

# Management of Pyrethroid-resistant Red Sunflower Seed Weevils

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## Introduction

In North Dakota and South Dakota, the red sunflower seed weevil, *Smicronyx fulvus* (LeConte) (Coleoptera: Curculionidae), is an annual pest of sunflower (Fig. 1). Although both sunflowers and red sunflower seed weevils are native to North America, commercial sunflower hybrids lack robust resistance to this pest (Cluever et al. 2025). As a result, red sunflower seed weevils can cause substantial yield loss. One study found that within a field, upwards of 50% of sunflowers can be infested, and in those infested plants, red sunflower seed weevil larvae can be present in as many as 80% of developing achenes (Cobia and Zimmer 1978). In fact, the red sunflower seed weevil is considered one of the primary reasons for the decline in sunflower production in Illinois and Missouri (Satterthwait 1946). In 2017, entomologists at SDSU received the first report of a pyrethroid insecticide failure for red sunflower seed weevil (Varenhorst et al. 2024). Since then, numerous field failure reports have been received each year. In addition, throughout the sunflower production areas of South Dakota, there have been very large red sunflower seed weevil populations present since 2016 (Fig. 2). Recent research from SDSU determined that the South Dakota red sunflower seed weevil populations are resistant to lambda-cyhalothrin, esfenvalerate, cypermethrin, deltamethrin, and beta-cyfluthrin. In 2025, entomologists at NDSU found evidence suggesting reduced susceptibility at one location in North Dakota. Due to the high level of resistance to pyrethroid insecticides, they are not recommended for red

sunflower seed weevil management in South Dakota, and their use in North Dakota should be closely evaluated to gauge effectiveness and delay the development of pyrethroid resistance.



Figure 1. Red sunflower seed weevil adult. Photo courtesy of Adam Varenhorst.



Figure 2. Sunflower head severely infested with red sunflower seed weevil adults hiding in the florets. Photo courtesy of Philip Rozeboom.

## Management Strategies for Pyrethroid-Resistant Red Sunflower Seed Weevils

Due to the limited insecticide options outside the pyrethroid class, we encourage growers, consultants, agronomists, and applicators to evaluate their red sunflower seed weevil management plan before an insecticide application. The following are recommendations for red sunflower seed weevil best management practices (adapted from Koch et al. 2018, Koch et al. 2025):

- Treat fields only when populations exceed the recommended thresholds. This will reduce selection pressure for the development of resistance to non-pyrethroid management options.
  - Regularly scout fields from the onset of flowering (R5.0) to 70% pollination (R5.7). The time between those stages depends on weather conditions and can range from 4 to 12 days.
  - Remember that red sunflower seed weevil population densities tend to be higher along field edges, so it is important to scout from multiple areas (5 sites) across the field that are at least 75 feet from the field edge.
  - Count the number of weevils on five plants at each site for a total of 25 plants (5 sites x 5 plants), and then calculate the average number of weevils per head.
  - Apply treatments only when populations exceed the economic threshold. For oilseed hybrids, the economic threshold is based on plant population, the market price of sunflowers, and the cost of insecticide and application (Knodel et al. 2026) and is typically more than 6 weevils per head. For confectionery hybrids, the threshold is more than 2 weevils per head (Peng and Brewer 1995).
  - Treat within 1 to 2 days of discovering the above threshold population to reduce the number of damaged sunflower seeds.
  - Do not treat sunflowers after R5.7.
- When thresholds are exceeded, apply insecticide products according to the label specifications.
  - Use the full labeled rate (do not use a higher or lower rate than what is specified on the label).
  - Ensure that appropriate volume and pressure are being utilized to ensure optimal coverage.
- Spray only at times specified on the product label and during conditions that will limit drift.
- Scout fields after the restricted-entry interval listed on the product label has expired to determine if the treatment was effective (i.e., red sunflower seed weevil populations are below threshold).
- If red sunflower seed weevil populations remain above threshold, retreat with an insecticide from a different mode of action group. In Table 1, insecticides currently labeled for red sunflower seed weevils in South Dakota are listed by mode of action group number, chemical class, active ingredient, and product trade names. In Table 2, insecticides currently labeled for red sunflower seed weevils in North Dakota are listed by mode of action group number, chemical class, active ingredient, and product trade names.
- Please report any suspected cases of insecticide failure/insecticide-resistant red sunflower seed weevils to your Extension Entomologist (contact information below).

IRAC Mode of Action Group #	Class	Active Ingredient	Trade Names
1B	Organophosphate	Malathion	FYFANON Malathion Insecticide, Drexel Malathion Insecticide 4EC, Malathion 57EC, FYFANON 57% EC, Malathion 5 Insecticide
3A	Pyrethroid	Beta-cyfluthrin	Baythroid XL, Cryptoid XL, Sultrus
3A	Pyrethroid	Cyfluthrin	Tombstone, Tombstone Helios
3A	Pyrethroid	Deltamethrin	Delta Gold 1.5EC, Delta Gold 100
3A	Pyrethroid	Esfenvalerate	Asana XL, S-FenvaloStar
3A	Pyrethroid	Lambda-cyhalothrin	Grizzly Too, Kendo, Lambda 1EC, LambdaStar, Silencer, Warrior II, (others)
3A	Pyrethroid	Zeta-cypermethrin	Cortex Maxx, Mustang, Mustang Maxx
3A+28	Pyrethroid+Diamide	Lambda-cyhalothrin + Chlorantraniliprole	Besiege
28	Diamide	Cyclaniliprole	Harvanta

Table 1. Foliar insecticides labeled for red sunflower seed weevil management in South Dakota - 2026.

IRAC Mode of Action Group #	Class	Active Ingredient	Trade Names
3A	Pyrethroid	Beta-cyfluthrin	Baythroid XL, Cryptoid XL, Sultrus
3A	Pyrethroid	Cyfluthrin	Tombstone, Tombstone Helios
3A	Pyrethroid	Deltamethrin	Delta Gold 1.5EC, Delta Gold 100
3A	Pyrethroid	Esfenvalerate	Asana XL, S-FenvaloStar
3A	Pyrethroid	Lambda-cyhalothrin	Grizzly Too, Kendo, Lambda 1EC, Lambda-Cy, LambdaStar, Silencer, Warrior II, (others)
3A	Pyrethroid	Zeta-cypermethrin	Cortex Maxx, Mustang, Mustang Maxx
3A+28	Pyrethroid+Diamide	Lambda-cyhalothrin + Chlorantraniliprole	Besiege
28	Diamide	Cyclaniliprole	Harvanta

Table 2. Foliar insecticides labeled for red sunflower seed weevil management in North Dakota - 2026.

For the red sunflower seed weevil, insecticidal management options in South Dakota are currently limited. However, there are non-insecticidal options that have been proven effective at reducing damage caused by red sunflower seed weevils. Previous research has demonstrated that planting an early-maturing sunflower variety around the edge of the sunflower field serves as an effective trap crop (Brewer and Schmidt 1995). In addition, utilizing early planting dates (1st to second week of May) can reduce red sunflower seed weevil infestation by desynchronizing the sunflower growth from the red sunflower seed weevil's lifecycle (Oseto et al. 1987, Prasifka et al. 2025). Successful management of the red sunflower seed weevil in South Dakota will require adopting other pest management strategies, such as early planting dates or trap crops, in addition to insecticide management.

### **Factors Contributing to Insecticide Resistance**

Several factors may have led to the development of pyrethroid-resistant red sunflower seed weevils:

- Pyrethroid insecticides have been used to manage red sunflower seed weevils since the 1980's. Most models suggest insecticide products are effective for approximately 25 years.
- Annual infestations of red sunflower seed weevils require management every year.
- Contract-obligated, insecticide applications requiring insecticide management regardless of pest pressure can result in unnecessary, prophylactic insecticide applications that increase the selection pressure of resistant populations.
- Very limited insecticide modes of action (Tables 1 and 2): Red sunflower seed weevil management relies almost exclusively on chemical management with heavy reliance on the pyrethroid class (3A).
- Misuse of labeled insecticides causing increased selection pressure:
  - Prophylactic applications (applications when red sunflower seed weevils were below threshold)
  - Applying insecticides at below the labeled rates
  - Repeated application of the same insecticide active ingredient or insecticide mode of action in a single season.

- Exceeding the labeled annual applications for an insecticide product and exceeding the labeled annual active ingredient limit.
- Ignoring the labeled minimum interval between treatments of the same insecticide active ingredient.

### **Contact Your Extension Entomologists:**

- North Dakota
  - Janet Knodel, North Dakota State University
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  - 701-231-7915
- South Dakota
  - Adam Varenhorst, South Dakota State University
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  - 605-688-6854

**Disclaimer:** Insecticides are given as examples only and do not imply endorsement of one product versus another nor discrimination against any product not mentioned by the authors or the universities.

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