
How sterile flies can manage onion maggot

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In 2018 and 2019, two growers opted to release sterile flies as their onion maggot management strategy moved forward. Over the next few years, populations of onion maggots have decreased and are now manageable in the field.

The onion maggot (*Delia antiqua*) is the larval stage of the onion maggot fly which can cause damage at every stage of onion development. In onions, one maggot can kill up to 20 plants early in the season. As a management strategy, onion maggot can reduce plant stands by over 50%. Later in the season, it can cause distorted growth and open wounds making it easier for pathogens to gain entry into the bulb (**Figure 1**).



Figure 1. Second generation larvae causing an older plant to wilt.

In conventional production, onion maggot management has relied heavily on chlorpy (products) and now with the use pattern being phased out in Canada, neonicotinoid seed treatments like Sepresto 75 WS are the primary management strategy for direct seeded onions. For the greenhouse, there are no insecticide drenches currently registered for control on the field.

In Quebec, Sterile Insect Technology (SIT) has been used for over a decade to eliminate chlorpyrifos, and the program is now used for onion maggot management on roughly 1000 acres. The flies are reared in a facility at the Phytodata Research Company in Sherrington, Quebec. P⁺ flies are dyed pink (to allow them to be distinguished from the wild population on sticky cards) and released at locations where growers allow flies to emerge in emergence boxes and then release them on a weekly basis (**Figure 2**).



Figure 2. Sterile onion maggot flies that have been dyed pink prior to their release in the field.

In Ontario, sterile onion maggot flies have been released at two field sites in Scotland (Huron county) over 5 years. Both of these locations had very different onion production systems. At one location, onions were transplanted and planted at a rate of 140,000 plants per acre while at the other, onion seeds were broadcast at a rate of ~8 million seeds per acre and harvested as onion set plants. At both locations, no chlorpyrifos has been applied for the past 5 years. Sticky cards were more

flies could be differentiated from wild flies by the pink dye described above.

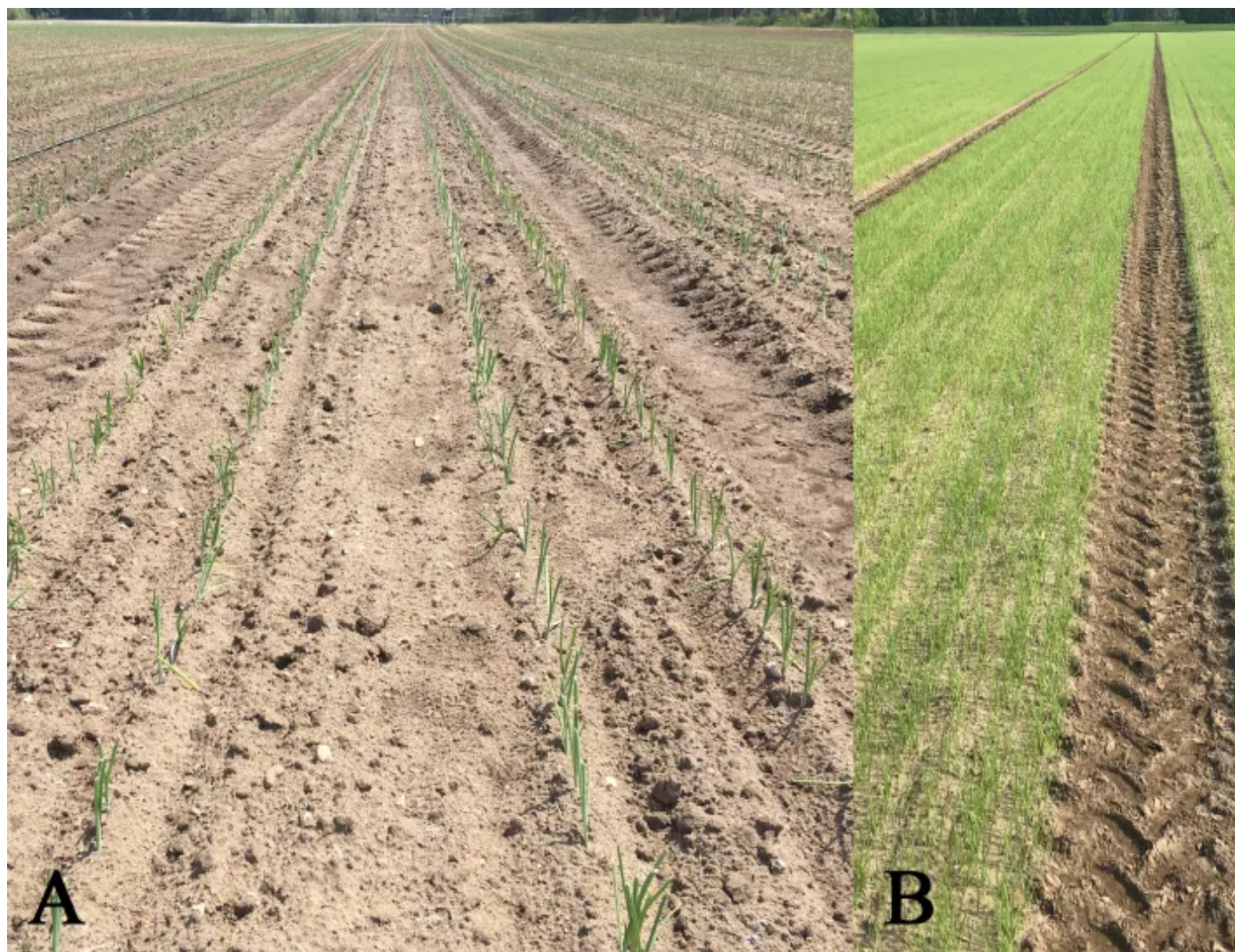


Figure 3. Transplant onions in Scotland planted at a rate of 140,000 plants per acre (**A**) while seeds were broadcast at 140,000 seeds per acre and harvested as onion sets (**B**).

At both Ontario locations, onion fields were transplanted or seeded yearly within ~3 km of the field. Many years the fields were directly adjacent to the previous year's field. Populations in 2023 were lower than all previous years and the number of plants harvested with onion sets decreased dramatically. At harvest, fewer bulbs are found to be distorted and as a result, the yield is higher.

In Exeter, fields of onion sets were planted adjacent to one another (500 m or less) yearly from 2021 and again in 2022 to 2023 making it easier for flies to find a suitable crop to lay eggs in the spring. The 2022 and 2023 fields were planted ~2 km south of where the 2018-2021 fields were. In fields adjacent to each other or following a short crop rotation, populations of onion flies were higher.

to levels high enough to cause observable damage at the Exeter field site. In 2023, the was halved from an average of ~100 000 flies per hectare per week to ~50 000 flies, y remained low.

Sterile flies have reduced the amount of onion maggot damage in these fields to levels past decade when chlorpyrifos was used in these fields. While neither of these farms a management strategy would work well in an organic production system. The sterile fl program are not genetically modified and wild onion maggot larvae are retrieved from fields, reared at Phytodata, and then sterilized using an x-ray irradiator. No chemicals process.

There are limitations to using sterile flies as the primary onion maggot management s is that both locations are uniquely isolated from other onion fields. Onion maggot flie meaning that even if you manage the insect well in your 30-acre onion field, but your the wild flies from their field may easily find your field. This is a concern for onions si onion production in Ontario is concentrated in muck soils with very small distances b

The second limitation is that only sterile onion maggot flies are being released. Seedc is sometimes responsible for damage in onion fields, and Phytodata is still working or seedcorn maggot.

A full report of the 2023 results can be found below. If you are interested in applying your farm, please contact myself at travis.cranmer@ontario.ca, or Anne-Marie Fortie

CROP: Onion (*Allium cepa* L.)
PEST: Onion Maggot (*Delia antiqua* (L.))

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TITLE: STERILE FLY RELEASE FOR ONION MAGGOT MANAGEMENT IN ONION SET AND COOKING ONION PRODUCTION IN ONTARIO

MATERIALS: Sterilized/irradiated *Delia antiqua* pupae, onion maggot sticky traps.

METHODS: Four fields near Exeter and Scotland, Ontario, were planted with onions in the spring of 2023. At the Exeter field sites, two fields, approximately 500 m apart, with Brady sandy-loam (**Figure 1, A**) and Granby sandy-loam (**Figure 1, B**) soils, were seeded at a high density of ~20 million seeds/ha (~8 million seeds/ac) between 15 and 18 May to produce onion sets. The west field measured approximately 16.1 ha (39.77 ac) and the east field was 8.9 ha (22.0 ac). Both fields had no insecticide treatments at planting or throughout the 2023 growing season. These two 2023 sterile insect release fields were 100 m or less from fields where onions were grown and sterile flies were released in 2022, and approximately 1.7 km from the 2018, 2019, 2020, and 2021 onion fields with releases (**Figure 1, C–H**). There were no major onion fields within 20 km of these sterile fly release fields.

Another two fields were transplanted with cooking onions near Scotland, Ontario, at an average density of ~345,000 plants/ha (140,000 plants/ac) with no chlorpyrifos applications, but other insecticides were applied to manage thrips (**Table 2**). The early transplanted field was comprised mainly of Brady loamy-sand and directly adjacent to the later transplanted field which was comprised of Granby loamy-sand. The east field is approximately 4.9 ha (12.0 ac) in size and was planted from 25 April to 6 May (**Figure 2, B**). The west field is approximately 10.0 ha (24.7 ac) in size and was planted from 6 May to 18 May (**Figure 2, A**). Both east and west fields had sterile flies released in 2023. There were no other major onion fields within a 20 km radius from either of these fields near Scotland. Flies were released in part of the field that was cropped in onions in 2020 (**Figure 2, J**).

Onion flies were reared by Phytodata, then sterilized and released using Sterile Insect Technology (SIT) according to Phytodata protocol. The *Delia antiqua* pupae were irradiated by Phytodata using an x-ray irradiator (model RS 1800Q, Rad Source Technologies Inc., GA, USA), dyed pink, shipped to Thedford/Exeter and Scotland, ON, emerged as adult flies, and kept alive until release, following protocols developed by Phytodata Inc (**Figure 3, C**). Fly releases at the Exeter sites began 22 May and releases at the Scotland sites began the week of 10 May. Both locations continued weekly releases until the week of 7 September. Flies were released after harvest to target the onion maggot population that would overwinter. Flies were released at least 30 m from the closest sticky card trap at all fields. Four onion maggot sticky traps, consisting of three stakes with blue sticky cards clipped above the crop canopy, were placed on the middle of each side of every field (**Figure 3, B**). Cards were monitored weekly for natural onion maggot populations and sterile/pink fly displacement throughout the growing season. In the fields producing onion sets in Exeter, damage plots (15 cm x 15 cm) capturing ~25 plants were set up a short distance away from the sticky traps at the flag leaf stage (**Figure 3, A**). At the Scotland fields, damage plots were created by counting out 25 plants on four rows for a total of 100 plants/plot. Damage plots were counted weekly until harvest at all field sites. The onions were harvested

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