

# Screening Root Maggot Lines/ Hybrids for Genetic Tolerance

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## Introduction

Sugarbeet Root Maggots (SBRM), *Tetanops myopaeformis* is causing increased production challenges in several U.S. Sugarbeet growing regions (Figure 1.) Northeastern North Dakota, Northwestern Minnesota, Wyoming/Colorado, and Idaho are a few areas where Sugarbeet Root Maggots (SBRM) are present. Root Maggots reduce plant stands, plant vigor and can cause a significant reduction of grower yield and profit. If no control measures are taken, the yield losses can be as much as 40% in some growing areas.

## US growing areas with presence of SBRM



### SBRM forecast

Map above just showing the increase in acres affected with RM over the 5 year span.

Shows growers the concern with the topic even if they might not have SBRM in their growing area at this moment.

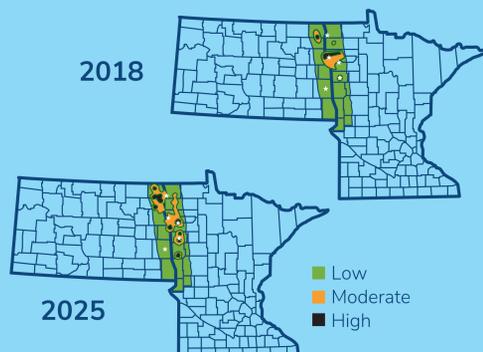
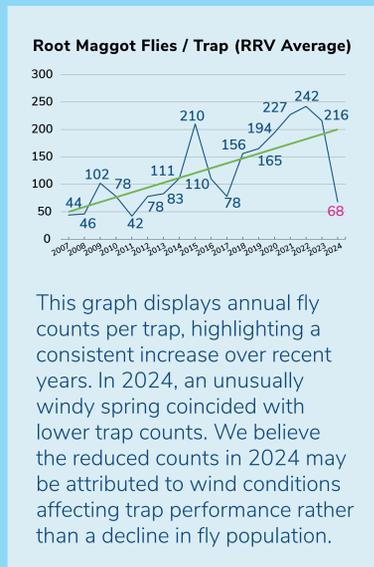


Figure 1. US sugar beet growing areas with sugar beet root maggot presence. (Prof Mark Boetel, NDSU, Fargo, USA).



This graph displays annual fly counts per trap, highlighting a consistent increase over recent years. In 2024, an unusually windy spring coincided with lower trap counts. We believe the reduced counts in 2024 may be attributed to wind conditions affecting trap performance rather than a decline in fly population.

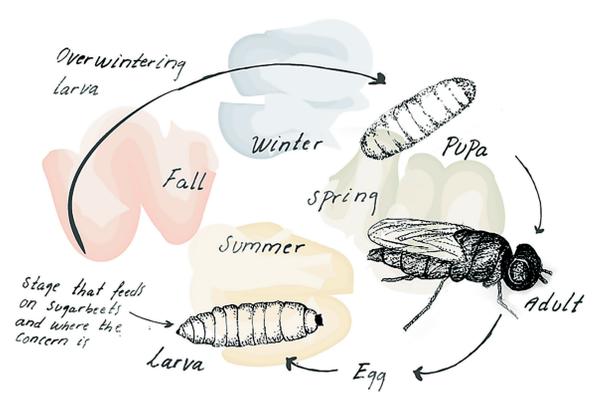


Figure 2. The life cycle of sugar beet root maggot (Drawing by Veronica, Lennefors, Malmö, SE).

## Life cycle

Sugar beet maggots have four life stages: egg, larvae (3 instars), pupa, adult. There is normally one generation per year.

SBRM overwinter as full-grown larvae approximately one foot (25-40 cm) deep in the soil in fields where sugar beets were grown during the previous growing season. During the spring, when the soil temperature increase, the larvae move closer to the soil surface where it will pupate.

The fly emergence generally begins in mid-April for western Idaho and late May for the Red River Valley. The fly emergence continues for a period of 4 to 6 weeks with peak fly period being temperature dependent.

The flies move to actively growing sugar beet fields and deposit most eggs in small clusters below the soil surface near or on the base of plants. One individual female can deposit 100-200 eggs over a season with eggs typically hatching within a 2-3-day time period.

The first-instar larvae are transparent/white, with a size of 0.75-2 mm, and they start to feed on root hairs by scraping the surface with their oral hooks.

The second-white instar larvae can be 3 times larger in size, and the cream colored third-instar 1.2 cm long. During the summer months they actively feed on sugar beet roots until reaching a mature stage at which they will then go into the diapause, lasting until the coming spring.

## SBRM Management

A common practice for years has been to spray insecticide at peak fly hatch to help control the SBRM population. Year-to-year registration challenges and the uncertainty of the future use of insecticides have caused a growing concern for the sugarbeet industry.

In addition to these common production practices, growers are also reliant on sugarbeet insecticide seed treatments to help with control. There are also different cultural strategies that can reduce the impact of sugarbeet root maggot larvae such as early planting. Older and larger plants are typically more vigorous and able to tolerate a higher level of plant injury in comparison to smaller plants in later-planted fields. In addition to cultural practices, and several years of testing, it is now recognized that there are certain lines with genetic resistance to root maggot feeding injury.

## UBS breeders' ongoing work on root maggot tolerance

SBRM nursery trials evaluating lines and hybrids are currently taking place in St Thomas due to this area having a high level of SBRM pressure. Through a rigorous and reliable SBRM nursery screening process, reliable results are being provided to the stakeholders. We have lines that are showing exceptional tolerance versus the susceptible varieties that really don't stand up to the maggot pressure. (Figure 3).

Roughly during the first week of August, nursery evaluation takes place.



Tolerant line in center – Susceptible on right – 1 row plots. Beets laid out so multiple people can give them a root rating

Figure 3. Evaluation of sugar beet lines and hybrids in field trials with high impact of sugar beet root maggot.

## Collaboration with the USDA

The U.S. Department of Agriculture (USDA) is examining sea beet (*Beta maritima*) to identify genetic variants naturally resistant to the sugarbeet root maggot (SBRM). Upon discovering such resistant lines, seed companies, such as UBS, can determine if these lines are already included in their breeding programs or can be utilized to enhance ongoing breeding efforts. Notably, certain SBRM-resistant lines developed in the 1950s from Turkish origins have been successfully integrated into our breeding program.



A field with annual beta maritima next to commercial beets.



Commercial beet (top) and wild type beet root (bottom).



Red germplasm with SBRM tolerance versus commercial beets from adjacent field.



Wild susceptible beet in SBRM nursery (top) versus wild tolerant beet in SBRM nursery (bottom).

## Conclusion

At UBS, we acknowledge the growing need for SBRM tolerant hybrids and that is why we continue enhancing our SBRM breeding program to address this growing concern of Root Maggots across the US. Our efforts in line development and evaluation have yielded promising results in improving SBRM tolerance. Recognizing the importance of collaboration, we are working with various stakeholders, including the USDA, to continue these research initiatives and provide superior hybrids to our growers in the future.

REFERENCES  
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Wenninger E.J., Daley T. B., Neher O. T., Bechinski E.J. 2019. Sugar Beet Root Maggot: Identification, Biology, and Management. Bul 492 (2019), University of Idaho.