Dark, reddish brown exudate oozes from cracks from late spring through fall and is a sign of active disease.

Effect of supplemental winter irrigation on severity of deep bark canker of walnut, Tulare County, cultivar Hartley

Year	Irrigation regime	Percent trees†		
		Healthy	Disease active	Disease inactive
1977	Winter plus standard	51.7	48.3	—
	Standard	48.2	51.3	—
		n.s.	n.s.	
1978	Winter plus standard	48.8	36.7	14.3
	Standard	36.3	45.3	18.1
		n.s.	n.s.	n.s.
1979	Winter plus standard	44.3	34.1	21.6
	Standard	34.8	52.3	11.6
		n.s.	*	n.s.
1980	Winter plus standard	43.2	28.4	28.4
	Standard	33.0	56.8	8.0
		n.s.	**	**

†Data collected from central nine trees in each treatment block. Figures are mean percent; arcsine transformation. Data analyzed using t-test; n.s. is not significant; * is significant, P = 0.05, **P = 0.01.

more cracks with exudate were scored actively diseased, and those with cracks but no ooze scored diseased but inactive. The inactive designation was not included until 1978.

Three years of added winter irrigation significantly decreased the percentage of trees with active disease symptoms and correspondingly increased the percentage of trees with inactive cankers (see table). Tensiometer readings showed more frequent periods of dry soil and lack of available water, particularly from January through July, in the standard-practice areas than where winter irrigation was included.

Results of this study support the observation that cultural practices can have a dramatic effect on incidence of deep bark canker disease. In this case, sufficient soil moisture was maintained by supplementing low rainfall with midwinter irrigations. Inadequate supply of water is a common problem in walnut culture, but programs aimed at improving tree vigor to combat deep bark canker need to include all aspects of tree culture. Procedures required to enhance recovery will vary with each orchard. Where increased soil moisture is indicated, the very serious problem of Phytophthora root and crown rot must be considered when designing an irrigation schedule.

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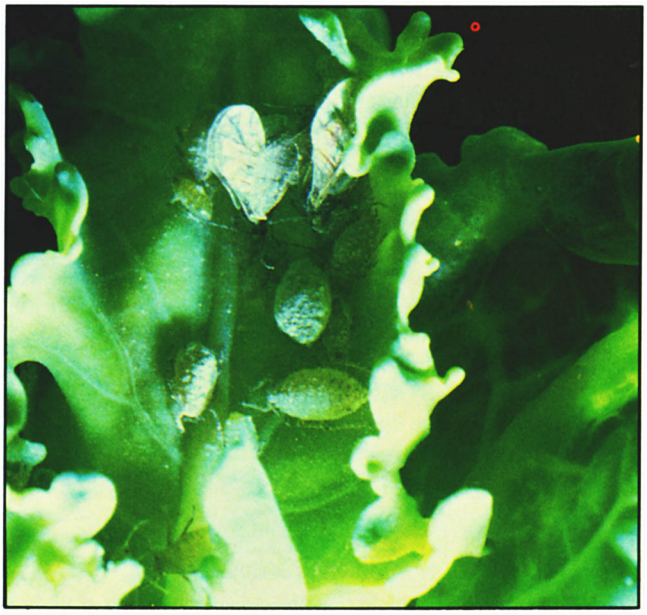
Cabbage aphid control on Brussels sprouts and broccoli

Norman F. McCalley



Cabbage aphids feeding in growing point of broccoli.

Cabbage aphids in Brussels sprouts and broccoli heads at harvest are cause for rejection of the crop by processors and fresh market buyers. To achieve acceptable control, growers apply systemic insecticide sprays at the onset of head formation and additionally as needed to protect the heads from infestation. Meta Systox-R and Phosdrin are the standard insecticides used in California's Salinas Valley.

The purpose of this investigation was to evaluate candidate insecticides against the cabbage aphid, *Brevicoryne brassicae* (L.), on Brussels sprouts and broccoli. Brussels sprouts 'Jade E' were transplanted June 16, 1976, in the first experiment at a test site at Hartnell Community College, Salinas. Plots 25 feet long by one bed (3 feet wide) were replicated four times in a randomized complete block design. Insecticides were applied

on July 15 by CO_2 backpack sprayer with a hand-held boom fitted with three Spraying Systems 8001 flat-fan nozzles operated at 40 pounds per square inch (psi) to deliver 100 gallons of spray per acre. Biofilm spreader-sticker was included with all insecticides at the rate of 0.5 pint per 100 gallons of water.

Evaluation was based on examination of the terminal leaves from 16 plants per plot, selected at random for evidence of living cabbage aphids four days after spraying. Results are expressed as the average percentage of infested plants, which more clearly conforms to the objectives of growers than insect numbers per se (table 1).

A high incidence of cabbage aphid infestation occurred during this experiment with 97 percent of the plants infested in the unsprayed checks. Meta Systox-R at 0.5 pound active ingredient per acre reduced the aphid infestation to 4.2 percent of the plants. No surviving cabbage aphids were found in plants sprayed with the experimental compound GCP 9646 at 0.5 and 1 pound active ingredient per acre (ai/a). No other insecticide treatment gave adequate control at the rates tested.

During evaluation for activity against the cabbage aphid, information also was obtained on control of imported cabbageworm, *Pieris rapae* (L.). Plants in the untreated checks averaged 37.1 percent infested. Orthene at 1 pound ai/a, the only effective insecticide against this pest, eradicated the infestation. Performance of the other insecticides was poor: four days after application, 28.3 to 57.4 percent of the plants remained infested (table 2).

GCP 9646 was phytotoxic at the 1 pound rate only, causing chlorotic areas on the upper surfaces of leaves, apparently where the spray had collected in leaf depressions. None of the other materials were phytotoxic under the conditions of this test.

The second experiment was situated in a portion of a commercial field of 'Green Duke' broccoli near Salinas. Planting was May 2, and first harvest August 2, 1977. Plots were 33 feet long by one bed (40-inch centers) replicated four times in a randomized complete block design. By July 20, the date of application, broccoli heads had formed, many already heavily infested with cabbage aphids. Insecticides were applied with a backpack CO_2 sprayer equipped with a hand-held boom fitted with six flat-fan nozzles operated to deliver 60 gallons dilute spray per acre at 60 psi. Biofilm spreader-sticker was added to all the insecticides at the rate of 0.5 pint per 100 gallons of water. Plants were randomly selected for insect control observations.

Two days after spraying, the exterior of the head and surrounding leaves of 50 plants per plot were examined in the field for presence of live aphids (table 3). Pounce, Ambush, Pydrin, and Curacron had little effect on reducing the infestation. Phosdrin, Meta Systox-R and GCP 9646 resulted in 13.5, 8, and 0.5 percent infested plants, respectively.

A more critical evaluation was taken to determine more precisely the ability of the insecticides to eradicate the aphid infestation in the heads. Five heads per plot were cut, covering leaves removed and the heads examined in the laboratory. It was found that 55 percent of the broccoli heads remained infested in plots sprayed with Phosdrin, a considerable difference from results of the field examination. The surviving aphids were protected by leaves partially covering the immature heads. Broccoli in Meta Systox-R plots had 10 percent, and in GCP 9646 plots no infestation (table 4). The other insecticides did not appreciably affect the incidence of cabbage aphid infestation in the heads. No phytotoxicity was observed from any of the treatments.

In conclusion, of 13 insecticides evaluated against the cabbage aphid on Brussels sprouts and broccoli, the experimental compound GCP 9646 was superior to the standard insecticides, Meta Systox-R and Phosdrin. The other candidate materials at the rates tested had little effect on reducing cabbage aphid infestation.

Based on results against the imported cabbageworm on Brussels sprouts, GCP 9646, GCP 9147, DPX 3853, Pirimor, Vydate, and Croneton do not appear promising for control of lepidopterous larvae. Orthene, registered for control of certain lepidopterous larvae on some other vegetable crops, was very effective against the imported cabbageworm on Brussels sprouts and broccoli, but did not provide adequate control of the cabbage aphid.

TABLE 1. Cabbage aphid control, Brussels sprouts, Salinas, California, 1976

Insecticide	Rate	Infested plants*†
	lb/ai/a	%
GCP 9646	1.0	0 a
GCP 9646	.5	0 a
Meta-Systox-R	.5	4.2 ab
DPX 3853	1.0	22.2 bc
DPX 3853	.5	24.3 c
Croneton	.5	23.3 c
GCP 9147	.5	48.9 d
Orthene	1.0	50.0 d
GCP 9147	1.0	71.4 e
Pirimor	.5	87.9 ef
Vydate	.5	89.1 ef
Check	—	97.0 f

*Evaluated July 19, 4 days after spraying.
†Means followed by the same letter are not significantly different at the 5% level of probability as determined by Duncan's new multiple range test. Subjected to arcsine transformation before analysis of variance.

TABLE 2. Imported cabbageworm control, Brussels sprouts, Salinas, California, 1976

Insecticide	Rate	Infested plants*†
	lb/ai/a	%
Orthene	1.0	0 a
GCP 9646	1.0	28.3 b
Meta-Systox-R	.5	31.3 bc
Croneton	.5	35.0 bcd
GCP 9147	.5	35.8 bcde
Check	—	37.1 bcde
GCP 9147	1.0	41.8 bcdef
Vydate	.5	42.6 bcdef
GCP 9646	.5	45.9 cdef
Pirimor	.5	50.0 def
DPX 3853	1.0	51.0 ef
DPX 3853	.5	57.4 f

*Evaluated July 19, 4 days after spraying.
†Means followed by the same letter are not significantly different at the 5% level of probability as determined by Duncan's new multiple range test. Subjected to arcsine transformation before analysis of variance.

TABLE 3. Cabbage aphid control, broccoli plants, Salinas, California, 1977

Insecticide	Rate	Infested plants*†
	lb/ai/a	%
GCP 9646	0.5	0.5 a
Meta-Systox-R	.5	8.0 b
Phosdrin	.5	13.5 b
Curacron	1.0	38.5 c
Pydrin	.2	41.0 c
Ambush	.2	42.5 c
Pounce	.2	43.5 c
Check	—	50.0 c

*Evaluated July 22, 2 days after spraying.
†Means followed by the same letter are not significantly different at the 5% level of probability as determined by Duncan's new multiple range test. Subjected to arcsine transformation before analysis of variance.

TABLE 4. Cabbage aphid control, broccoli Salinas, California, 1977

Insecticide	Rate	Infested heads*†
	lb/ai/a	%
GCP 9646	0.5	0. a
Meta-Systox-R	.5	10. a
Pounce	.2	45. b
Phosdrin	.5	55. b
Pydrin	.2	60. bc
Check	—	55. bc
Curacron	1.0	65. bc
Ambush	.2	75. c

*Evaluated July 22, 2 days after spraying.
†Means followed by the same letter are not significantly different at the 5% level of probability as determined by Duncan's new multiple range test. Subjected to arcsine transformation before analysis of variance.

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