Mosaic viruses are a major threat to cucurbit production in Riverside and Imperial counties, and are transmitted in a nonpersistent way by aphids, which can acquire them from an infected plant or weed host and transmit them to a healthy plant within seconds. Insecticidal treatment of the vectors in fields fails to prevent spread of these viruses because transmission is so rapid and because the most efficient vector (the green peach aphid) does not readily colonize cucurbits but migrates to them from other crops and weed hosts.

In 1977, research was initiated to investigate two different approaches to this problem. Reflective mulches (aluminum-coated paper and white polyethylene plastic) were used to exclude migrating aphids from the plantings, and mineral oil (citrus spray oil) was applied as a film on the foliage of plants to prevent aphids from inoculating them with virus. The mulches reflect the sun’s ultraviolet rays, which the aphids "see" instead of the blue-green light (color) of plants. In effect, they receive a signal to “keep flying” instead of landing.

Mulch treatments were 30 inches wide and were laid on the soil surface before seeding. Mineral oil (2 and 4 gal/acre) was applied twice weekly as a water emulsion spray. Metasystox-R (MSR) was applied weekly to another treatment, and an untreated control was included. Experimental plots comprised four 50-foot rows of Zucchini Dark Green summer squash, replicated five times. The experiment was seeded on January 26, and normal cultural practices were followed.

Aphids migrating into the plots were monitored weekly in yellow water pan traps. The traps were 14.5 x 11.5 x 5.5 inches in size and located at plant height in the center of each plot. The aphids reached a peak in late February, and activity remained high through late March, when migrating populations declined. Most aphids trapped were green peach aphids (tables 1 and 2); 67,620 aphids were trapped in the untreated plots throughout the season. Mulch treatments greatly reduced the number of aphids entering the plots. Aluminum foil was the most effective with a 96 percent reduction in aphids over the whole season, while white plastic caused a 68 percent reduction. The effectiveness of the white plastic declined rapidly in mid-April, but the aluminum foil remained effective even when plants were large and appeared to cover most of the reflective surface. Mineral oil treatments caused slight

**Reflective mulches**

Nick C. Toscano □ Jeff Wyman □ Ken Kido
Hunter Johnson, Jr. □ Keith Mayberry

An aerial view of an experimental reflective mulch plot at the Meloland Field Station near Riverside.

Below are seen plants that were established 18 inches apart through holes in the mulch. Later tests developed a system for laying down the mulch strips mechanically.

Above are 30-inch-wide mulch strips which were hand applied on the south slope of the squash planting beds.

Photos by Max Clover
reductions in aphid numbers (17 percent and 33 percent from 2- and 4-gal/acre rates, respectively) and weekly MSR sprays had no effect on aphid migration into the plots.

**Virus infection**

Virus symptoms began to appear in early March, indicating that initial infection began in the plots with the late February aphid flights. Infection spread rapidly. By late May more than 90 percent of plants in untreated plots and those treated weekly with MSR were infected.

Mineral oil effectively reduced virus spread, particularly early in the season, and averaged 23 percent and 36 percent reductions in virus incidence from the 2- and 4-gal/acre rates over the entire season. The effectiveness of the oil was reduced when plants began rapid growth, because complete plant coverage could not be maintained even with a twice-weekly schedule.

Mulch treatments were extremely effective throughout the season in reducing the incidence of virus. Aluminum foil was the most effective in this regard, reducing virus incidence by more than 90 percent until May and averaging an 85 percent reduction for the whole season. The effectiveness of white plastic declined throughout the season, but still averaged 63 percent reduction (table 3). Both watermelon mosaic viruses I and II were isolated from infested plot plants.

**Plant Growth**

Plots were rated in March for evidence of phytotoxicity and overall vigour. In early March, no differences between treatments were observed except for the MSR and 4-gal/acre mineral oil sprays which caused some necrosis and stunting. In mid-March, this phytotoxic reaction was more severe: the MSR-treated plants were significantly stunted. At this time, the plants mulched with white plastic were significantly more vigorous than those in other treatments. Total plant counts taken later in the season revealed that both mulch treatments had significantly greater plant stands, although equal numbers of hills were seeded initially.

**Fruit Yield**

Fruit was harvested and weighed three times weekly from April 12 through May 9. Total yield in the untreated plots was 385 cartons (18 pounds each)/acre (3.46 tons) from 16,551 squash averaging 42 cents per pound each. Weekly MSR treatments has
little effect on total yield (3 percent overall increase) and would not justify the cost of applications. Mineral oil at 2 gal/acre increased yields by 10 percent, but, at 4 gal/acre, no yield increase was observed, and the practical use of these oil formulations would not be justified. This approach to virus spread control does have great potential, however, if suitable formulations can be identified.

Mulch treatments were extremely effective in increasing squash production. Over the entire harvest period, both aluminum foil and white plastic mulches increased production by 45 percent over untreated controls. Total yields in both mulched treatments were 558 cartons/acre (5 tons) from more than 20,000 fruit averaging 47 cents per pound of fruit (table 4). This rate of production would increase gross income by more than $750/acre (at $4.50/carton) and would justify the initial mulching costs of between $150 and $200 per acre.

The effect of mulched treatments on yield was particularly evident in the early harvest with 86 percent and 76 percent increases in the aluminum foil and white plastic plots, respectively. Such an intensification of early production would be doubly beneficial because it would concentrate peak production when market price is likely to be highest and would allow early termination with accompanying labor savings and a reduced effect of late-season mosaic infection.