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TITLE: THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR MUCK VEGETABLE CROPS, 2020

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 (MCRS). 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 2020, 56 commercial vegetable fields, totalling 605 acres (onion 246 A., carrot 329 A., celery 20 A., potato 10 A.), were intensively scouted for 21 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 18 May to 30 October 2020, the diagnostic laboratory of the MCRS received 67 samples for diagnosis. Of these, 63% were diagnosed with infectious diseases (42 samples), 13% with insect issues (9 samples) and 24% were diagnosed with an abiotic disorder (16 samples). These samples were associated with the following crops: carrot (48%), onion (34%), celery (10%) and other crops (8%). 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 (new site - https://bradford-crops.uoguelph.ca/), 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), BREMCAST (for lettuce downy mildew) and BSPCAST (for Stemphylium leaf blight of onion), 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 2020, 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. Insect damage at harvest was very minimal this season. Carrot rust fly counts were over threshold in most regions early in the season, but due to a lack of developed carrots and proper timing of insecticide applications very little damage was found at harvest and counts were low later in the season. The high rust fly emergence was likely due to overwintering pupae from second generation rust flies in 2019.

Table 1. Average percent carrot rust fly and carrot weevil damage on carrots at harvest in scouted fields in the Holland Marsh, 2020.

Location	% Damaged Carrots	
	Weevil damage	Rust fly damage
West HM	0.5	0.0
South HM	0.0	0.0
Central HM	0.0	0.0
North HM	0.0	0.0
East HM	0.0	0.3
Average	0.1	0.06

Carrot weevil adults were first found in wooden Boivin traps on 25 May in carrot fields (Fig. 1). The threshold of 1.5 or more weevils/trap was reached by 9 June in most regions of the Holland Marsh. Overall, 52% of fields in the IPM program reached the 1.5 weevil/trap threshold, and 21% of fields reached the 5 weevil/trap threshold.

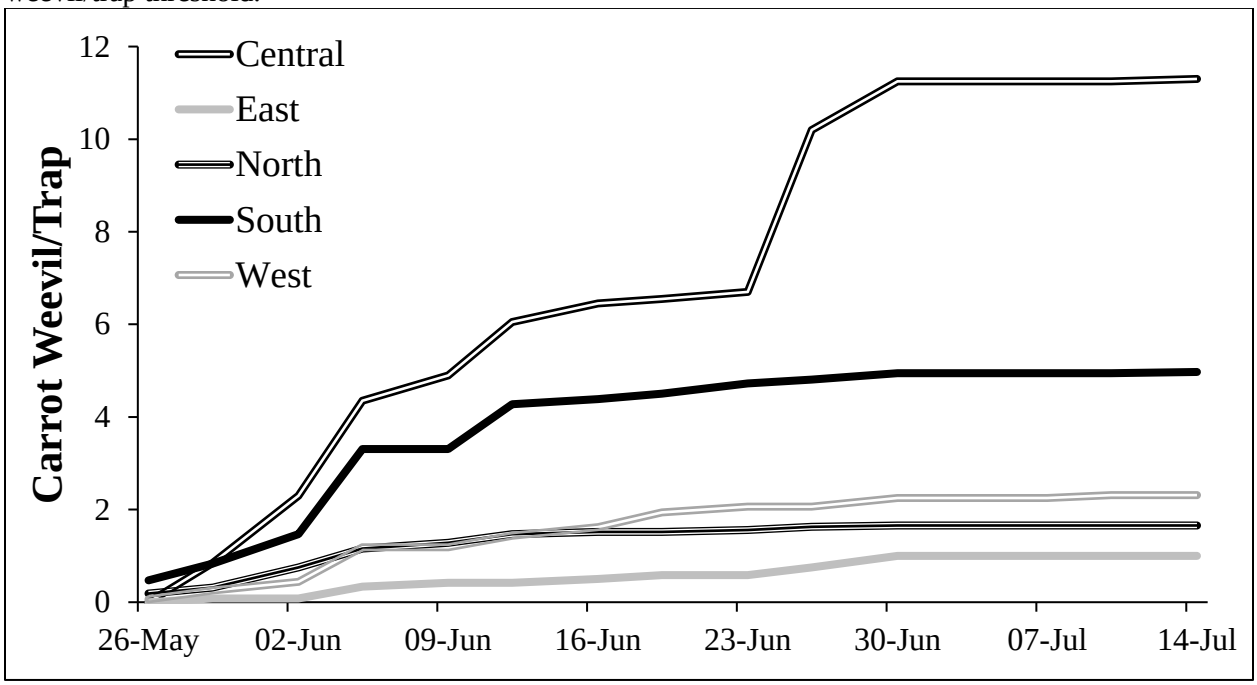

Figure 1. Average cumulative number of carrot weevils/trap in different regions of the Holland Marsh, 2020.

Carrot weevil counts were similar to counts over the past five years and damage was lower than expected. Most growers now use Rimon which is very effective at controlling carrot weevil.

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 29 May, which was exactly when the degree day model predicted first generation emergence. The highest rust fly activity during the first generation, across all regions, was on 19 June, when 48% of scouted fields had exceeded the threshold of 0.1 flies/trap/day, with the highest activity during the second generation on 25 August when 34% of scouted fields had exceeded the threshold.

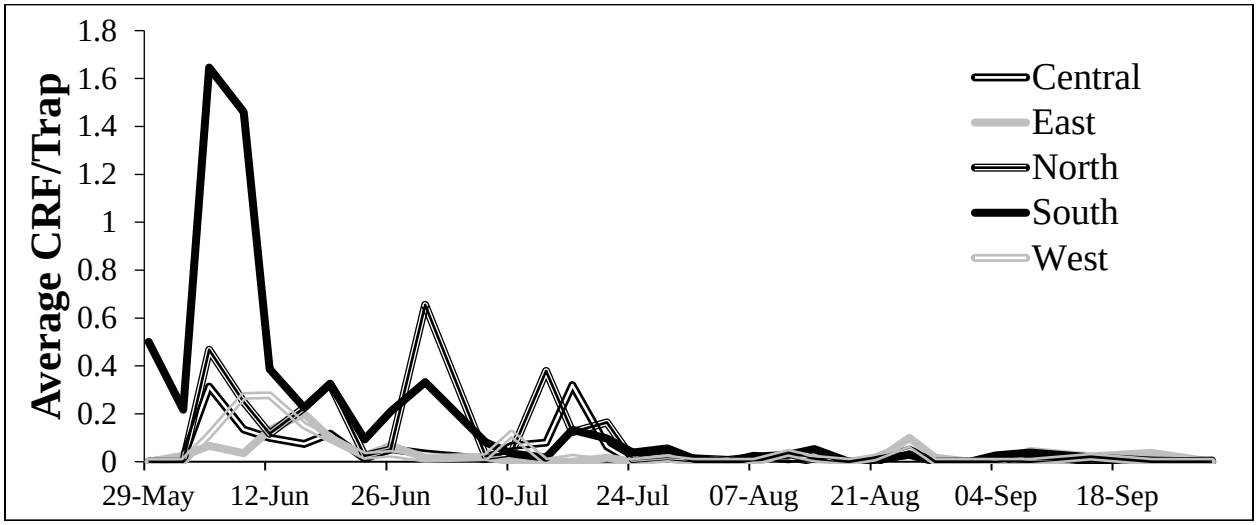

Figure 2. Average carrot rust fly (CRF) counts/trap/day in different regions of the Holland Marsh, 2020.

Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhopper adults were first found on orange sticky traps on 29 June in carrots and celery. Sticky traps and sweepnetting (100 sweeps per field) were used to estimate populations occurring within fields. Counts peaked around the end of July when 17% of fields were above the 20 ALH/trap threshold.

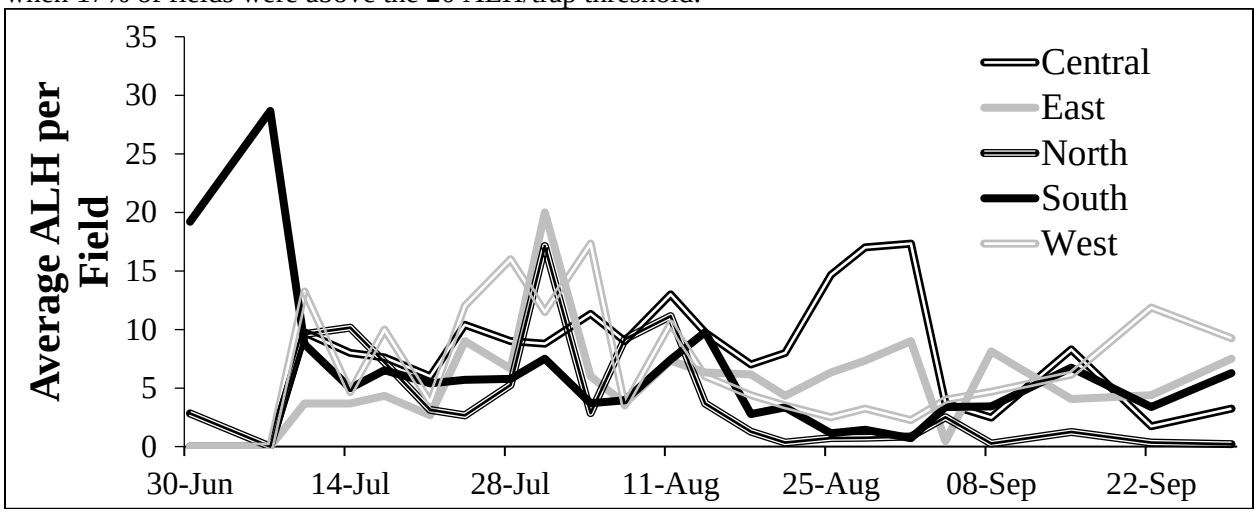

Figure 3. Average aster leafhopper counts/trap in different regions of the Holland Marsh, 2020.

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 23 July. Three scouted carrot fields reached 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 from each field often had a few disease issues, typically at low rates. Cavity spot (*Pythium* spp.) and forking/splitting (nematodes and/or *Pythium* spp.) were the most common throughout carrot

fields, similar to previous years in the Holland Marsh. Fusarium dry rot, crater rot, crown gall and aster yellows were present, but disease incidence was generally low in most fields.

Table 2. Disease incidence on carrot samples collected from commercial fields in the Holland Marsh, Ontario in 2020.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Cavity Spot	*Pythium* spp.	100	1-52
Forking/Split	Nematodes and/or *Pythium* spp.	100	2-42
Crown Gall	*Agrobacterium tumefaciens*	38	0-15
Crater Rot	*Rhizoctonia* spp.	19	0-2
Fusarium Dry Rot	*Fusarium* spp.	8	0-1
Aster Yellows	*Phytoplasma*	4	0-1

ONION

Insects

Onion fields were scouted for onion maggot (*Delia antiqua*) (Fig. 4), onion thrips (*Thrips tabaci*) (Fig. 5), cutworms and other insect pests. The degree day threshold for emergence of first generation onion flies was reached on 25 May. The first onion flies were also found on 25 May and counts were generally low throughout the season, which has been typical for several years in the marsh (Figure 4). There were increases in counts at the end of July in the south region and beginning of August in the central region.

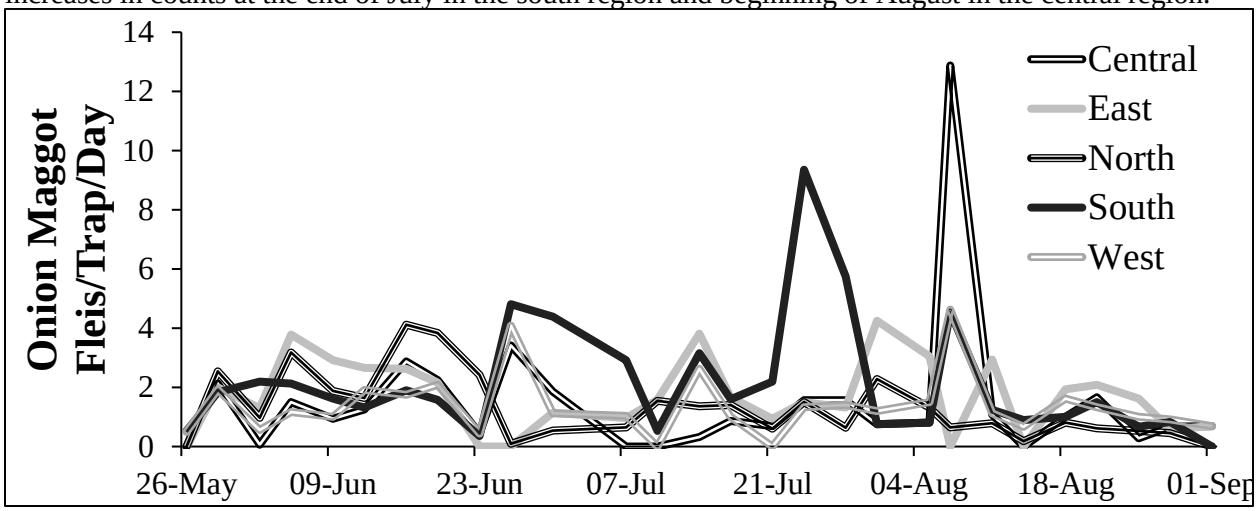

Figure 4. Average onion fly counts/trap/day in different regions of the Holland Marsh, 2020.

Thrips populations were slightly higher this year compared to 2019. Average counts increased at the beginning of July and August, but all fields stayed below the 3 thrips/leaf threshold. Thrips were first found on 16 June. Counts peaked on 10 July when 8% of fields exceeded 1 thrips/leaf.

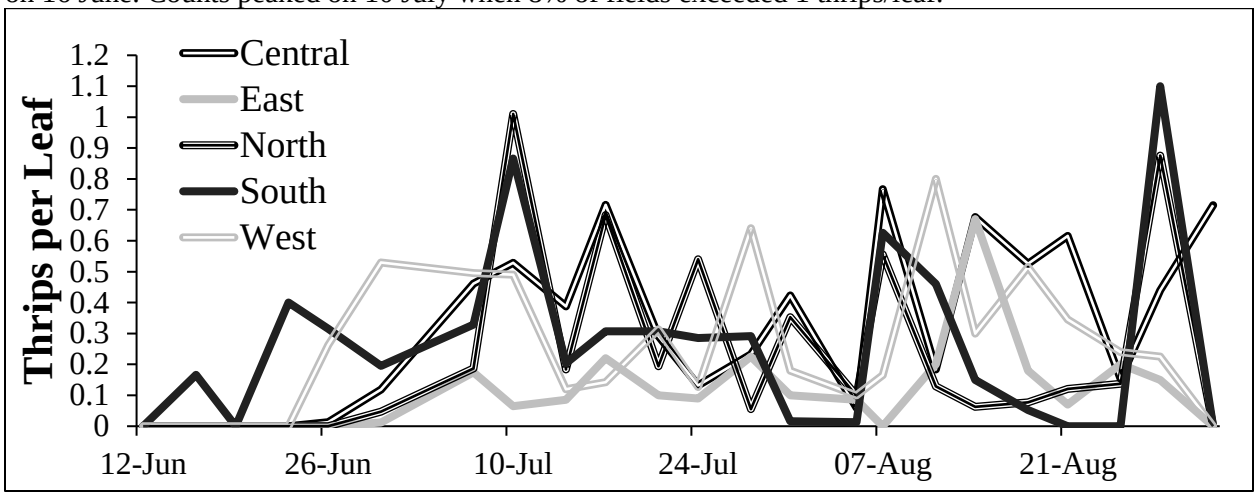

Figure 5. Average thrips counts in different regions of the Holland Marsh, 2020.

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 2020 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 25 June. There were multiple periods where conditions were favourable for downy mildew throughout the growing season, however, the disease was never found in the marsh. Disease forecasting predicted warranted sprays on 8 and 20 August. White rot was observed in <1% of fields, with the highest incidence up to 5%. Botrytis spores were detected on 10 July but 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 2020.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Stemphylium leaf blight	*Stemphylium vesicarium*	100	1-90
Pink root	*Setophoma terrestris*	96	0-60
Purple blotch	*Alternaria porri*	69	0-10
Smut	*Urocystis cepulae*	14	0-3
Bacterial rot/soft rot	*Erwinia carotovora*	12	0-2
White rot	*Sclerotium cepivorum*	<1	0-5

CELERY

Insects

In 2020, 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 2020, tarnished plant bug and aster leaf hopper populations and damage were very low. Carrot weevil damage in celery fields was also very low. No leaf miner, aphid, caterpillar or cutworm damage was reported.

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 and incidence was very low. Black heart was identified. Low incidences of leaf blight were identified in both celery field during the 2020 growing season.

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