

Solving weevil resistance

Hay & Forage Grower is featuring results of research projects funded through the Alfalfa Checkoff, officially named the U.S. Alfalfa Farmer Research Initiative, administered by National Alfalfa & Forage Alliance (NAFA). The checkoff program facilitates farmer-funded research.

ALTHOUGH alfalfa weevils have developed resistance to pyrethroid insecticides, causing severe alfalfa losses in the Western U.S. and concern elsewhere, producers may still be able to utilize pyrethroids on a limited basis. They'll need to alternate those insecticides with others using different modes of action as well as implement additional control options, according to Alfalfa Checkoff research by Kevin Wanner, Montana State University Extension entomologist.

The research also highlights the need to register new insecticides for alfalfa with different modes of action — critical for alfalfa weevil management, he noted.

In 2019, Western farmers and ranchers reported losing a majority of first cutting to alfalfa



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weevil defoliation after two or even three applications of pyrethroid insecticides. Weevil populations ballooned to high levels — 100 larvae per single sweep net sample, which is five times the economic thresh-

old. “After talking to colleagues in other Western states, it was clear that alfalfa weevil resistance to pyrethroid insecticides was suspected across the region,” Wanner said.

The producer reports prompted a collaboration between Montana State University and the University of California–Davis to quantify the degree of pyrethroid resistance in the West and develop multi-state recommendations. That research led to Wanner’s Alfalfa Checkoff-funded project, which entailed on-farm research to support the registration of new insecticides for alfalfa.

“The majority of effective and available insecticides for alfalfa weevil control all contained pyrethroid active ingredients. It quickly became clear that forage alfalfa suffered from a lack of different active ingredients with different modes

of action that can be used in rotation to manage pyrethroid resistance in alfalfa weevils,” Wanner asserted.

The purpose of the project was to evaluate new insecticides, combinations of older insecticides, and the timing and rates of currently registered insecticides for control of alfalfa weevil. “We were able to take advantage of a USDA-NIFA-funded research project to maximize the results of NAFA’s Alfalfa Checkoff grant,” Wanner noted. “Good on-farm collaborations with regional producers and implementing consistent experimental procedures in three diverse

alfalfa-producing regions in Montana, Oregon/Washington, and Arizona proved to be a valuable approach.”

Wanner’s research showed, because of cross-resistance, all mode of action (MoA) 3A pyrethroid products registered for forage alfalfa become ineffective. Rotating the insecticide MoA and using noninsecticide strategies such as an early harvest, where applicable, are critical to preserving their usefulness.

“If you see ‘slipping’ control with pyrethroid insecticides — for example, needing maximum label rates to achieve the same level of control previously provided by lower rates — managing

Figure 1. Efficacy of Warrior (after three years without using a pyrethroid) and Steward

Treatment	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	β-cyfluthrin	2.8
Sevin XLR	1A	Carbaryl	48.0
Diamethoate 400EC	1B	Diamethoate	16.0

PROJECT RESULTS

- All MoA3A pyrethroid insecticides were ineffective in areas with known alfalfa weevil resistance (control ranged from 40% to 80%), except Brigade (bifenthrin, registered for seed alfalfa).
- In these same areas, Steward (indoxacarb) was effective at the lower 6.7 ounce per acre rate (control was typically over 90%). Higher rates of Steward may be necessary when early applications and extended persistence are required.
- Older products: MoA1A Sevin XLR was not effective and produced phytotoxic yellowing of alfalfa; MoA1B Dimethoate 400EC provided promising results on its own in Montana and mixed with a pyrethroid in Washington.
- New products: Endigo and Actara (not registered for alfalfa) were effective at one of three sites.
- After three years without using a pyrethroid, control provided by MoA3A Warrior increased from 0% to 80%.

the resistance will prolong the usefulness of this valuable insecticide group,” Wanner said.

By conducting trials in the same commercial field in Montana for four consecutive years, Wanner and his team made a preliminary estimate of how quickly pyrethroid insecticides might regain their effectiveness. “Avoiding the use of pyrethroids for three to five years

in areas with high resistance may restore their efficacy, but resistance will return quickly when pyrethroid use is resumed. I’d recommend using MoA3A pyrethroids no more than once every three years, rotating with MoA22A Steward and noninsecticide options,” Wanner pointed out.

“The diversity of alfalfa production systems and the importance of custom-

izing alfalfa weevil management recommendations were reinforced by this project. A ‘one-size-fits-all’ approach will not work,” he said. ●



For further information on results of Alfalfa Checkoff-funded projects, visit NAFA’s website at <https://alfalfa.org/research.php>.



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