Cantaloupe Mosaic

insect vectors of virus disease resist insecticides in field tests

R. C. Dickson, J. E. Swift, L. D. Anderson, and John T. Middleton

Cantaloupe mosaic—a virus disease—has cut the production of early-summer melons in the desert valleys of southern California, particularly in the Imperial Valley.

Losses from this disease during the 1947 and 1948 seasons amounted to about one-third of the crop.

The viruses most commonly found in melons in this area are all members of the cucumber virus series. A survey in the Imperial and Palo Verde valleys attempted to determine the frequency of the several viruses present. Of 179 collections made, six were cucumber virus No. 1; 13 a second cucumber virus; and 160 squash-mosaic virus.

The symptoms of these three virus diseases are similar and difficult to distinguish in melons. The viruses cause a conspicuous mosaic pattern in the leaves, with some rolling and disfiguration, and usually reduce the size of the leaves without material change of their perimeter. The petioles and stems may be slightly mottled. Immature fruits are conspicuously mottled, with more or less circular, raised, dark-green areas upon a light-green background; fruits are frequently distorted into odd shapes. The sutures on ripening cantaloupe fruits appear broad and shallow. Normal-appearing cantaloupes from mosaic-infected vines contain less soluble solids than fruits from healthy vines.

The Vectors

The squash mosaic virus is spread in this area by transient populations of aphids, chiefly the green peach aphid. It seldom breeds on melons, but on sugar beet, lettuce, and various weeds. It may be noted here that the increase in aphid populations and mosaic prevalence in the Imperial Valley occurred at the time that sugar beets became an important crop in that area.

The number of aphids caught on sticky-board traps in the Imperial Valley in 1948 and 1949 proved to be related to the outbreak of mosaic in that area. There was a striking difference between the two seasons, both in aphid population and in mosaic infection. Melon plants were injured much less during the 1949 season than in the two previous years, both because of the lower percentage of mosaic infection and because, in most fields, the mosaic appeared too late to cause much crop loss. If a melon plant is not infected until after the crop is set and nearly matured, little or no injury results. In 1949 severe crop injury was confined to a few late fields.

Aphid populations in the Palo Verde Valley were lower during the two seasons studied than the corresponding populations in the Imperial Valley. There was also less mosaic in the Palo Verde Valley both seasons. During the 1949 season, aphids were particularly scarce in the Palo Verde Valley, with the result that cantaloupe mosaic was difficult to find. The lower populations of aphids in the Palo Verde Valley seem to be tied in with the absence of sugar beets, which are not grown there because of the presence of Texas root rot fungus in the soil.

Vector Behavior

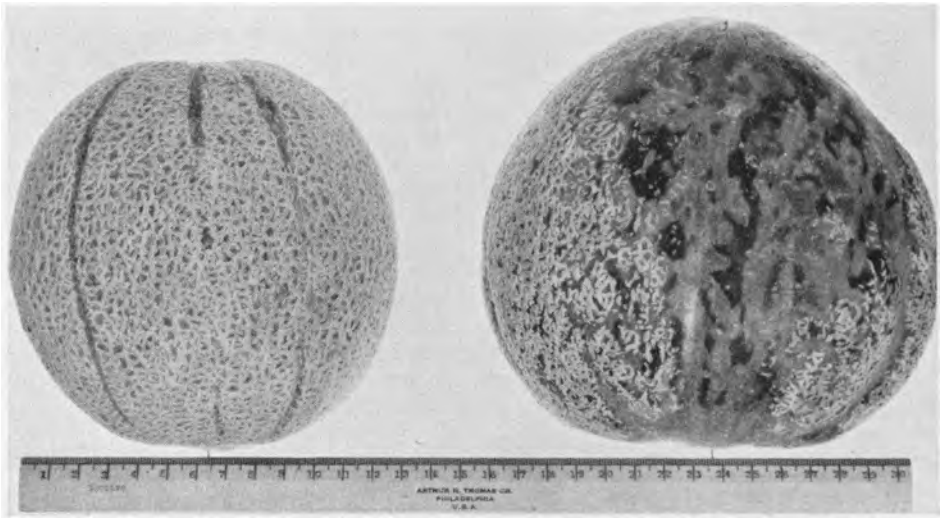
During a heavy flight, an estimated 40 million aphids passed a one-mile front each hour. These heavy flights occurred only during calm periods of relatively high temperature and did not ordinarily last more than three or four hours. Aphids do not fly during high winds and as a result a high population of newly emerged winged aphids is built up on the source plants in the course of the windy periods. As soon as the wind dies down and the temperature rises, the aphids take off in swarms.

Cantaloupe runners showing mottling and malformation caused by cantaloupe mosaic.

Flight is apparently at random, so that the aphids move with the air drift, gradually spreading out as they go. Some evidence indicated that these aphid swarms did not move much more than five miles. Scattered individuals covered a somewhat longer distance.

Counts made during heavy flights showed that the number of aphids landing on each melon hill averaged about 50 per minute, and that the number leaving during this period was about the same. Each aphid began feeding immediately after it landed, and each feeding period totaled 40 seconds on the average. Having fed for this short period, the aphid withdrew its beak, walked up to the

Continued on page 12



Normal fruit—left—of Powdery Mildew Resistant No. 6 cantaloupe compared with fruit of same variety injured by cantaloupe mosaic.

SPACING

Continued from page 10

and September 16th were highest for the close spacings. The total yields after additional harvests on October 1st and 19th showed little differences between the 1½- and two-foot treatments but these were significantly higher than the three- and four-foot spacings. The fruit size ranged from an average of .277 pounds per fruit on the plots with a 1½-foot spacing to .297 pounds per fruit on the four-foot spacing.

Observations

In every test early yields were higher on the close than on the wider spacings. On the closely spaced treatments a high percentage of the total crop usually was harvested in the first one or two pickings. These higher early yields are probably due to the greater number of plants per acre since the rate of ripening of the individual fruit is not influenced by plant spacing.

Some advantages of high early yields are: *1*, a larger portion of the crop might be harvested before fall rains or early frosts; *2*, quality of the crop is usually higher in the early pickings; and *3*, a higher percentage of the crop is harvested when labor is more plentiful and harvesting costs are cheaper.

In most of the tests the total yield was increased by closer plant spacing. The total yield may be materially influenced by the length of the harvest season. When the harvest season is terminated unusually early by adverse weather conditions, the closer spacings may show a considerable advantage in yield.

Plant spacings did not greatly affect fruit size although there was some trend toward larger size on the four- and six-foot spacings.

Neither did spacing appreciably influence the quality of the fruit. In the 1947 test there was less sunburn on the 1½-foot spacing than on the three- or six-foot treatments. Test four in 1948 showed slightly greater loss of fruit from mold on the one-foot spacing than on the two-foot or wider spacings.

Plant spacings of 1½ to two feet in the row appear to be the most desirable for the Pearson variety grown for canning. In areas where plants normally grow rather large, the two-foot spacing may be preferable. Spacings closer than 1½ feet showed no advantage in yields and in years when fruit set is late and vine growth larger than usual, these extra close spacings may be more difficult to harvest. Close spacings are easily obtained on field seeded tomatoes. On the transplanted crop the change from a three-foot to a 1½- to two-foot spacing will mean increased costs for plants and planting. Therefore, growers are advised to determine for their own conditions if the close spacing will increase net returns.

On changing to closer spacings a tomato grower should watch his field carefully to determine if a change in irrigation practice is necessary. With more plants per acre the crop may require more water, particularly late in the season.

Since these tests were conducted on irrigated crops, the results should not be applied to tomatoes grown without irrigation.

D. M. Holmberg is Farm Advisor, Yolo County.

P. A. Minges is Associate Agriculturist, Truck Crops, in Agricultural Extension, Davis.

M. P. Zobel is Associate in the Experiment Station, Truck Crops, Davis.

CANTALOUPE

Continued from page 9

tip of a leaf, and flew away. Each aphid was moving across the fields in a succession of short flights, feeding for short periods on a large number of plants.

This type of feeding is so very efficient in spreading the virus that an extremely low initial incidence of virus infection was increased very rapidly. Sources of infection may be native gourds, zucchini, or other summer squash plants which are grown through the winter in the Imperial Valley, volunteer melons, or seed-borne infection of melon and squash plants.

Virus infection is extremely rare early in the season. Only one case of seed-borne mosaic was found in the desert areas in 1949, even though a considerable number of plants was scouted. This may be a result of the virus-free seed program. The overwhelming numbers of potential aphid vectors that move over the fields in certain years, pick up this rare and scattered virus inoculum and increase it in an almost geometrical ratio.

It should be noted that the presence of volunteer melon plants in fields in which melons had been grown the previous year may nullify the use of virus-free seed.

Insecticides and Repellents

Attempts were made to control the spread of cantaloupe mosaic by the use of insecticides and repellents. Aphids seemed to be able to fly through insecticide clouds without ill effects. No measurable degree of mosaic control was obtained by any of the treatments tried.

The hope that a repellent could be found was based on the observation that, on approaching a plant, in normal flight, an aphid hesitates for a fraction of a second at a distance of one to 1.5 inches from the plant surface. At this point the aphid appears to be sensing, perhaps smelling, the plant to decide whether or not to land. If the plant could be made unattractive to the aphid, it would fly on without landing, and its potential as a vector would be nullified.

A number of plant oils, known repellents for other insects, and various evil-smelling substances were made into dusts and applied on young melon plants at weekly intervals. The only one of these to show a measurable degree of control was tetramethyl thiuramdisulfide, particularly when used at 10%. But the use of this compound resulted in a delay of only a few days in the appearance of mosaic.

R. C. Dickson is Assistant Entomologist in the Experiment Station, Riverside.

J. E. Swift is Farm Advisor, Imperial County.

L. D. Anderson is Associate Entomologist in the Experiment Station, Riverside.

John T. Middleton is Associate Plant Pathologist in the Experiment Station, Riverside.

The above progress report is based on Research Project No. 1085.

WAX

Continued from page 6

fruit ratio would be comparable, in which increments of growth made after the wax was applied were known and under conditions in which it was suspected that water might be lacking to the fruit during this time. These conditions would evaluate more critically than has been done the effect of the wax upon cherry size.

Reid M. Brooks is Associate Professor of Pomology and Associate Pomologist in the Experiment Station, Davis.

L. L. Claypool is Associate Professor of Pomology and Associate Pomologist in the Experiment Station, Davis.

Fred M. Charles, Farm Advisor, assisted in the 1949 trials in San Joaquin County.

The above progress report is based on Research Project No. 920-F.

INSECT

Continued from preceding page

in tomato fields by the latter part of August. If environmental conditions favor the establishment of the pest in the early season, there is danger that the increased population by mid-summer may result in defoliation to a point where serious sunburning of the fruit may occur.

A. E. Michelbacher is Assistant Professor of Entomology and Associate Entomologist in the Experiment Station, Berkeley.

W. W. Middlekauff is Assistant Professor of Entomology and Assistant Entomologist in the Experiment Station, Berkeley.

N. B. Akesson is Instructor in Agricultural Engineering and Junior Agricultural Engineer in the Experiment Station, Davis.