of the zinc in the plant was derived from the nutrient solution or soil on which it was grown.

Results to date have been encouraging. An initial experiment indicated that foliarly absorbed zinc is not translocated to the roots of tomato plants to any great degree. Instead, it seems to be localized in the young tissues in the top of the plant. Other data seem to indicate that absorption of zinc takes place mostly during the daylight hours.

These types of results can be applied directly in the field, for the correction of zinc deficiency and for increasing the efficiency of materials applied to the leaves.

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