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# TITLE: THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR MUCK VEGETABLE CROPS, 2018

An Integrated Pest Management (IPM) program is provided to growers in the Holland/Bradford Marsh, Ontario, by the University of Guelph - Muck Crops Research Station. This project was funded in part through the Ontario Agri-Food Innovation Alliance. Funding was also provided in part by the Bradford Cooperative Storage Ltd., agrochemical companies, and growers participating in the Muck Crops Research Station IPM program. The main objectives of the project are: to scout growers' fields for diseases, weeds, and insect pests, to provide growers with disease and insect forecasting information, to identify and diagnose diseases, insect pests and weeds, and to implement roto-rod spore traps to trap and analyze spores of various vegetable crop pathogens.

## SCOUTING

In 2018, 67 commercial vegetable fields, totalling 705 acres (onion 318 A., carrot 358 A., celery 29 A.), were intensively scouted for 24 growers. Fields were scouted twice per week during the growing season and growers received scouting reports after each field survey.

## DIAGNOSTICS, EXTENSION & DISSEMINATION OF INFORMATION

Any grower, whether participating in the IPM program or not, may bring in samples (plant, insect, or weed) for diagnosis. The on-site tools available for diagnosis are visual inspection and laboratory inspection using a microscope and culturing. Diagnoses are made by comparison to known symptoms, published descriptions of pathogens, insect pests and weeds, and personal experience. Following assessment, the extension advice given was based on Ontario Ministry of Agriculture and Food and Rural Affairs (OMAFRA) recommendations for pesticides.

From 15 May to 24 October, 2018, the diagnostic laboratory of the MCRS received 90 samples for diagnosis. Of these, 75% were diseases (64 samples), 16% physiological disorders (14 samples), and 8% insect issues (7 samples). These samples were associated with the following crops: onion (52%), carrot (28%), celery (12%), and other crops (8.2%). For extension services, data collected from growers' fields and the MCRS research plots were compiled twice per week, analyzed and summarized. The results were compiled in an 'IPM report' and updated twice per week and circulated to participating growers, academia, industry, OMAFRA staff, posted on the MCRS web site (www.uoguelph.ca/muckcrop), and a copy was displayed at the Bradford Co-op.

## PEST PREDICTIVE MODELS

The IPM program provides disease and insect forecasting based on spore traps, disease forecasting models BOTCAST (for botrytis leaf blight of onion), DOWNCAST (for onion downy mildew), and BREMCAST (for lettuce downy mildew), degree day models, and insect traps. These disease and insect forecasts alert growers by predicting the potential for disease and insect pest incidence.

## CROP PEST SUMMARIES

At the end of the scouting program, 100 onions were examined after lodging or 100 carrot samples were collected from each scouted field and assessed for damage from insects and diseases/physiological disorders.

***CARROT***

**Insects**

In 2018, carrot fields were scouted for carrot weevil (*Listronotus oregonensis*), carrot rust fly (*Psila rosae*), aster leafhopper (*Macrosteles quadrilineatus*) and other insect pests. Degree day models were used to predict the occurrence of the various life stages of these insects.

**Table 1.** Average percent carrot rust fly and carrot weevil damage on carrots at harvest in scouted fields in the Holland Marsh, 2018.

| Location | % Damaged Carrots | |
|---|---|---|
| | Weevil damage | Rust fly damage |
| West HM | 1.0 | 0.0 |
| South HM | 1.5 | 0.0 |
| Central HM | 0.9 | 0.0 |
| North HM | 9.7 | 0.2 |
| East HM | 3.0 | 0.0 |
| Average | 3.5 | <0.1 |

Carrot weevil adults were first found in wooden traps on 22 May in carrot fields (Fig. 1). The threshold of 1.5 or more weevils/trap was reached by 24 May in most regions of the Holland Marsh. Only 5% of fields in the IPM program did not reach the 1.5 weevil/trap threshold, and 80% of fields reached the 5 weevil/trap threshold.

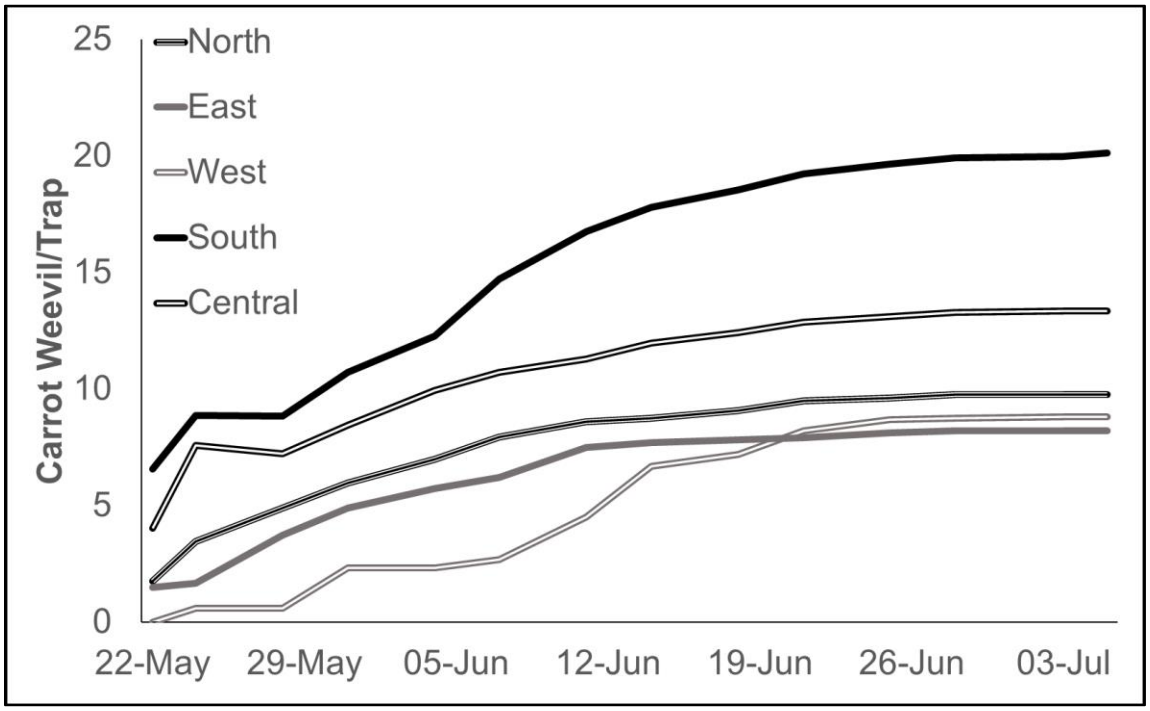


**Figure 1.** Average cumulative number of carrot weevils/ trap in different regions of the Holland Marsh, 2018.

Carrot weevil counts were very similar to counts over the past five years, however in most fields damage was much lower. This is likely due to grower adoption of the new control product, Rimon.

Orange sticky traps and degree day models were used to monitor and estimate carrot rust fly (Fig. 2). Carrot rust flies were first found on sticky traps on 4 June, which was 7-10 days after the degree day model predicted emergence. The highest rust fly activity was on 25 June, where 17% of scouted fields had exceeded the threshold of 0.1 flies/trap/day, with the highest activity during the second generation on 23 August where 8% of scouted fields had exceeded the threshold.

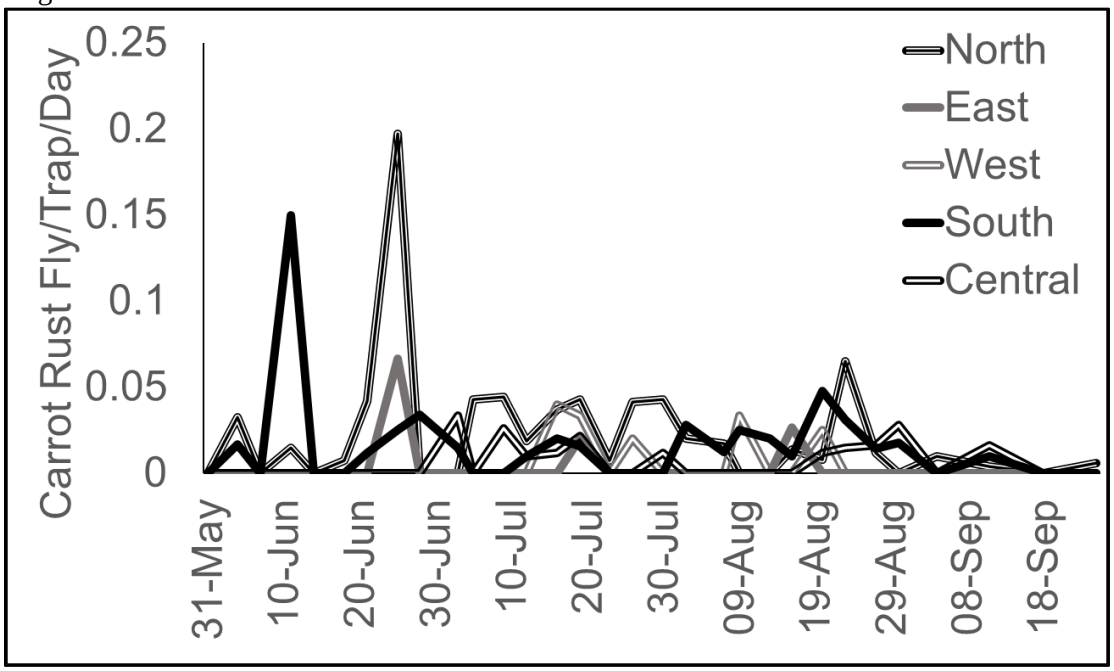


**Figure 2.** Average carrot rust fly counts/trap/day in different regions of the Holland Marsh, 2018.

Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhopper adults were first found on orange sticky traps by the middle of June in carrots and celery. Sweepnettting (100 sweeps per field) were used to estimate populations occurring within fields. Counts peaked in the middle of July and generally dropped below threshold for the rest of the season.

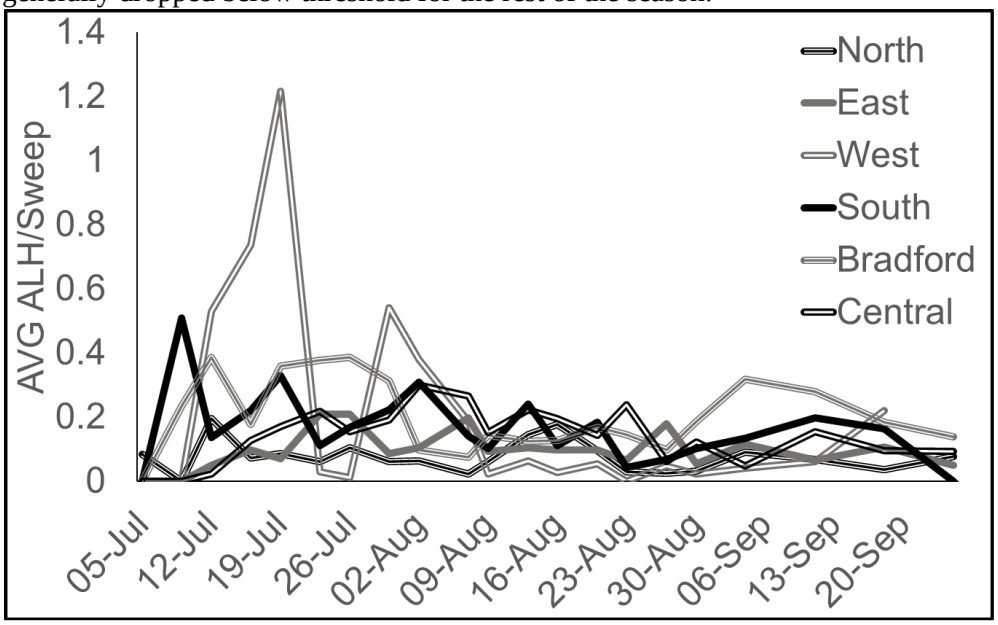


**Figure 3.** Average aster leafhopper counts/trap in different regions of the Holland Marsh, 2018.

**Diseases**

Carrot fields were scouted for the carrot diseases in the Holland Marsh. Leaf blight, which is caused by the fungi *Alternaria dauci* and *Cercospora carotae*, was first seen on 12 July. In late August, 15% of fields had exceeded the leaf blight threshold of 25% of plants infected.

Samples of 100 carrots were taken from each scouted fields and roots were assessed for diseases (Table 2). Overall, samples often had several disease issues, typically at low rates. Cavity spot (*Pythium* spp.) and forking/splitting was ubiquitous, which is typical of most years in the Holland Marsh. Fusarium dry rot was present, but disease incidence was low in affected fields.

**Table 2.** Disease incidence on carrot samples collected from commercial fields in the Holland Marsh, Ontario in 2018.

| DISEASE | CAUSAL AGENT | FIELDS INFECTED (%) | INCIDENCE (%) |
|---|---|---|---|
| Cavity Spot | *Pythium* spp. | 74 | 1-14 |
| Fusarium Dry Rot | *Fusarium* spp. | 9 | 2-3 |
| Crater Rot | *Rhizoctonia* spp. | 52 | 1-19 |
| Crown Gall | *Agrobacterium tumefaciens* | 49 | 1-12 |
| Aster Yellows | *Phytoplasma* | 9 | 1-2 |
| Forking/Split | | 100 | 1-44 |

***ONION***

**Insects**

Onion fields were scouted for onion maggot (*Delia antiqua*) (Fig. 5), onion thrips (*Thrips tabaci*) (Fig. 6), cutworms and other insect pests. The degree day threshold for emergence of first generation onion flies was reached on 18 May. The first onion flies were found on 22 May and as has been typically for several years in the marsh, counts were generally low throughout the season (Figure 5).

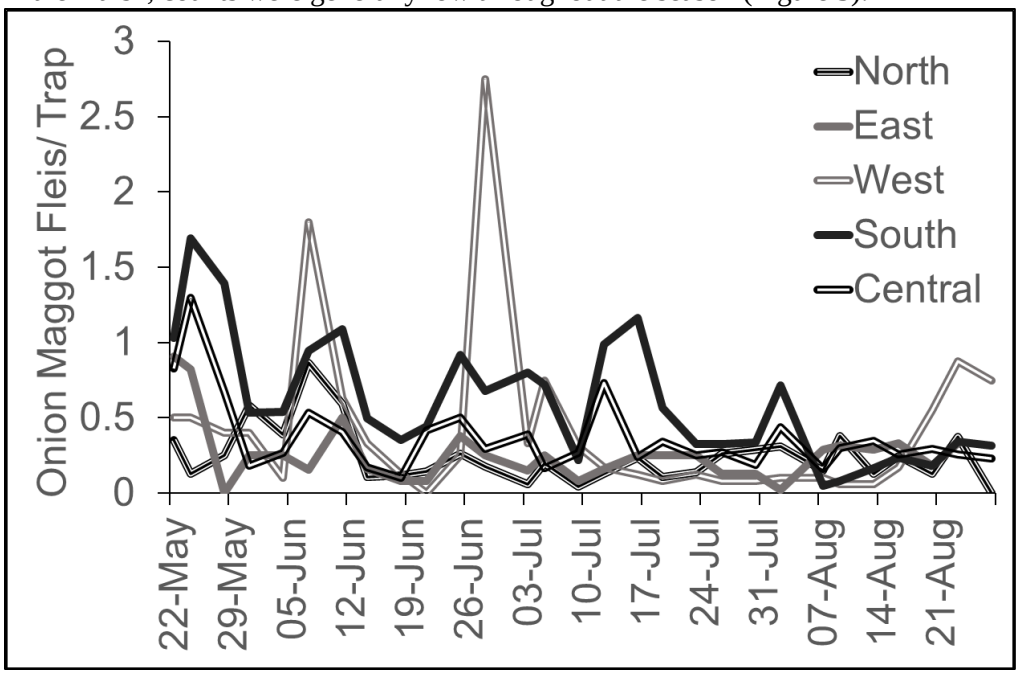


**Figure 5.** Average onion fly counts/trap/day in different regions of the Holland Marsh, 2018.

Thrips were a generally constant risk to onion fields in 2018, although most fields stayed below threshold throughout the season. Thrips were first found on 4 June. The threshold of 1 thrip/leaf was first reached by any field on 28 June, and counts peaked with 11% of fields exceeding the threshold on 12 July.

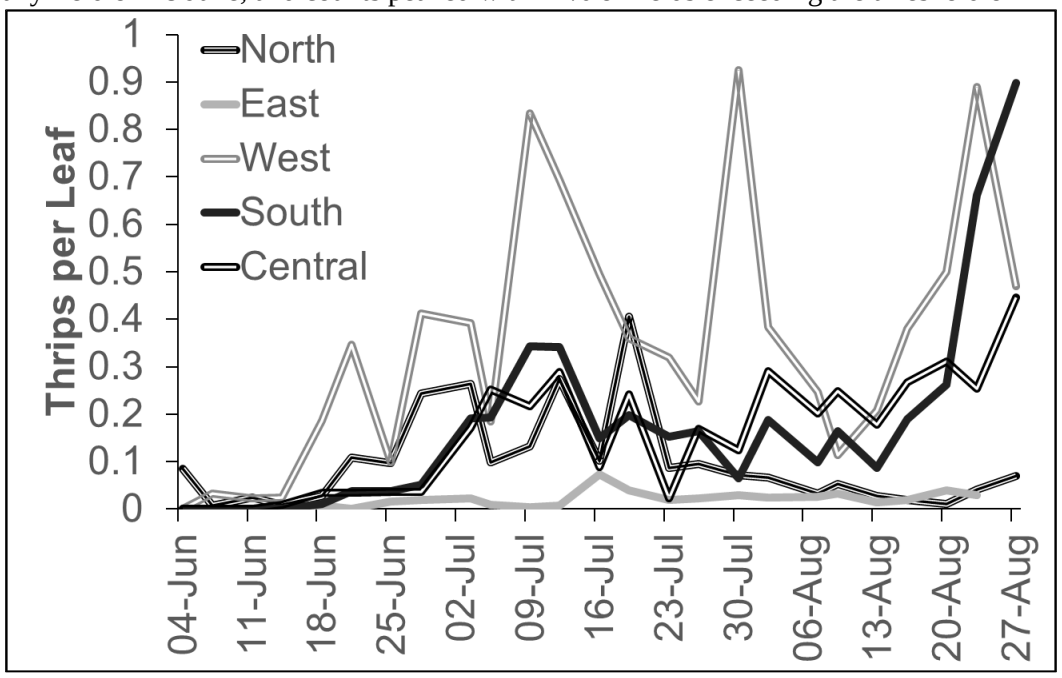


**Figure 6.** Average thrips counts in different regions of the Holland Marsh, 2018.

**Diseases**

Onion fields were scouted for botrytis leaf blight (*Botrytis squamosa*), downy mildew (*Peronospora destructor*), purple blotch (*Alternaria porri*), white rot (*Sclerotium cepivorum*), pink root (*Phoma terrestris*), stemphylium leaf blight (*Stemphylium vesicarium*) and other diseases.

The main disease on onions in 2018 was stemphylium leaf blight (Table 3). Of all scouted onion fields, 94% of fields showed symptoms of stemphylium leaf blight. First symptoms of stemphylium leaf blight in scouted fields were seen on 18 June. Disease forecasting predicted downy mildew to be active this season, suggesting sprays were warranted on July 31 and 11 August. It appears the preventative sprays were successful in avoiding an outbreak of the disease. Downy mildew sporulation was only found in one field that was not participating in the IPM program. White rot was observed in 25% of fields, with a high incidence in some fields (up to 12%), with symptoms occurring early in the growing season. Botrytis spores were not detected in 2018, and at no point were any symptoms of botrytis leaf blight seen in the marsh.

**Table 3.** Disease incidence on onion samples examined in commercial fields in the Holland/Bradford Marsh, Ontario in 2018.

| DISEASE | CAUSAL AGENT | FIELDS INFECTED (%) | INCIDENCE (%) |
|---|---|---|---|
| White rot | *Sclerotium cepivorum* | 25 | 1-12 |
| Bacterial rot/soft rot | *Erwinia carotovora* | 11 | 1-3 |
| Smut | *Urocystis cepulae* | 21 | 1-5 |
| White rot | *Sclerotium cepivorum* | 25 | 1-12 |
| Stemphylium leaf blight | *Stemphylium vesicarium* | 100 | |
| Purple blotch | *Alternaria porri* | 7 | |

## *CELERY*

### Insects

In 2018, four celery fields were scouted for carrot weevil, aster leafhopper, tarnished plant bug (*Lygus lineolaris*) and aphids. Insect traps and degree day models were used to predict the occurrence of the various life stages of carrot weevil, aster leafhopper and tarnished plant bug. In 2018, limited tarnished plant bug and aster leaf hopper, while no leaf miner or aphid damage was reported. However, several fields reported noticeable carrot weevil damage. This carrot weevil damage was often paired with bacterial rots that in some cases completely reduced the marketability of the plant.

### Diseases

Celery leaf curl or celery anthracnose (*Colletotrichum fioriniae*), is a relatively new disease threatening celery production in Ontario. Celery leaf curl was found in two of four scouted celery fields, and black heart was found in two fields. Leaf blight was not seen in celery fields during the 2018 growing season. B

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