Section VII.
Foliage & Seed Feeding Pests

EFFECTS OF CHLORPYRIFOS AND SULFUR ON PEST THRIPS AND SPIDERS ON GRAPE

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In 2003, we conducted a field experiment, replicated in two separate plots (A and B) within an abandoned vineyard in Umatilla, Oregon. We followed the impacts of the broad-spectrum insecticide chlorpyrifos and the fungicide sulfur, alone and in combination, on pest thrips nymphs and canopy-dwelling spider phenology from May-September.

The experiment was a completely random 2 X 2 factorial design, with two replicates assessed simultaneously and located approximately 100 m apart. Unmanaged vegetation surrounded each site, including grapevines (*Vitis vinifera* L.), Russian olive trees (*Elaeagnus angustifolia* L.), and blackberry bushes (*Rubus armeniacus* Focke), and both replicates had weedy groundcover dominated by Russian thistle (*Salsola* sp.).

There were 10 vines in each of the following four treatments:

1) -C-S = a control without spray applications.
2) +C-S = chlorpyrifos-only (Lorsban®-4E, Dow AgroSciences LLC, Indianapolis IN) applied once in May at a rate of 1.12 kg/ha.
3) -C+S = sulfur-only, (Microthiol® Disperss™ micronized wettable sulfur, Elf Atochem North America Inc., Agrichemicals Group, Philadelphia PA) applied at 2-3 wk intervals at a rate of 11.21 kg/ha.
4) +C+S = a combination treatment with Lorsban®-4E and Microthiol® Disperss™ applied at the same timing and rates previously mentioned.

Chemicals were applied using a Stihl® powered backpack sprayer (Model SR420, STIHL Inc., Virginia Beach VA). Chlorpyrifos was only applied once on 5-22-03, while sulfur was applied on the following dates: 5-22-03, 6-12-02, 7-1-03, 7-31-03, and 8-14-03.

Leaf and canopy suction sampling were used to assess the grape arthropod fauna. Twenty leaves of average size and age were taken monthly from the central region of each vine to obtain data on thrips nymphs. A leaf blower (Model PB-1010, Echo Inc., Lake Zurich, IL)

modified to suck air, and thus draw insects into a collecting bag, was used to sample spiders. The collecting bag (18 by 24 cm) was constructed from 55 μ mesh material (NITEX® Screen, Dynamic Aqua-supply Ltd., Surrey, BC) and inserted into the end of the blower suction tube, folded over the tube lip, and fastened using a rubber band or plastic ring covered with a seven mm wire screen to keep out debris. Canopy suction samples were taken prior to any chemical applications in May (A, 5-22-03; B, 5-21-03) and again after spraying had been terminated on 8-19-03. Due to differences in vine stature, on each sampling date vines in the A replicate were each sampled for 10 seconds, while in the B replicate each vine was sampled for 30 seconds.

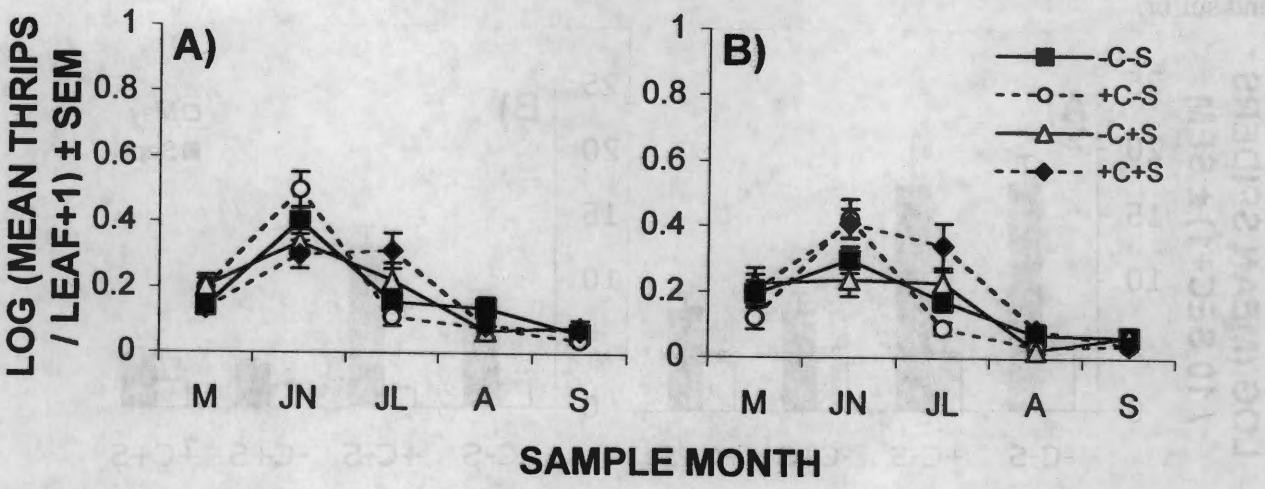
Arthropod densities were converted to arthropods/leaf or arthropod/10 sec of suction and log (X+1) transformed. Time series data were analyzed using repeated measures MANOVA, with initial arthropod density prior to spray applications as a covariate.

Replicate did not have a significant effect on pest thrips densities, and so data were combined for analysis (*replicate* X *chlorpyrifos* X *sulfur*: $P = 0.62$; *replicate* X *chlorpyrifos*: $P = 0.15$; *replicate* X *sulfur*: $P = 0.50$). Densities of pest thrips were low in May, peaked in June, and then declined, leading to a significant time effect ($P < 0.001$; Figs. 1a-b). Chlorpyrifos increased but sulfur decreased thrips densities, leading to a statistically significant interaction (*chlorpyrifos* X *sulfur*: $P = 0.008$), which was strongest in mid-season (*chlorpyrifos* X *sulfur* X *time*: $P = 0.04$). Positive effects of chlorpyrifos and suppressive effects of sulfur on thrips densities became less dramatic as the season progressed (*chlorpyrifos* X *time*: $P < 0.001$; *sulfur* X *time*: $P = 0.002$).

Before chemicals were applied, there were no significant differences in SP densities in either replicate (A, *chlorpyrifos* X *sulfur*: $P = 0.98$; *chlorpyrifos*: $P = 0.58$; *sulfur*: $P = 0.52$; B, *chlorpyrifos* X *sulfur*: $P = 0.32$; *chlorpyrifos*: $P = 0.91$; *sulfur*: $P = 0.22$; Figs. 2a-b). There was no interactive effect of chemicals on spider densities (*chlorpyrifos* X *sulfur*: A, $P = 0.54$; B, $P = 0.21$), while sulfur had a detrimental effect on spiders in both replicates (A, $P < 0.001$; B, $P < 0.001$), and chlorpyrifos was only harmful in the B replicate (A, $P = 0.74$; B, $P = 0.01$).

Overall, densities of pest thrips nymphs were higher immediately after chlorpyrifos application, perhaps due to negative effects of this organophosphate chemical on predator densities. Sulfur was weakly suppressive to pest thrips early in the season. However, it is not known how these chemicals affect thrips development. Thus, high densities of thrips nymphs in July in treatments with sulfur may reflect negative effects of this fungicide on thrips developmental rates. Sulfur appeared to suppress canopy-dwelling spider densities, while chlorpyrifos only had a negative effect on spiders in one replicate. Vines in this replicate were taller, and had cooler, more humid canopies compared to vines in the other replicate, which may have influenced chlorpyrifos efficacy and/or degradation.

Figs. 1a-b. Pest thrips nymphs densities from leaf sampling, (A) A and (B) B replicates. -C-S = control, +C-S = chlorpyrifos only, -C+S = sulfur only, +C+S = chlorpyrifos and sulfur.



Figs. 2a-b. Canopy-dwelling spider densities from canopy suction sampling, (A) A and (B) B replicates. -C-S = control, +C-S = chlorpyrifos-only, -C+S = sulfur-only, +C+S = chlorpyrifos and sulfur.