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TITLE: THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR MUCK VEGETABLE CROPS, 2019

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 2019, 61 commercial vegetable fields, totalling 621 acres (onion 293 A., carrot 298 A., celery 20 A., potato 10 A.), were intensively scouted for 22 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 23 May to 14 October, 2019, the diagnostic laboratory of the MCRS received 72 samples for diagnosis. Of these, 71% were diagnosed with infectious diseases (51 samples), 10% with insect issues (7 samples) and 19% were diagnosed with an abiotic disorder (14 samples). These samples were associated with the following crops: carrot (46%), onion (33%), celery (11%) and other crops (10%). 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 website (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 2019, 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. Rust fly damage was more common in the harvest samples this year, which is likely due to second generation feeding.

Table 1. Average percent carrot rust fly and carrot weevil damage on carrots at harvest in scouted fields in the Holland Marsh, 2019.

Location	% Damaged Carrots	
	Weevil damage	Rust fly damage
West HM	0.6	0.4
South HM	0.0	4.7
Central HM	0.5	4.0
North HM	0.0	4.6
East HM	0.0	0.8
Average	0.2	2.9

Carrot weevil adults were first found in wooden traps on 23 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. Overall, 53% of fields in the IPM program reached the 1.5 weevil/trap threshold, and 31% of fields reached the 5 weevil/trap threshold.

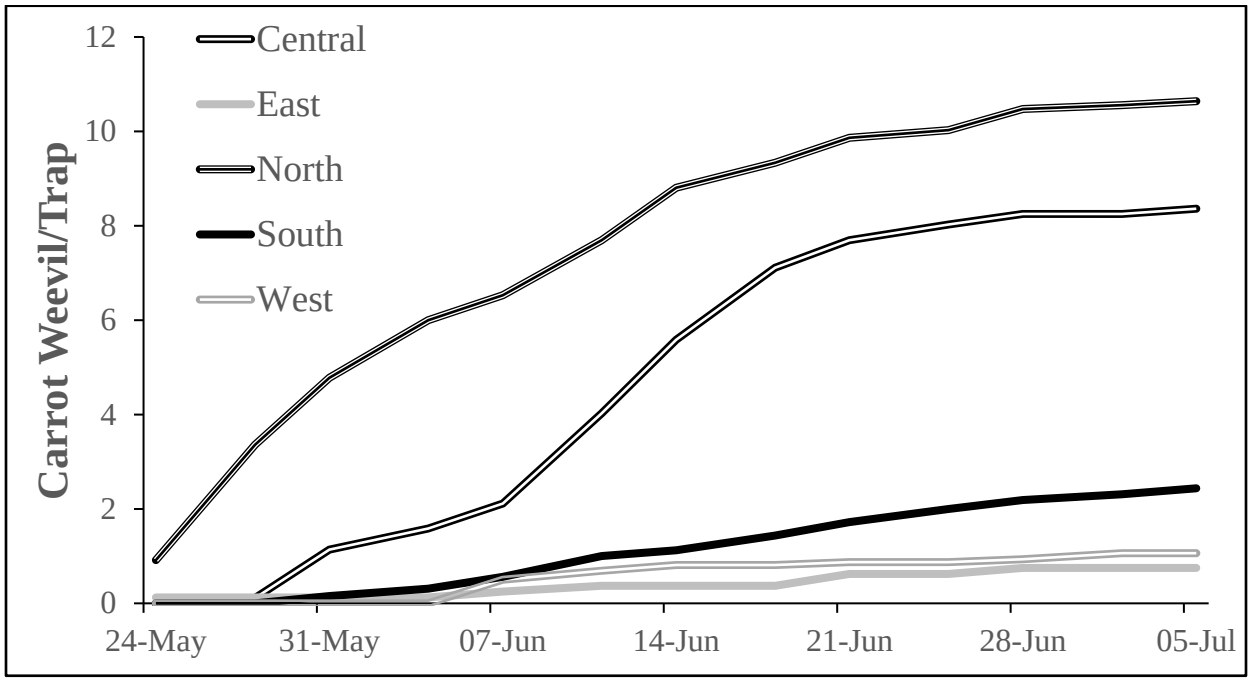

Figure 1. Average cumulative number of carrot weevils/trap in different regions of the Holland Marsh, 2019.

Carrot weevil counts were similar to counts over the past five years; however, damage in most fields was lower than expected. 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 11 June, which was ~10 days after the degree day model predicted first generation emergence. The highest rust fly activity during the first generation was on 26 July, when 16% of scouted fields had exceeded the threshold of 0.1 flies/trap/day, with the highest activity during the second generation on 18 September when 44% of scouted fields had exceeded the threshold.

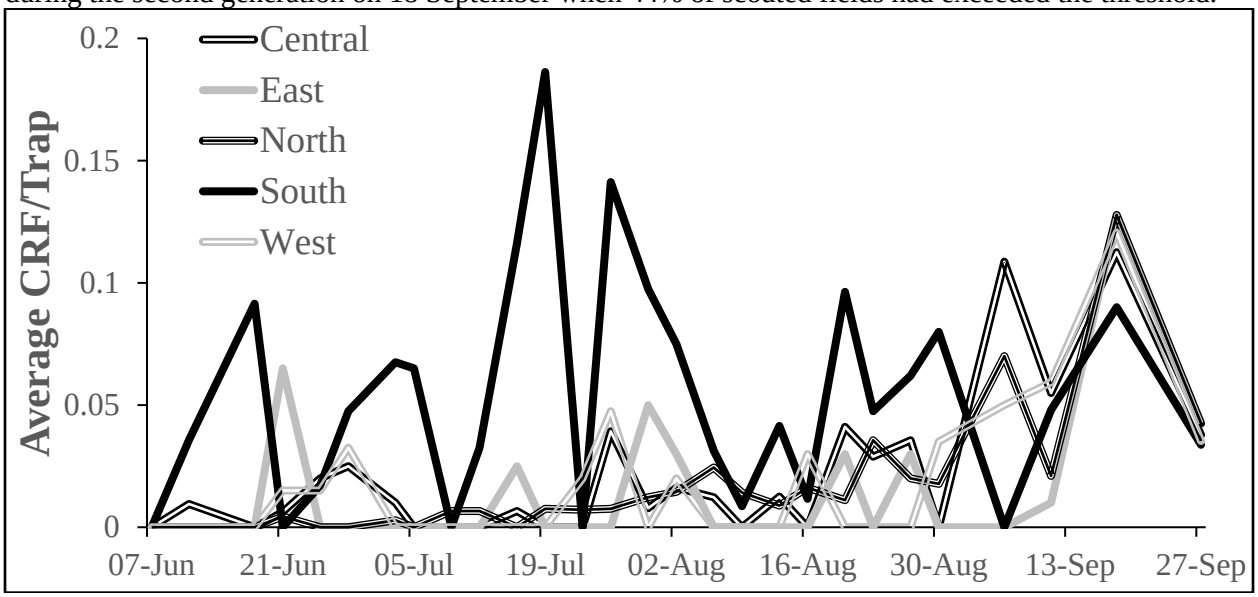

Figure 2. Average carrot rust fly (CRF) counts/trap/day in different regions of the Holland Marsh, 2019.

Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhopper adults were first found on orange sticky traps on 11 July in carrots and celery. Sweepnetting (100 sweeps per field) were used to estimate populations occurring within fields. Counts peaked around the end of July and generally dropped below threshold for the rest of the season.

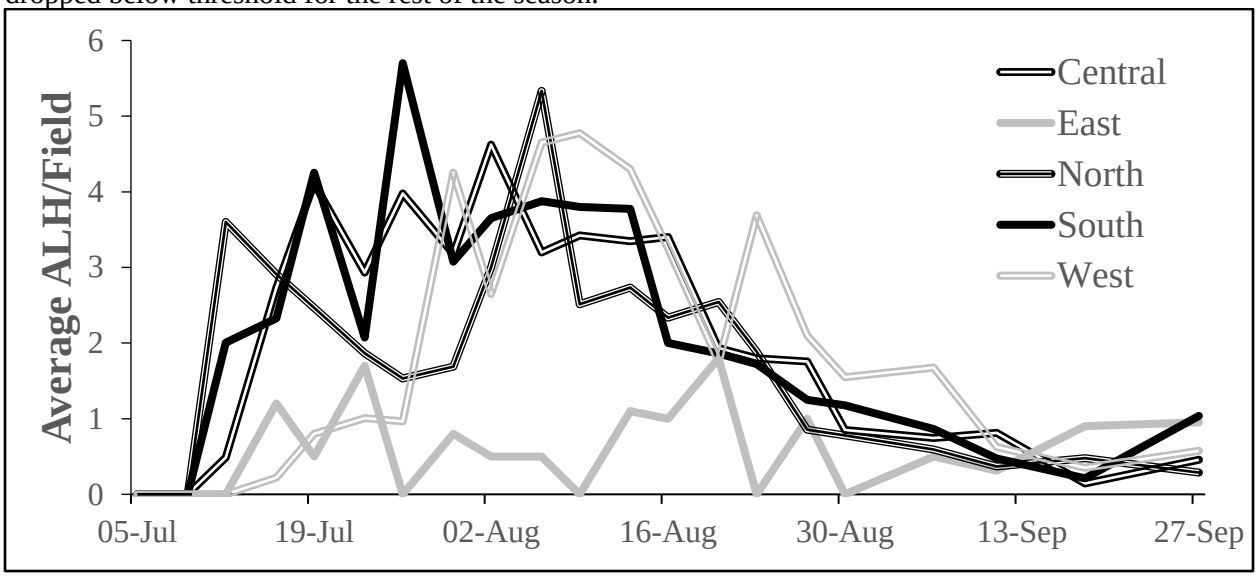

Figure 3. Average aster leafhopper counts/trap in different regions of the Holland Marsh, 2019.

Diseases

Carrot fields were scouted for diseases throughout the growing season. Leaf blights, which are caused by the fungi *Alternaria dauci* and *Cercospora carotae*, were first seen on 11 July. No scouted carrot fields exceeded the leaf blight threshold of 25% of plants infected during the growing season.

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 were common throughout most fields, which is similar to previous years in the Holland Marsh. Fusarium dry rot, crater rot and crown gall were present, but disease incidence was low in most affected fields.

Table 2. Disease incidence on carrot samples collected from commercial fields in the Holland Marsh, Ontario in 2019.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Cavity Spot	*Pythium* spp.	93	1-56
Fusarium Dry Rot	*Fusarium* spp.	10	1-8
Crater Rot	*Rhizoctonia* spp.	13	1-8
Crown Gall	*Agrobacterium tumefaciens*	43	1-21
Aster Yellows	*Phytoplasma*	3	1
Forking/Split		100	3-34

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 22 May. The first onion flies were found on 23 May and, which has been typical for several years in the marsh, counts were generally low throughout the season (Figure 5).

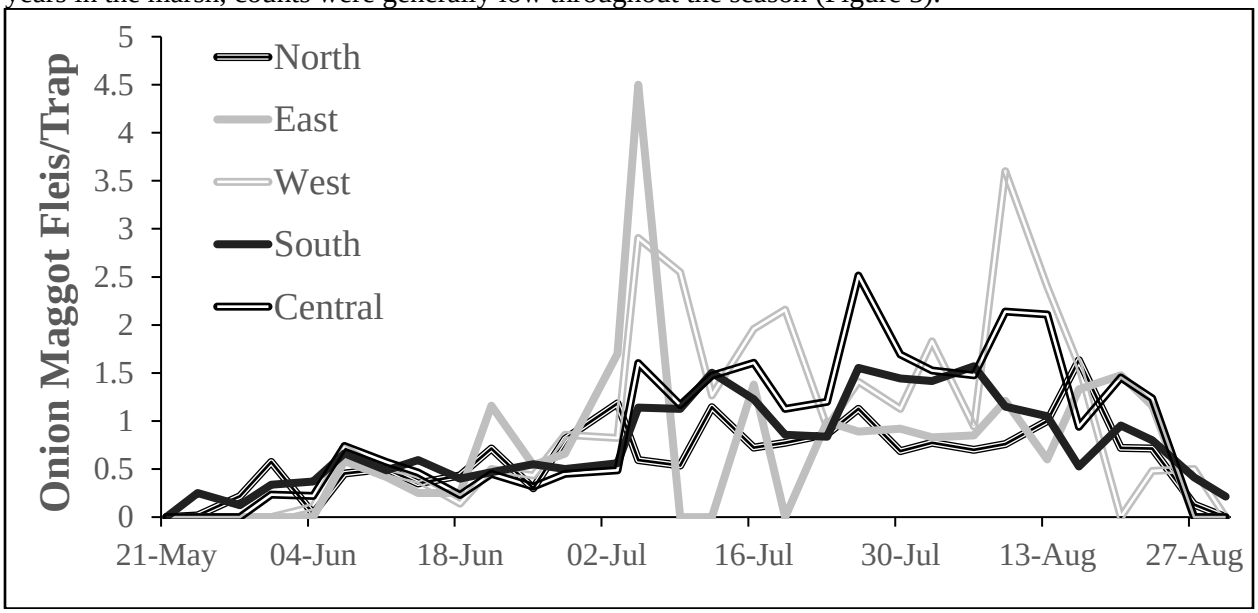

Figure 5. Average onion fly counts/trap/day in different regions of the Holland Marsh, 2019.

Thrips populations were generally low in scouted onion fields in 2019. Average counts increased slightly after the middle of July, although most fields stayed below threshold throughout the season. Thrips were first found on 4 July. The threshold of 1 thrips/leaf was first reached on 29 July, and counts peaked with 6% of fields exceeding the threshold on 5 August.

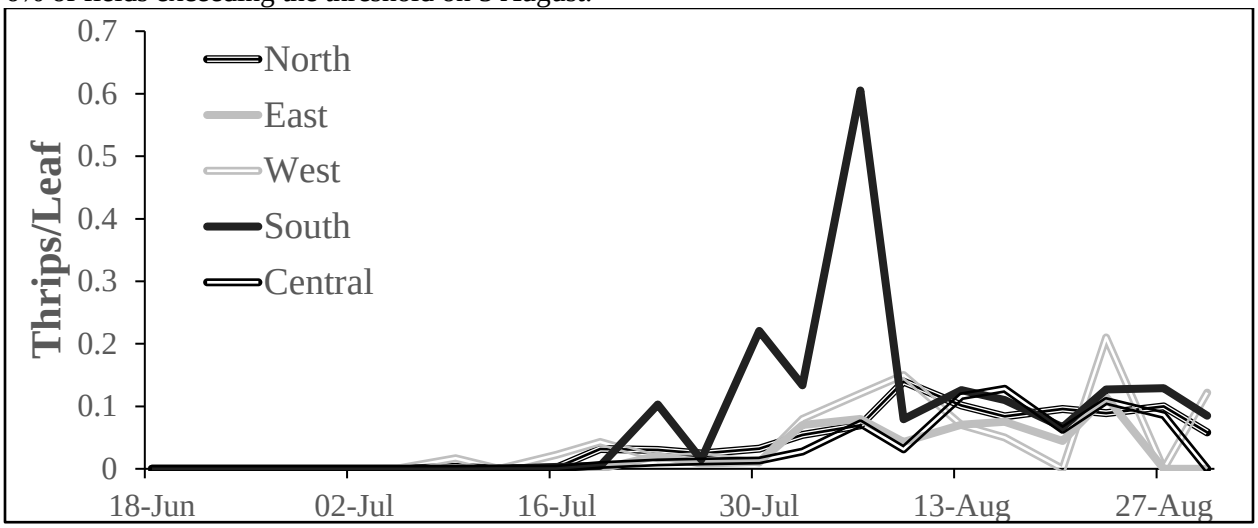

Figure 6. Average thrips counts in different regions of the Holland Marsh, 2019.

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 2019 was stemphylium leaf blight (Table 3). All scouted onion fields showed symptoms of stemphylium leaf blight. First symptoms of stemphylium leaf blight in scouted fields were seen on 27 June, when scouting for stemphylium began. There was a low risk of downy mildew throughout most of the growing season as disease forecasting only predicted warranted sprays on 7 and 18 September. White rot was observed in 33% of fields, with the highest incidence up to 8%. For the second year in a row, no botrytis spores were detected in 2019 and no symptoms of botrytis leaf blight were seen in the marsh.

Table 3. Disease incidence on onion samples examined in commercial fields in the Holland/Bradford Marsh, Ontario in 2019.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
White rot	*Sclerotium cepivorum*	33	1-8
Bacterial rot/soft rot	*Erwinia carotovora*	3	1
Smut	*Urocystis cepulae*	27	1-5
Pink root	*Setophoma terrestris*	27	3-10
Stemphylium leaf blight	*Stemphylium vesicarium*	100	1-90
Purple blotch	*Alternaria porri*	0	0

CELERY

Insects

In 2019, two 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 2019, tarnished plant bug and aster leaf hopper populations and damage were low, while no leaf miner or aphid damage was reported. Also, carrot weevil damage in celery fields was infrequent.

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 both scouted celery fields, while black heart was found in one scouted field. Leaf blight was identified in one celery field during the 2019 growing season.

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