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 IN 2025**

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

METHODS: Three fields near Exeter and Scotland Ontario, were planted with onions in the spring of 2025. Near Exeter, two fields, approximately 2.1 km apart, with Granby / Brady sandy-loam (**Figure 1, A-C**) and Brady sandy-loam (**Figure 1, D)** soils, were seeded at a high density of ~20 million seeds/ha (~8 million seeds/ac) between 12 and 15 May to produce onion sets. The northern field measured approximately 19.4 ha (48.0 ac) and the southern field was 16.3 ha (40.3 ac). Both of these fields had no insecticide treatments at planting or throughout the 2025 growing season (**Table 2**). The Exeter 2025 sterile insect release fields were less than 2.0 km from where onions were grown and sterile flies were released between 2018–2024 (**Figure 1, E–I**). In 2025, there were no other major onion fields grown within a 20 km radius from these fields near Exeter.

Another field was transplanted with cooking onions near Scotland, Ontario, at an average density of ~345,000 plants/ha (140,000 plants/ac) with no insecticides used at transplant, but insecticides were applied to manage thrips later in the season (**Table 2)**. This transplanted field was comprised of Caledon / Camilla sandy-loam and measured approximately 9.5 ha (23.4 ac) in size and was planted from 25 April to 17 May (**Figure 2, A**). In 2025, there were no other major onion fields within a 20 km radius from this field near Scotland. Sterile flies were released in nearby fields that were cropped in onions in the last six years (**Figure 2, B–N**).

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 Grand Bend 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 and Scotland sites began the week of 7 May with both locations and continued weekly until the week of 3 September. The Exeter fields released an average of ~15,000 flies/ha/season while the Scotland site released at an average rate of ~75,000 flies/ha/season. Flies were also released after onion harvest to target the onion maggot population that would overwinter and be a target for the 2026 crop. Flies were released at least 30 m from the closest sticky card trap at all fields throughout the growing season. 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 25 plants within four rows for a total of 100 plants/plot. Damage plots were counted weekly until harvest at

all field sites. The onions were harvested 18 August to 9 September at the Exeter fields, and from 13 August to 24 September at the field near Scotland (**Tables 1, 3**).

RESULTS: As outlined in Tables 1–3 and in Figures 1–5.

CONCLUSION: Historically, onion maggot (*Delia antiqua*) management has relied heavily on group 1B organophosphates, specifically chlorpyrifos insecticides, which are now no longer a registered use pattern for onions in Canada. Sterile Insect Technology (SIT) in Québec has shown that the release rates of sterile flies could be decreased by up to 90% within 5 years of repeated use due to the reduction of wild populations, decreasing the cost of sterile fly programs over time. Likewise, based on previous monitoring and releases, this work demonstrates the decline of wild fly populations and offers an effective tool to manage onion maggot without chlorpyrifos.

In the Exeter field site, sticky card counts of wild flies indicated an average number of wild flies of 1.3 and 0.7 flies / trap / week throughout the season, which was a decrease compared to counts in 2024 (season average of 2.0 and 1.6 flies / trap / week.) and 2023 (season average of 1.9 and 2.0 flies / trap / week.) The number of flies released per season per hectare started at 100,000 flies / ha / season in 2019 and has been decreased to ~16,000 flies / ha / season in 2024 and to ~15,000 flies / ha / season in 2025. The Exeter field was within 2 km or less from where onion sets were grown over the past seven years where sterile flies were released. Despite growing onions in fields adjacent to each other, and a decrease in the average rate of flies released per hectare, no plants were found during the duration of the season that showed onion maggot damage and the amount of flies captured per week remained relatively low. Peaks of 2.8 and 1.5 flies / trap / week were counted at the Exeter field sites which was less than the 2024 Exeter field which had a peak of 7.2 flies / trap / week. (**Table 1; Figure 4**). This was the fourth year where all fields of onion sets were grown without the use of any insecticides. These results indicate that wild onion maggot levels remained low as a result of sterile fly releases even with continuing cropping of onion sets in the same area for eight years, despite no clothianidin/imidacloprid seed treatment and no chlorpyrifos drench at planting as well as no foliar insecticides applied throughout the growing season (**Table 2**).

At the Scotland field site, season average fly counts were the lowest recorded with an average number of wild flies recorded at 0.7 flies / trap / week (**Figure 5**). A peak of 2.2 wild flies / trap / week was observed 29 May (**Table 3; Figure 5**). Flies were originally released at an average rate of 100,000 flies / ha / season and were dropped to 75,000 flies / ha / season in 2024 and 2025. The release field in Scotland was last planted with onions in 2022 and was adjacent to where onions were grown in 2024, 2021, 2020, and 2019 (**Figure 2**). These results indicate that wild onion maggot levels remained low as a result of sterile fly releases even with continuing cropping of onion transplants in the same area for seven years and no chlorpyrifos drench at planting.

Over the years, sticky cards are typically replaced on a Tuesday at the field sites near Exeter and Wednesday at the field sites near Scotland, while the sterile flies were released on Sunday/Monday. More accurate numbers of wild and sterile flies may have been recorded if the traps were changed 2–3 times per week opposed to a single time per week. Despite no chemical management towards wild onion maggot flies, this data demonstrates that onion maggot can be managed effectively by releasing sterile flies when there are no fields that can act as a refuge of wild flies in the general vicinity.

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Table 1. Sterile fly release dates, plant stage, weekly average trap counts and damage plot fly population levels at the Exeter release field sites. Flies were released at a rate of approximately 15,000 flies per hectare per season.

	Release Field – Exeter North ~19.4 ha					Release Field – Exeter South ~16.3 ha				
Date	Release Quantity ('000)	Plant Stage[1]	Wild Flies	Pink Flies	Damage Plots[2]	Release Quantity ('000)	Plant Stage[1]	Wild Flies	Pink Flies	Damage Plots[2]
25/05/06	0	--	--	--	--	0	--	--	--	--
25/05/13	10	pre	0.0	0.0	--	9	pre	0.3	0.4	--
25/05/20	13	pre	0.9	0.0	--	11	pre	1.4	0.5	--
25/05/27	17	loop	1.5	0.1	--	14	loop	2.8	0.4	--
25/06/03	24	loop	1.0	0.0	--	20	flag	1.4	0.0	--
25/06/11	28	1LS	0.6	0.0	32.5	24	1LS	2.0	0.0	29.5
25/06/17	28	2LS	0.4	0.0	33.3	24	2LS	1.5	0.0	34.3
25/06/24	24	2LS	0.0	0.0	31.5	20	3LS	0.4	0.0	30.8
25/07/02	22	3LS	0.8	0.0	30.8	18	4LS	0.3	0.0	29.5
25/07/09	16	4LS	1.0	0.0	29.3	13	4LS	3.1	0.0	28.3
25/07/15	10	5LS	0.6	0.0	29.3	8	4LS	0.8	0.0	28.0
25/07/22	15	5LS	0.8	0.0	29.0	12	4LS	0.7	0.0	28.0
25/07/29	20	5LS	0.7	0.0	27.5	17	5LS	1.3	0.0	26.3
25/08/05	19	5LS	0.8	0.0	24.3	17	5LS	0.3	0.0	25.5
25/08/12	13	wind	0.0	0.0	--	11	wind	0.0	0.0	--
25/08/19	11	wind	0.0	0.0	--	9	post	0.0	0.0	--
25/08/26	13	post	0.0	0.0	--	12	post	0.0	0.0	--
25/09/03	11	post	--	--	--	10	post	--	--	--

[1] Plant stage where pre = pre-emergence, loop = loop stage, flag = flag leaf stage, LS = leaf stage, wind = windrowed, post = after pulling/harvest, and -- = data points not taken

[2] Average number of plants in within a 15 cm x 15 cm square

Table 2. Insecticide applications from seeding to harvest at the Scotland field sites. No insecticides were applied at the field sites near Exeter during the 2025 season.

Date	Field(s)	Trade Name	Common Name	Rate / Hectare
25/06/12	All	Movento 240 SC	Spirotetramat	365 mL
25/06/19	All	Movento 240 SC	Spirotetramat	365 mL
25/06/21	All	Agri-Mek SC	Abamectin	270 mL
25/06/30	All	Agri-Mek SC	Abamectin	270 mL
25/07/13	All	Delegate WG	Spinetoram	336 g
25/07/22	All	Delegate WG	Spinetoram	336 g
25/07/29	All	Exirel	Cyantraniliprole	1500 mL
25/08/05	All	Exirel	Cyantraniliprole	1500 mL

Table 3. Sterile fly release dates, plant stage, trap counts and damage plot levels at a release field site near Scotland, ON. Flies were released at a rate of approximately 75,000 flies pre hectare per season.

		Release Field – Scotland ~9.5 ha			
Date	Release Quantity ('000)	Plant Stage[1]	Wild Flies	Pink Flies	Damage Plots[2]
25/05/02	0	--	--	--	--
25/05/07	0	--	--	--	--
25/05/14	29	2LS	1.3	0.0	--
25/05/21	36	4LS	0.4	0.8	100.0
25/05/28	46	5LS	2.2	0.0	99.5
25/06/04	67	6LS	1.0	0.0	97.8
25/06/12	78	8LS	0.8	0.0	96.5
25/06/19	78	9LS	2.0	0.0	93.0
25/06/25	67	10LS	0.0	0.0	90.8
25/07/03	61	11LS	0.3	0.0	88.0
25/07/10	43	11LS	0.9	0.0	86.5
25/07/16	24	11LS	0.6	0.0	84.5
25/07/24	41	11LS	0.0	0.0	84.5
25/07/31	56	11LS	1.0	0.0	84.5
25/08/06	54	11LS	0.1	0.1	82.3
25/08/13	36	wind	0.0	0.0	73.5
25/08/20	30	post	0.0	0.0	--
25/08/28	38	post	0.0	0.0	--
25/09/03	32	post	--	--	--

[1] Plant stage where LS = leaf stage, wind = windrowed, and post = harvest, and -- = data points not taken
[2] Average number of plants in damage plots starting with 100 plants per plot on 21 May, 2025

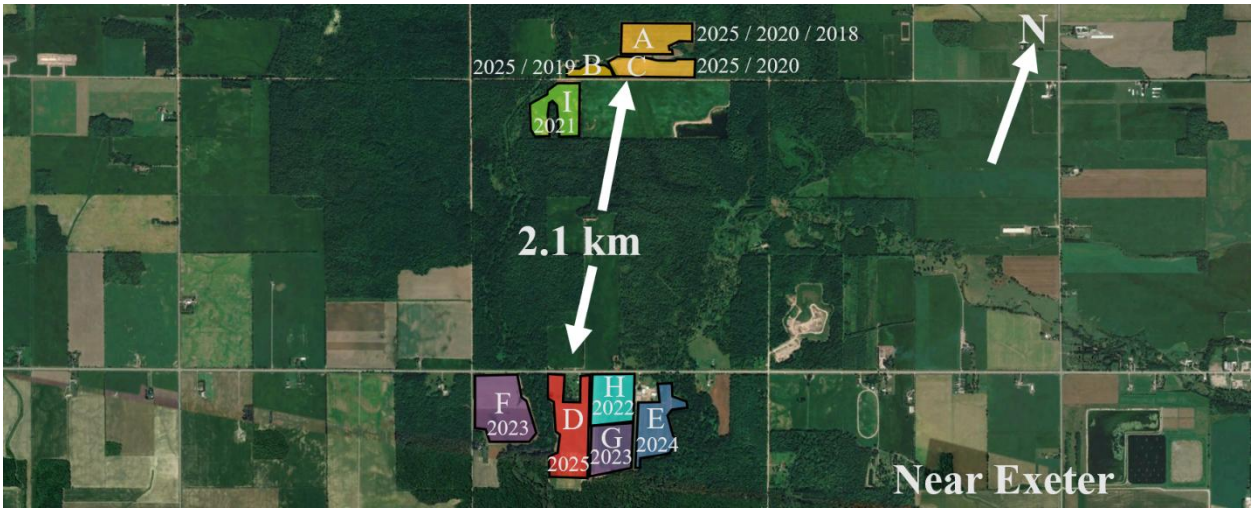

Figure 1. The Exeter release field sites approximately 19.4 ha (48 ac) in size (**A–C**) and 16.3 ha (40.3 ac) in size (**D**). Sterile flies have been released in this 2 km area since 2018 and no control fields (with no sterile fly releases) have been conducted since 2020 (**E–I**).

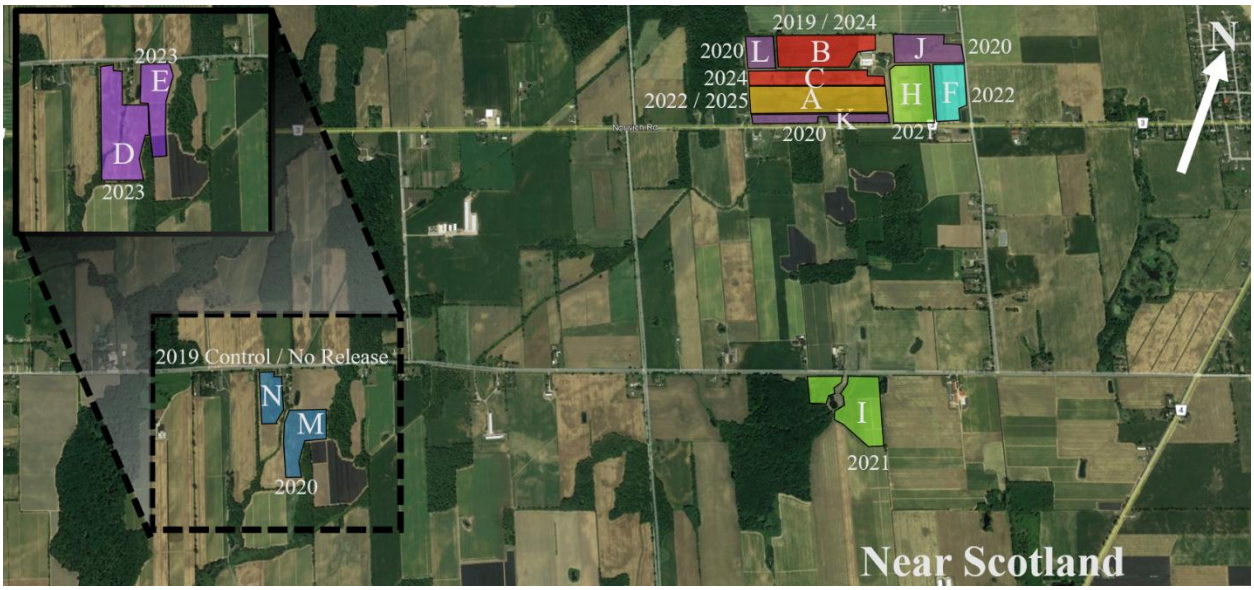

Figure 2. Sterile flies were released and monitored at one onion field near Scotland in 2025. The release field measured approximately 9.5 ha (23.4 ac) (**A**). Sterile flies were released in onion fields within 2 km in going back to 2019 (**B–M**). All fields had flies released in them during the given year unless stated otherwise as a control field (**N**).

Figure 3. Damage plots in onion set field in a 15 cm x 15 cm square (**A**), sticky cards (**B**), and sterilized, pink onion maggot flies prior to release (**C**).

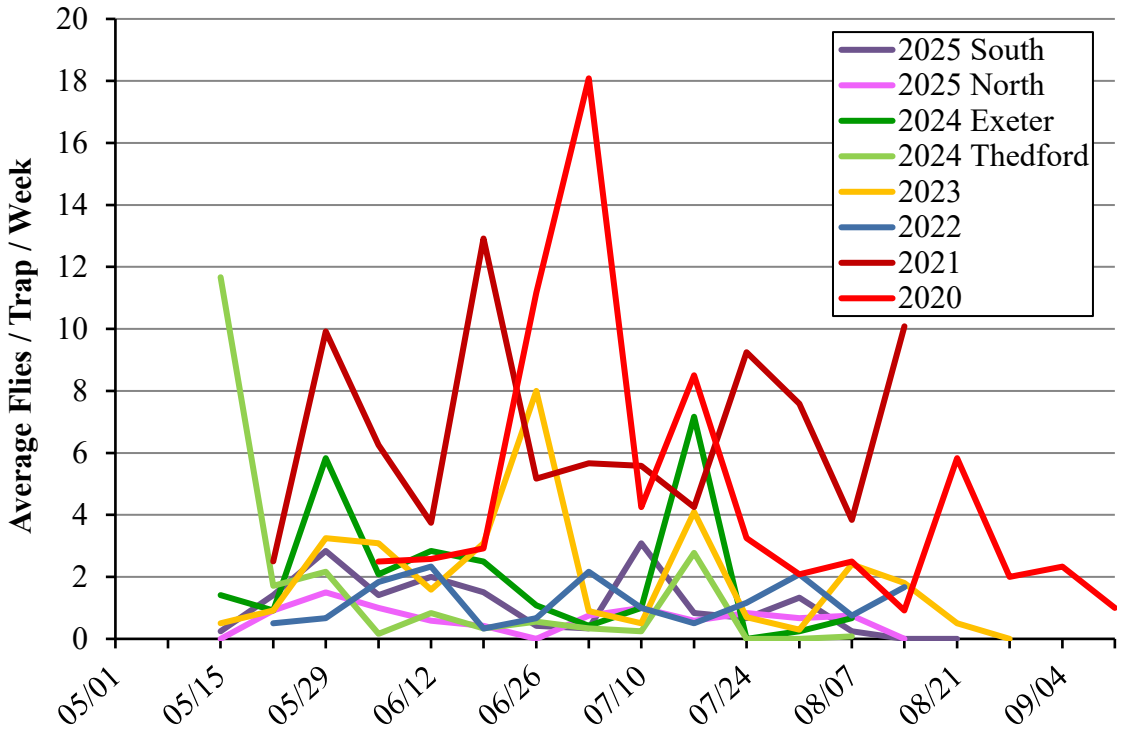

Figure 4. Average wild flies per sticky trap per week at the release field sites near Exeter, ON. Except for the Thedford field site in 2024, all fields shown were within 2 km of each other. Wild / fertile fly counts at the release fields near Exeter in 2025 (**South = purple, North = pink**) peaked at 3.1 and 1.5 flies / trap / week.

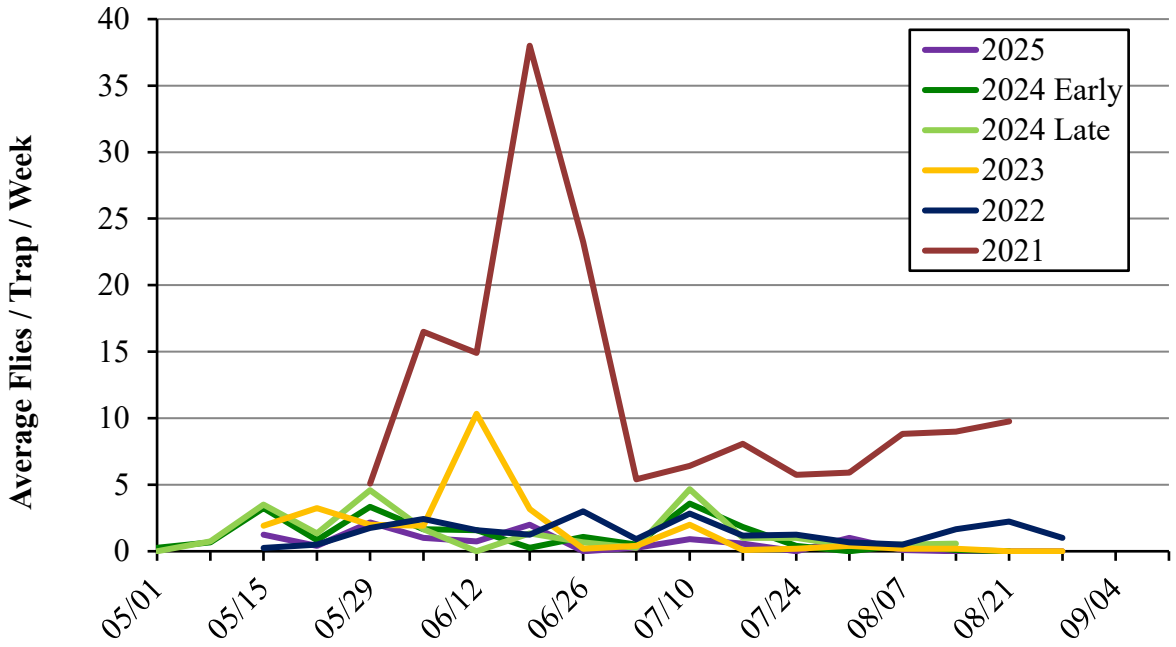

Figure 5. Average wild flies per sticky trap per week at the field sites near Scotland. Wild / fertile fly counts at the release fields near Scotland in 2025 (**purple**) peaked at 2.2 flies / trap / week.