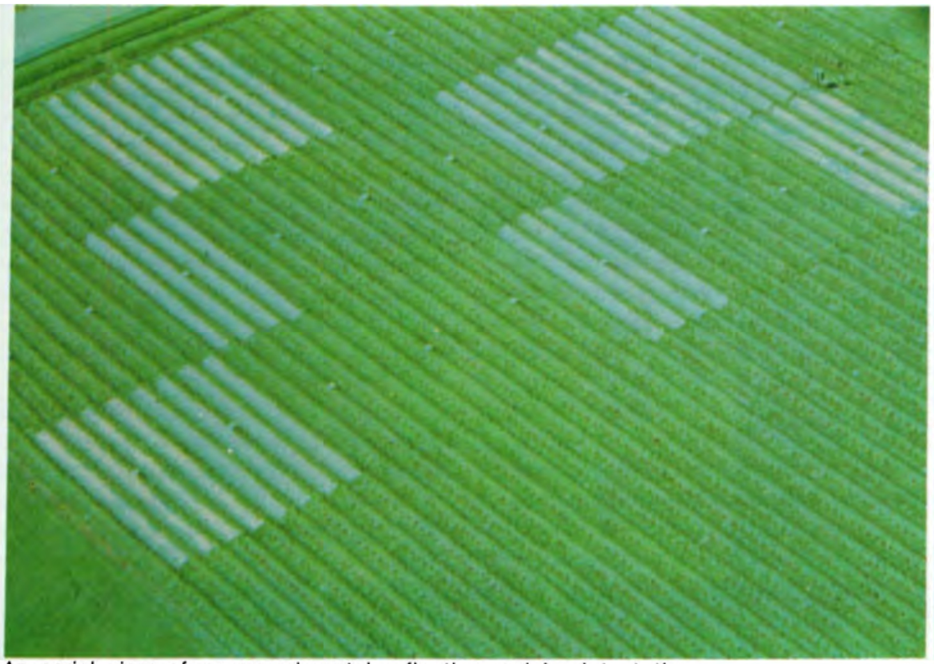


An aerial view of an experimental reflective mulch plot at the Meloland Field Station near Riverside.

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

Reflective mulches foil insects

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

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 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

TABLE 1. Alate Aphids Trapped in Yellow Water Traps Located in Summer Squash Plantings, Meloland, CA., 1977.

	Mean Alate Aphids/Trap/Day [a]											Total Aphids/Trap
Treatment	Feb 23	Mar 4	Mar 8	Mar 15	Mar 22	Mar 29	Apr 5	Apr 12	Apr 19	Apr 26	May 10	During Season
Aluminum mulch	4 a	8 a	15 a	6 a	7 a	4 a	4 a	9 a	16 a	14 a	7 a	540 a
White plastic mulch	142 ab	54 a	106 ab	59 ab	60 a	27 b	40 b	40 b	47 cd	36 b	22 b	4,358 b
Mineral oil (4%)	226 bc	231 b	428 b	119 bc	190 b	47 c	71 c	52 bc	25 ab	31 b	15 b	9,061 c
Mineral oil (2%)	293 bcd	270 bc	497 b	185 c	226 b	49 c	83 cd	69 cd	38 bc	28 b	19 b	11,177 cd
Methyl demeton (0.56 kg ai/ha)	442 d	366 c	501 b	175 c	239 b	51 c	110 d	73 d	45 cd	29 b	16 b	13, 016 d
Untreated control	386 cd	371 c	534 b	223 c	254 b	53 c	91 cd	70 cd	58 d	27 b	16 b	13,524 d

[a] Mean of 5 replicates. Means followed by the same letter are not significantly different, Duncan's Multiple Range Test (0.05 level).

TABLE 2. Aphid Species Trapped in Yellow Water Traps Located in Untreated Summer Squash Plantings, Meloland, CA., 1977.

	Mean Number of Alate Aphids Per Trap [a]											Total No.	Percent of
Aphid Species	Feb 23	Mar 4	Mar 8	Mar 15	Mar 22	Mar 29	Apr 5	Apr 12	Apr 19	Apr 26	May 10	aphids/trap	total
Green peach aphid, *Myzus persicae* (Sulzer)	2496	3018	2190	1804	1436	274	598	396	212	38	36	12,498	91.75
Sow-thistle aphid, *Hyperomyzus lactucae* (L.)	0	0	0	0	0	8	14	40	118	114	168	446	3.42
Oat bird-cherry aphid, *Rhopalosiphum padi* (L.)	64	20	24	38	20	52	6	0	2	2	4	232	1.7
Blue alfalfa aphid, *Acyrthosiphon kondoi* Shinji	56	6	8	4	0	10	12	2	12	2	8	120	0.88
Greenbug, *Schizaphis graminum* (Rondani)	0	42	22	16	0	4	0	2	0	2	2	90	0.66
Turnip aphid, *Lipaphis crysimi* (Kaltenbach)	4	8	22	2	6	14	6	4	12	2	2	82	0.6
Mealy plum aphid, *Hyalopterous pruni* (Geoffroy)	0	2	0	0	0	2	2	4	8	2	4	24	0.18
Cowpea aphid, *Aphis craccivora* Koch	4	4	8	2	0	2	0	0	0	0	0	20	0.15
Corn leaf aphid, *Rhopalosiphum maidis* (Fitch)	0	2	0	16	0	0	0	0	0	0	0	18	0.13
Melon aphid, *Aphis gossypii* Glover	4	0	0	6	0	0	0	2	0	0	2	14	0.1
English grain aphid, *Macrosiphum avenae* (Fabricius)	4	0	0	0	0	0	0	0	0	0	0	4	0.03
Lettuce seed-stem aphid, *Acyrthosiphon lactucae* (Passerini)	0	0	0	2	0	0	0	0	0	0	2	4	0.03
Canadian fleabane aphid, *Uroleucon erigeronensis* (Thomas)	0	0	0	0	0	0	2	2	0	0	0	4	0.03
Potato aphid, *Macrosiphum euphorbiae* (Thomas)	0	0	0	0	0	0	0	2	0	0	0	2	0.015
Waterlily aphid, *Rhopalosiphum nymphaeae* (L.)	0	0	0	0	0	0	0	0	0	0	2	2	0.015
Mediterranean grain aphid, *Rhopalosiphum rufiabdominalis* (Sasaki)	0	2	0	0	0	0	0	0	0	0	0	2	0.015

[a] Based on 1/10 or 1/20 subsample by volume.

TABLE 3. Watermelon Mosaic Virus Infection In Summer Squash Plantings, Meloland, CA., 1977.

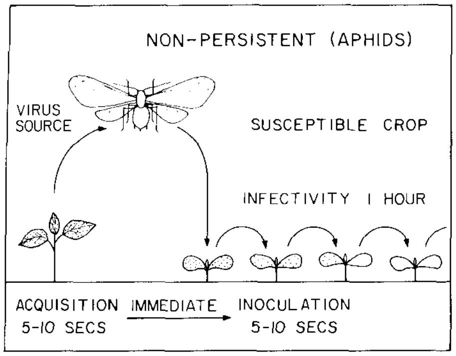
	Percent Virus Infected Plants [a]				
Treatment	Apr 5	Apr 11	Apr 19	Apr 26	May 4
Aluminum mulch	0.2 a	0.8 a	1.9 a	6.4 a	36.6 a
White plastic mulch	0 a	2.1 a	7.0 a	26.0 b	65.3 b
Mineral oil (4%)	0.2 a	4.1 b	19.4 b	47.0 c	84.8 c
Mineral oil (2%)	1.1 ab	7.7 c	21.2 b	59.8 cd	84.6 c
Methyl demeton (0.56 kg/ha)	3.1 b	11.6 cd	38.1 b	59.2 cd	94.0 d
Untreated control	1.4 ab	13.4 d	31.1 b	65.8 d	90.0 cd

[a] Mean of 5 replicates. Means followed by the same letter are not significantly different, Duncan's Multiple Range Test, 0.05 level.

TABLE 4. Yield Responses in Summer Squash Plantings Treated with Various Mulch and Spray Treatments to Reduce Virus Infection, Meloland, CA., 1977.

	Yield During Harvest Periods Indicated [a]						
	Apr 12 to 22		Apr 27 to May 9		All season		Mean Weight/ Fruit
Treatment	No. fruit	Weight (kg)	No. fruit	Weight (kg)	No. fruit	Weight (kg)	(kg)
Aluminum mulch	139.8 a	30.7 a	111.2 a	21.1 a	251.0 a	51.8 a	0.21 a
White plastic mulch	114.2 ab	28.1 a	114.8 a	23.5 a	229.0 ab	51.6 a	0.23 a
Mineral oil (2%)	86.6 bc	18.4 b	109.2 a	21.5 a	195.8 bc	39.9 b	0.20 a
Methyl demeton (0.56 kg/ha)	85.8 bc	16.5 b	108.0 a	20.9 a	193.8 bc	37.4 b	0.19 a
Untreated control	84.4 bc	16.6 b	105.6 a	19.7 a	190.0 c	36.3 b	0.19 a
Mineral oil (4%)	79.6 c	14.7 b	103.8 a	20.3 a	183.4 c	35.0 b	0.19 a

[a] Mean of 5 replicates. Means followed by the same letter are not significantly different, Duncan's Multiple Range Test, 0.05 level.



Schematic diagram of nonpersistent virus transmission by aphids.

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.

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Wilt and dieback of Canary Island palm in California

Tolbert V. Feather □ Howard D. Ohr □ Donald E. Munnecke

Canary Island palm *(Phoenix canariensis* Hort. ex Chab.) is used extensively as an ornamental throughout inland and coastal areas of California. In 1938 a disease of these palms in California was reported as a bud rot caused by the fungus *(Gliocladium vermoeseni* (Biourge) Thom. *(Penicillium vermoeseni).* Other fungi were not associated with this disease, and it was of minor importance on *P. canariensis* palms. However, during 1973-1977 a vascular wilt and bud rot caused by the fungus *Fusarium oxysporum* Schlect. was reported on *P. Canariensis* in Italy, France, and Japan.

In recent years many mature palms in Los Angeles, Orange, San Bernardino, and San Diego counties have been destroyed by a severe and rapidly spreading disease, which reduces the canopy of affected trees. The fungi *G. vermoeseni* and *F. oxysporum* have been consistently cultured from leaves of diseased trees, and these fungi, both singly and in combination, are pathogenic on 4- to 6-month-old *P. canariensis* seedlings. This is the first report of the occurrence and symptomatology of a disease complex of *G. vermoeseni* and *F. oxysporum* on *P. canariensis* palm.

The disease causes the continuing death of leaves until only juvenile leaves remain intact. New leaves are not produced and the bud is invaded and eventually dies. Collapse of an affected tree may occur within several months or the tree may survive for several years. Symptoms first appear on mature or recently matured leaves. Typically, the spines or pinnae on one side of the leaf base become brown and dry and die along the rachis from the base towards the tip of the leaf. Pinnae on the other side of the leaf then die from the tip to the base. Occasionally, pinnae on both sides of the rachis die from the tip of the leaf to the base. Before individual pinnae die, dark or necrotic streaks may be observed along their length. As the leaf dies, a brown discoloration appears on the bottom side of the rachis and may extend the rachis length and width. Pink spore masses of *G. vermoeseni* may be seen in blisters under the brown epidermis of the affected leaf or on old leaf bases on the tree.

A black-brown dry rot, usually adjacent to the outer discoloration, may be found upon dissecting the leaf rachis. When the rachis is sectioned longitudinally, discolored vascular bundles and tissue adjacent to the bundles are visible as thin brown streaks. Frequently, a brilliant pink-purple discoloration is present within the leaf rachis. Both *G. vermoeseni* and *F. oxysporum* may be isolated, either in combination or in pure culture, from any of the affected areas of the rachis. However, pure cultures of *F. oxysporum* are usually isolated from the discolored vascular bundles and pure cultures of *G. vermoeseni* are usually isolated from the black-brown dry rot areas.

To date this disease complex has been found only on *P. canariensis* palms in southern California. In areas where the disease is present there have been considerable tree losses in the past two years. The disease seems to be spread rapidly and there is cause for concern if diseased palms are found among healthy trees. Field observations of disease spread and past cultural histories of different plantings provide evidence that the disease may be rapidly spread by pruning practices.

The only precaution that can be recommended at present is to avoid excessive pruning of *P. canariensis* palms. Trees are commonly pruned once every 1 to 2 years and are cut back to 10 to 20 leaves. If possible, only dead fronds should be removed and pruning tools should be disenfested as workers move from tree to tree. One part of liquid household bleach (sodium hypochlorite) to four parts water is a suitable disinfestant. The relationship and relative importance of *G. vermoeseni* and *F. oxysporum* in this disease complex are unknown. Further studies on the nature and possible control of the disease are in progress.

Photos page 20.

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