

Early Planting and Hybrid Maturity Effects on Red Sunflower Seed Weevil (*Smicronyx fulvus*) Damage in North Dakota Sunflower Production

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The red sunflower seed weevil, *Smicronyx fulvus*, remains the most economically important insect pest of sunflowers in the northern Great Plains. In South Dakota, growers now routinely report severe yield and oil losses as *S. fulvus* populations have reached historic highs and developed resistance to pyrethroids. In contrast, populations in North Dakota have remained comparatively stable, though historically they have reached damaging levels exceeding 100 weevils per plant.

Early planting and early-maturing hybrids successfully reduced *S. fulvus* damage in trials conducted during the 1980s. Recent industry concerns combined with higher spring temperatures and shifts in tillage practices and insecticide efficacy raise the question of whether these cultural strategies could again be beneficial, particularly if North Dakota begins experiencing similar outbreaks. However, the later insurance-approved planting window for North Dakota may narrow the window of pest avoidance.

To address these uncertainties, this study summarizes results from multi-year field trials in both North Dakota and South Dakota focusing on the sites at Dickinson and Carrington, ND. This study evaluated whether early planting and early-maturing hybrids provided measurable reductions in *S. fulvus* damage and whether these strategies influenced yield or oil content under present ND pest pressure.

Materials and Methods

Trials were conducted at Dickinson (western ND) and Carrington (central ND) from 2022–2024, representing three site-years where *S. fulvus* was present at measurable levels. At each site, two hybrids (one early-maturing and one normal maturity) were planted across three or four planting dates aligned with the local crop insurance window. Plot sizes varied by site, but all received standard agronomic management and no insecticide applications.

A number of field observations were collected including the onset of pollen shed ($\approx 10\%$ R5). Combine harvests or hand-harvested subsamples were used to quantify yield (lb/a), and oil content was measured using NMR analysis. X-rayed subsamples (100–200 seeds per plot) were assessed for *S. fulvus* feeding injury and secondary lepidopteran damage. Each site-year was analyzed separately for effects of planting date, hybrid, and their interaction.

Results

North Dakota sites had more compressed bloom windows compared with South Dakota. Across ND site-years, planting dates differed by 28–33 days, yet bloom onset often differed by less than half that interval because later plantings accumulated heat units more rapidly. Reduced phenological separation limited opportunities for bloom to escape peak weevil emergence.

Seed damage by *S. fulvus* was variable by site and year.
Dickinson (2022)

- Hybrid \times planting date interaction was significant in 2022.
- Early planting reduced weevil damage by $>70\%$ only in the early-maturing hybrid.
- The normal-maturity hybrid showed no significant date effect, indicating that hybrid choice influenced whether early planting provided any benefit.

Carrington (2023 and 2024)

- Planting date had no effect on *S. fulvus* damage and damage remained low across all timings 2023.
- In 2024 the early planting (17 May) showed slightly lower weevil damage, but injury was confounded by substantial seed feeding from *Cochylis hospes* (banded sunflower moth), making *S. fulvus*-specific patterns less clear.

The overall ND pattern showed very little effect of planting date. When planting date did reduce damage, the effects were hybrid specific. The low pest populations in ND during these study years likely contributed to the absence of detectable, consistent trends.



Effect of *Cochulis hospes* caused misshapen heads and confounded the weevil results for 2024.

Yield and Oil Content

Across ND site-years, yield (lb/a, data not shown) was not significantly influenced by planting date, with the exception of hybrid-related effects in some years. These findings contrast with South Dakota, where late-June plantings often yielded less due to higher *S. fulvus* pressure.

No clear, repeatable pattern emerged linking oil content to planting date in ND. Notably, regression analyses from South Dakota showed strong negative associations between weevil injury and oil content, but this relationship was much weaker in North Dakota because seed damage levels were lower and more variable.

Discussion

Across three location-years in North Dakota, early planting and early-maturing hybrids did not provide consistent reductions in *S. fulvus* seed damage. Several factors likely explain these results:

- Weevil abundance in ND remained modest compared with the severe infestations in South Dakota. Cultural tactics that rely on large phenological mismatches may be difficult to detect statistically when baseline pest pressure is low.
- North Dakota's crop insurance planting window begins about 15 days later than South Dakota's, limiting how early growers can plant. As a result, even the earliest ND plantings may still overlap significantly with weevil emergence.
- Rapid heat accumulation in late May and June shortened the interval between bloom in early vs. late plantings. This biological convergence reduces the potential for avoidance.
- At Dickinson in 2022, only the early-maturing hybrid showed reduced damage in early planting, suggesting that hybrid phenology may need to advance more than planting date alone to achieve consistent avoidance in ND.

Despite low weevil pressure during these trials, historical outbreaks in ND and strong gene flow across the region mean that resistance-driven population increases remain possible. If *S. fulvus* pressure rises in ND, cultural avoidance may become more beneficial—similar to the clear advantages demonstrated in South Dakota.