ALFALFA PEST CONTROL AND WATER QUALITY

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ABSTRACT

Organophosphates (OP) including Lorsban, Lock-On, and Imidan move offsite from alfalfa fields via irrigation runoff at levels exceeding State Water Resources Control Board objectives for toxicity standards. This OP toxicity was significantly higher for weak alfalfa fields than for strong stands. Warrior and Baythroid, (pyrethroids) did not move offsite in the irrigation tailwater. Efficacy trials for pest control showed that the pyrethroids controlled the Egyptian alfalfa weevil as well as the standard OP treatments; however, they may cause aphid outbreaks. Costs for the pyrethroids are the same or lower than the OP's.

Key Words: alfalfa, water quality, Egyptian alfalfa weevil control

INTRODUCTION

Chlorpyrifos (Lorsban®) has been routinely detected in water quality monitoring projects in the Sacramento and San Joaquin rivers at levels high enough to kill the EPA aquatic test species Ceriodaphnia. These invertebrates are indicators of the health of aquatic systems and serve as primary food for many larval and juvenile fish. State and Regional Water Quality Control Board (SWRCB) projects have found that one source for this Lorsban contamination is from alfalfa fields. Lorsban moves offsite in irrigation runoff after fields are treated with Lorsban for Egyptian alfalfa weevil control. For example, toxic quantities of Lorsban were found in alfalfa tailwater samples 7 irrigations after being treated with Lorsban by the Regional Water Quality Board.

The magnitude and duration of the Lorsban-caused toxicity to Ceriodaphnia from alfalfa irrigation runoff is in violation of the objectives for toxicity standards in the Water Quality Control Board Basin Plan. In 1998, the state of California placed the Sacramento and San Joaquin River as well as the associated Delta/Estuary on the Clean Water Act 303(d) list of impaired waterways in part because of elevated levels of Lorsban moving offsite from alfalfa fields. These listings necessitate the development of Total Maximum Daily Loads (TMDLs). TMDLs will restrict the quantities of Lorsban coming off of specific areas. Lorsban is widely used in California for a variety of urban as well as other agricultural applications, and is subject to restrictions stemming from the TMDL limitations. Additionally, Lorsban is a primary target of the Food Quality Protection Act (FQPA) of 1996.

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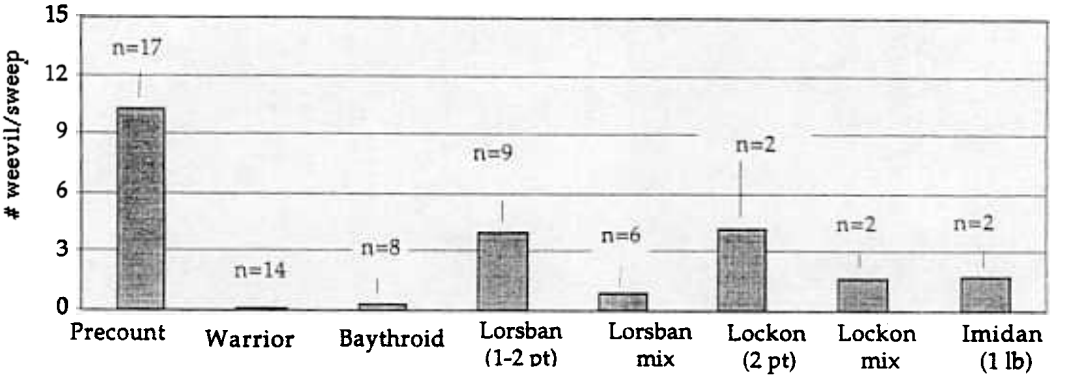
Treatment	Formulated rates/Acre	Number of sites
Warrior	3.2 oz	13
Baythroid	2.5 and 2.8 oz	6
Lorsban	1 pt, 1.5 pt, and 2 pt	9
Lorsban+ Malation	0.5 pt + 1.5 pt	2
Lorsban+Ambush	1 pt + 6 oz and 6.4 oz	2
Lorsban + Warrior	1 pt + 2.5 oz	1
Lock-On	2 pt	2
Lock-On + Ambush	2 pt + 5 oz and 1.5 pt + 10 oz	2
Imidan	1.0 lb	2

was added to the water quality samples to assess for organophosphate (OP) toxicity. A total of 17 different fields (78 samples) were sampled for water quality.

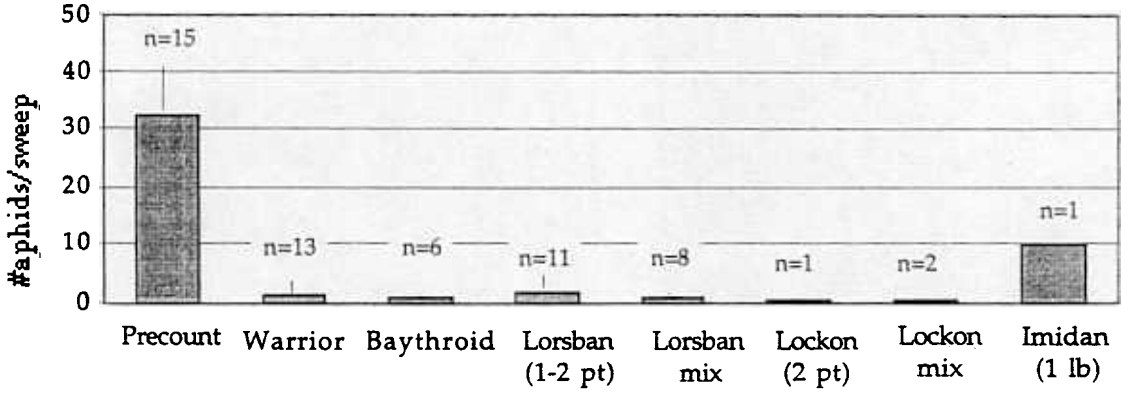
RESULTS

The following figures summarize the results for insect control with the various treatments. The number on the top of the bars designates the number of sites sampled.

Fig. 1. Average number of weevils per sweep for cut 1 pre- and post count.



2. Average number of aphids per sweep for cut 1 pre-and post count.



*Beneficial insect pre- and post counts was <1 per sweep, so not graphed.

Fig. 3. Average number of blue and pea aphids and beneficial insects per sweep for cut 2. The sample size (number of field sites) is included in the parentheses.

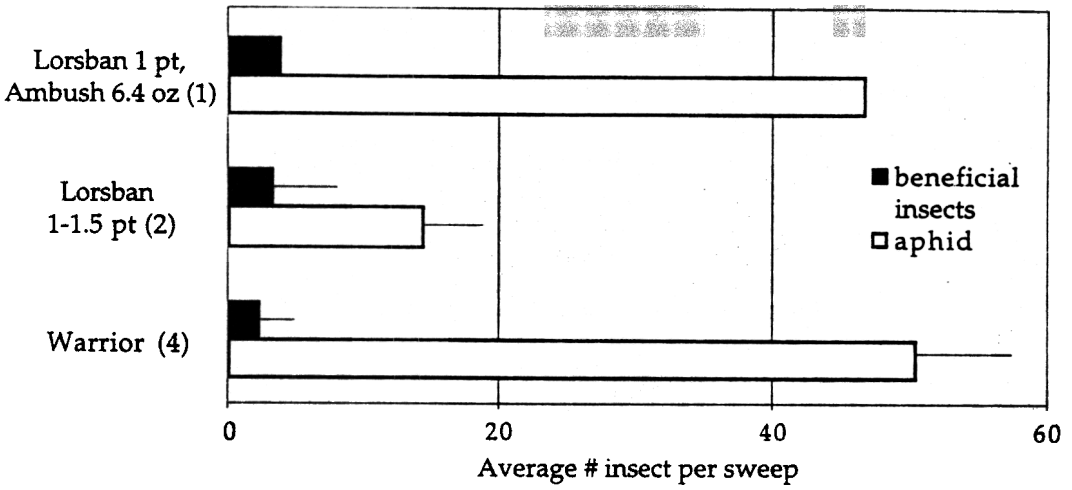
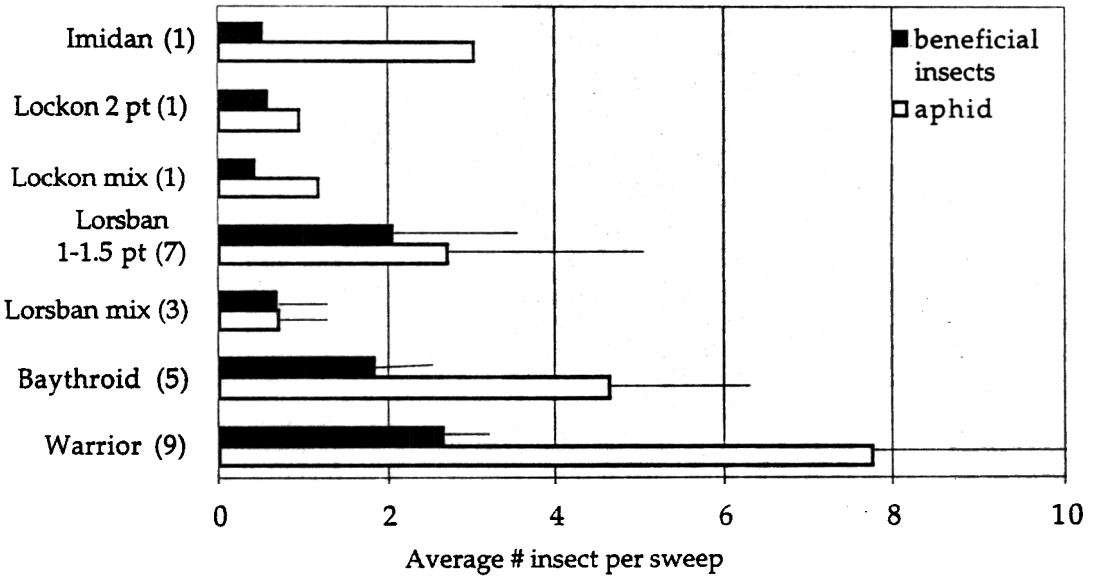


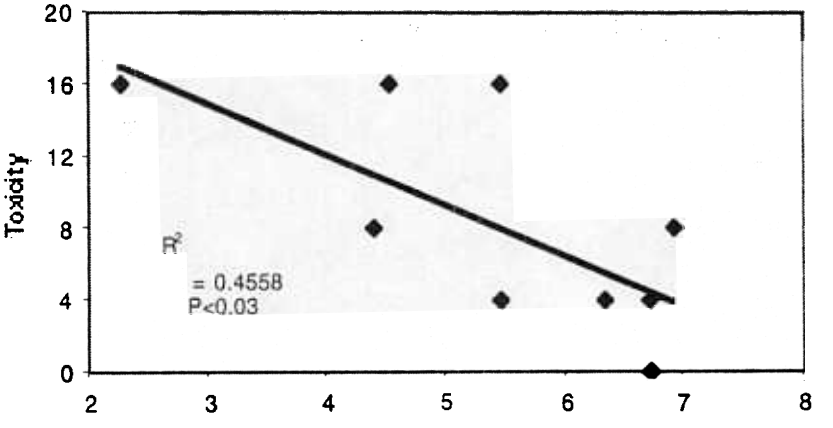
Fig. 4. Average number of blue and pea aphids and beneficial insects per sweep for cut 3. The sample size is included in the parentheses.



Spotted alfalfa aphids per stem were not graphed for cut 6 because levels were less than 5 per stem and not significantly different between the Lorsban and Warrior treatments. The costs for the pyrethroid sprays are the same as the OP insecticides. An added benefit of the Warrior and Baythroid treatments is that we did not see any phytotoxicity to the alfalfa plants that occurred when Lorsban or Lock-On was used. This phytotoxicity occurred when Lorsban and Lock-On were applied when spring temperatures were so cold that the alfalfa stopped growing for a week.

The following table summarizes the results of the water quality samples taken for the different insecticide treatments.

Treatment	Number of sites sampled	% Mortality Ceriodaphnia	Toxic at what dilution?	PBO removed toxicity?
Warrior	10 6 11	0 0	25-6.25%	Yes
Lockon: all rates, all tank mixes	3	100%	25-6.25%	Yes
Imidan		100%		Yes



Stand count (av. # of crowns per sq. ft.)

CONCLUSION

These data are the first year results of a 2 year project, so the information presented here is still preliminary. Current results for insect data show that both Warrior and Baythroid give excellent weevil control. Lorsban or Lock-On alone at 1 to 2 pints per acre kept weevils below the economic threshold level of 10-15 weevils per sweep, however, control was not as efficacious as when tank mixes with either Ambush or Malation were used. Lorsban at 1 pint per acre gave limited alfalfa weevil control. All materials, except Imidan, gave good aphid control, for 2 to 3 weeks.

A concern of using either Baythroid or Warrior for weevil control is that these materials are pyrethroids, which have a history of being disruptive to beneficial insects, resulting in secondary pest outbreaks. In this first year trial, we did not see any adverse effects of using either Baythroid or Warrior for weevil control in alfalfa. We had some elevated levels of aphids in the second cutting of alfalfa after spraying with the pyrethroids, however, these numbers were way below threshold levels. By the third cutting, numbers of aphids were low and insignificant in both the pyrethroid and Lorsban treated plots. Spotted alfalfa aphids were numerous in alfalfa fields this summer, but remained well below the threshold of 20 per stem. There were no significant differences in numbers of spotted alfalfa aphids between the Lorsban and Warrior treated plots.

Water quality assays with Ceriodaphnia showed that Lorsban, Lockon, and Imidan moved offsite with alfalfa irrigation runoff. Warrior and Baythroid were not detected in our water column toxicity tests, so probably not moving offsite. Pyrethroids are extremely insoluble in water and bind tightly to soil and plants right after application. They may move offsite with soil particles in the irrigation runoff, but will not be found in the water column. Since very little soil moves offsite from alfalfa fields, very little pyrethroid is probably moving offsite. Lorsban toxicity in the tailwater samples was highest when applied to weak stands. This occurs because more Lorsban drifts on the soil when applied to weak stands (because of the lack of plant canopy); this material is then picked up by the irrigation water.

Our suggestions to mitigate the amount of OP's moving offsite and into the delta to decrease TMDL's include the following: 1) minimize irrigation runoff; 2) know where your water is flowing; if it is draining directly into a slough that leads to the delta, and you can't control your water runoff, do not use OP's; 3) Avoid spraying weak alfalfa stands with OP's; 4) avoid spraying weak head and tail areas of alfalfa stands with OP's; 5) overseed with berseem clover (similar protein and ADF as alfalfa) as an alternative tool to weevil control; weevils will not feed on berseem, so when overseeded in alfalfa, this forage fills in and makes up for any loss in alfalfa production due to weevil damage to the alfalfa; and 6) use return systems to re-use irrigation water on your fields.

If the amount of OP's moving offsite from alfalfa fields is not reduced by voluntary compliance, DPR regulations will be imposed. This will include issuing restricted use permits or canceling registration of materials. If issuance of restricted use permits does not reduce the amount of insecticides moving offsite, the SWRCB will step in and further regulate insecticides, likely resulting in cancellation of insecticides registered for alfalfa.

Future research should concentrate on the following: 1) efficacy trials for Egyptian alfalfa weevil (EAW) and armyworm control on new pesticides that do not move offsite and that have minimal impacts on non-target organisms; 2) efficacy trials on the impact of pyrethroids on beneficial insects; 3) efficacy trials for the impact of microbial insecticides for armyworms control; 4) economic threshold levels for EAW; and 5) assessing possible offsite movement of pyrethroids from alfalfa fields via soil particles.