On-Farm Research to Support the Registration of New Insecticides for Alfalfa

Kevin Wanner, Montana State University

RATIONALE & OBJECTIVES

- Alfalfa weevils have developed resistance to insecticides with pyrethroid active ingredients.
- Products such as Warrior II, Mustang Maxx, Baythroid XL, and generic formulations that are commonly used to control alfalfa weevil damage fail in areas where resistance has developed.
- During 2021 and 2022 insecticide trials were conducted in commercial alfalfa fields.
- New and currently registered insecticides were evaluated for alfalfa weevil control, including timing and rates, to provide best use recommendations.

STUDY DESCRIPTION

Plot Layout:

- Experimental plots measured 10' X 30' with 5 replicates for each treatment.
- An untreated 5' buffer was maintained around every plot.
- 12 treatments were tested (Table 1).
- Insecticides were applied at 25 PSI & 18 GPA using a Chapin™ 24v backpacker sprayer, a 4' boom and TeeJet® nozzles (015 Green DG110-VS).

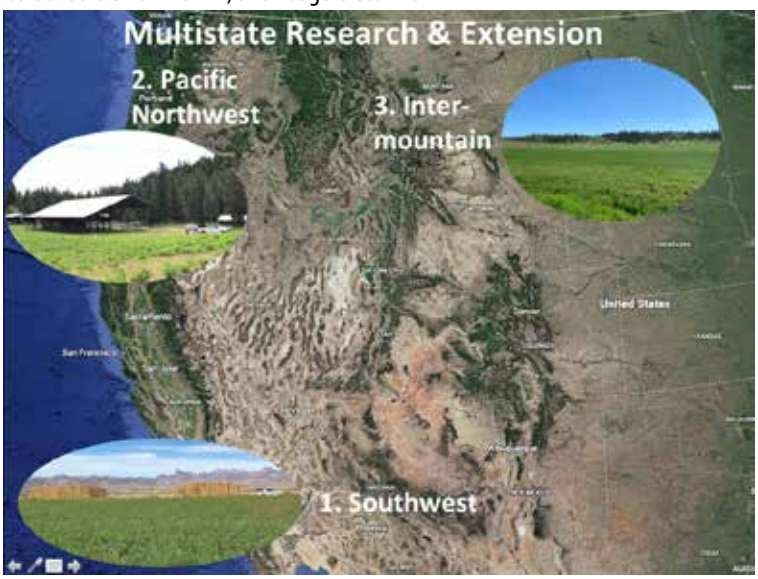
Analysis:

- 180° sweep net samples were taken from each plot one week after spraying insecticide.
- Average numbers of alfalfa weevils were analyzed by ANOVA and Fisher (LSD) test.

Table 1. List of treatment factors.

Treatments	MOA	Active Ingredient	Rate oz/acre
Warrior II-low rate	3A	Lambda cyhalothrin	1.28
Warrior II-high rate	3A	Lambda cyhalothrin	1.92
Steward-low rate	22A	Indoxacarb	6.7
Steward-high rate	22A	Indoxacarb	11.3
Endigo ZCX	3A,4A	Thiamethoxam, Lambda cyhalothrin	4.5
Actara	4A	Thiamethoxam	3.46
Mustang Maxx	3A	Zeta-cypermethrin	4.0
Brigade	3A	Bifenthrin	6.4
Permethrin	3A	Permethrin	8.0
Baythroid XL	3A	ß-cyfluthrin	2.8
Sevin XLR	1A	Carbaryl	48.0
Diamethoate 400EC	1B	Dimethoate	16.0

Figure 1. Commercial alfalfa fields known to have pyrethroid resistant alfalfa weevils were selected in three different regions of the Western US: 1. Parker AZ; 2. Goldendale & Yakima WA; and Lodge Grass MT.



RESULTS

Figure 2. Insecticide timing. A) Early at peak 1st instars or B) Peak 2nd and 3rd instar stage).

- ALL MoA3A pyrethroid insecticides were ineffective in areas with known resistance (control ranged from 40-80%), with the exception of Brigade (bifenthrin, registered for seed alfalfa).
- In these same areas, Steward (indoxacarb) was effective at the lower 6.7 ounce/acre rate (control was typically >90%). Higher rates of Steward may be necessary when early applications and extended persistence are required.
- Older products: MoA 1A Sevin XLR was not effective and it produced phytotoxic yellowing of the alfalfa; MoA 1B Dimethoate 400EC provided promising results, on its own in MT, and mixed with a pyrethroid, in WA.

- New products: Endigo and Actara (not registered) were effective at 1 of 3 sites.
- Insecticide efficacy varied with geographic location.
- Earlier timing of spray applications may provide better alfalfa weevil control.
- After 3 years of not using a pyrethroid use, control provided by MoA 3A Warrior increased from 0% to 80% (Figure 6).

Figure 3. Percent (%) control of alfalfa weevils in the Southwestern Region 6 days after treatment (DAT). Insecticides applied at peak 2nd and 3rd instar stages.

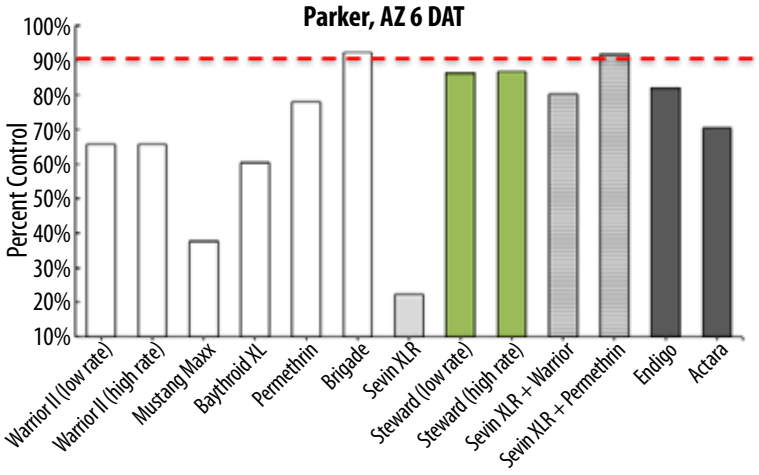


Figure 4. Percent (%) control of alfalfa weevils in the Pacific Northwest Region 6 days after treatment (DAT). Insecticides applied at peak 2nd and 3rd instar stages.

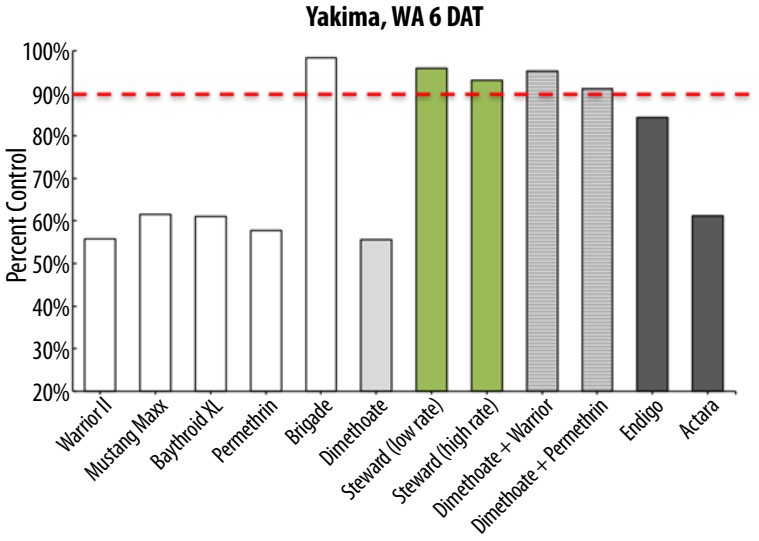


Figure 5. Percent (%) control of alfalfa weevils in the Intermountain Region 6 days after treatment (DAT). Insecticides applied during peak 1st instar stage.

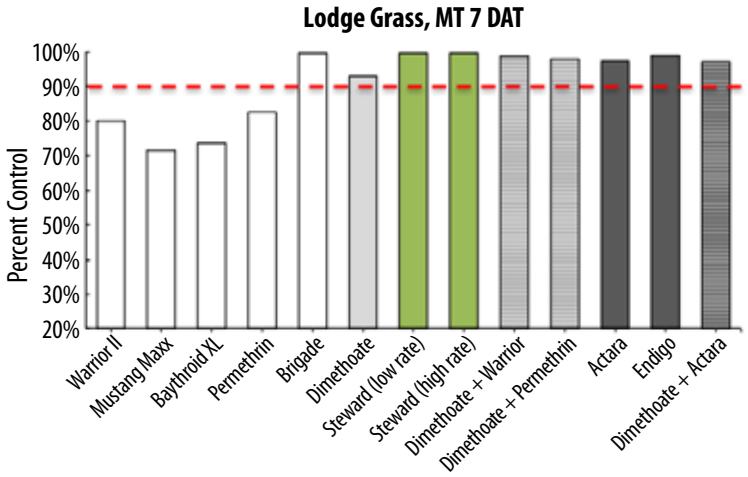
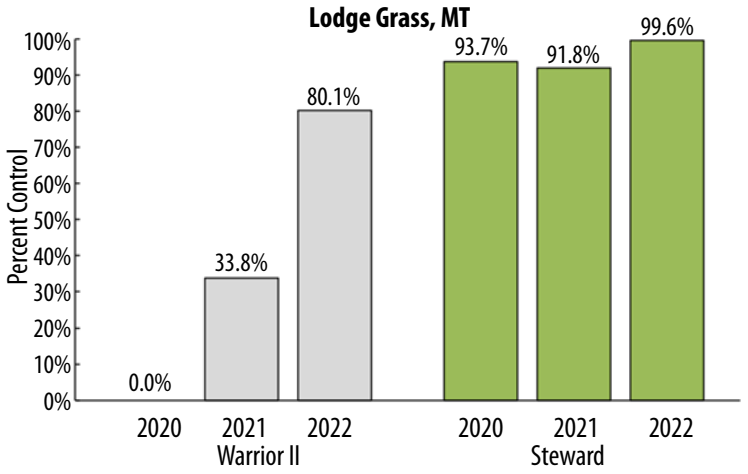


Figure 6. Pyrethroid resistance declined (% control improved) during a three-year period when Steward replaced Warrior as the insecticide used in the commercial forage alfalfa field.



CONCLUSIONS/SUGGESTIONS

- A specific MoA group insecticide should be applied once every three years at most; alfalfa weevil control methods should be rotated yearly.
- Forage alfalfa producers should use MoA3A pyrethroids no more than once every three years. The addition of dimethoate may improve efficacy of the pryrethroid when it is used.
- In most cases the 6.7 ounce/acre rate of Steward is effective, and Steward should be used only once every three years, to prevent resistance developing to this product.

Alfalfa
U.S. Alfalfa Farmer Research Initiative

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