AUTHORS: BLAUEL T & MCDONALD M R
U of Guelph, Dept. of Plant Agriculture, Ontario Crops Research Centre - Bradford

TITLE: THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR MUCK VEGETABLE CROPS, 2023

An Integrated Pest Management (IPM) program is provided to growers in the Holland/Bradford Marsh, Ontario, by the University of Guelph Ontario Crops Research Centre - Bradford. 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 2023, 50 commercial vegetable fields, totalling 559 acres (onion 239 ac, carrot 256 ac, celery 56 ac and potato 8 ac), were intensively scouted for 17 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 14 March to 6 November, 2023, the diagnostic laboratory of the OCRC-B received 126 samples for diagnosis. Of these, 71% were diagnosed with infectious diseases (89 samples), 11% with insect issues (14 samples) and 18% were diagnosed with an abiotic disorder (23 samples). These samples were associated with the following crops: onion (46%), carrot (30%), celery (14%) and other crops (10%). For extension services, data collected from growers' fields and research station 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 OCRC-B website (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), BSPCAST (for Stemphylium leaf blight of onion), an onion white rot model and a Sclerotinia white mold of carrot model, insect 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, samples were taken from each field for assessment. One hundred onions were examined after lodging and 100 carrot samples were collected. The samples were assessed for damage from insects, diseases and physiological disorders. The onion samples were examined by hand pulling 10 onions from 10 random locations throughout each field. The carrot samples were collected by hand pulling 20 carrots near each of the four corners and middle (5 locations total) of each field.

CARROT

Insects

In 2023, 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 caused by carrot weevil and rust fly was low overall with only a few fields experiencing some damage (Table 1). Aster leafhoppers were found throughout the season; however, populations and aster yellows severity were lower than last year.

Table 1. Average percent carrot weevil and carrot rust fly damage on carrots at harvest in scouted fields in the Holland Marsh, 2023.

Location within Holland Marsh	% Damaged Carrots	
	Weevil damage	Rust fly damage
West	0.0	1.0
South	0.6	0.3
Central	0.0	1.6
North	0.0	0.0
East	0.0	5.7
Average	0.1	1.7

Carrot weevil adults were first found in wooden Boivin traps on 19 May in carrot fields (Fig. 1). Carrot weevils were only found in 64% of scouted carrot fields. Overall, 14% of fields in the IPM program reached the 1.5 weevil/trap threshold, and 5% of fields reached the 5 weevil/trap threshold.

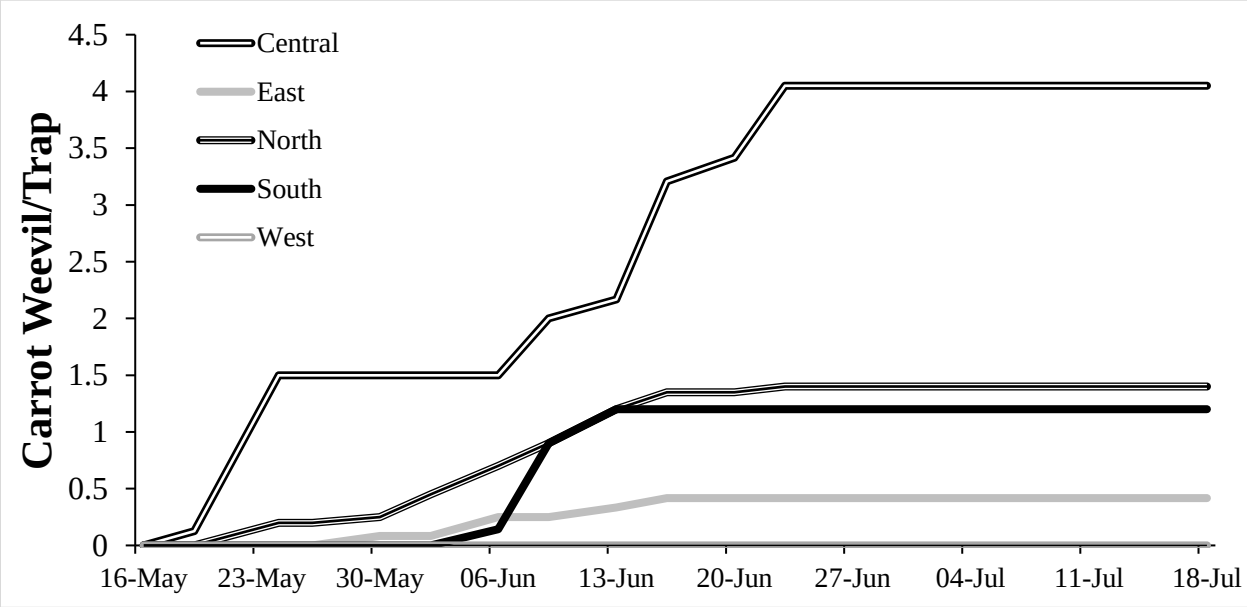

Figure 1. Average cumulative number of carrot weevils/trap in different regions of the Holland Marsh, 2023.

Populations and damage due to carrot weevil remained low, similar to the past few years. The increased uptake of growers now using Rimon and Exirel, which are very effective at controlling carrot weevil, has contributed to decreased carrot weevil damage.

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 26 May, 7 days after the degree day model predicted first

generation emergence (19 May). The highest activity during the second generation was on 11 August when 18% of scouted fields had exceeded the threshold.

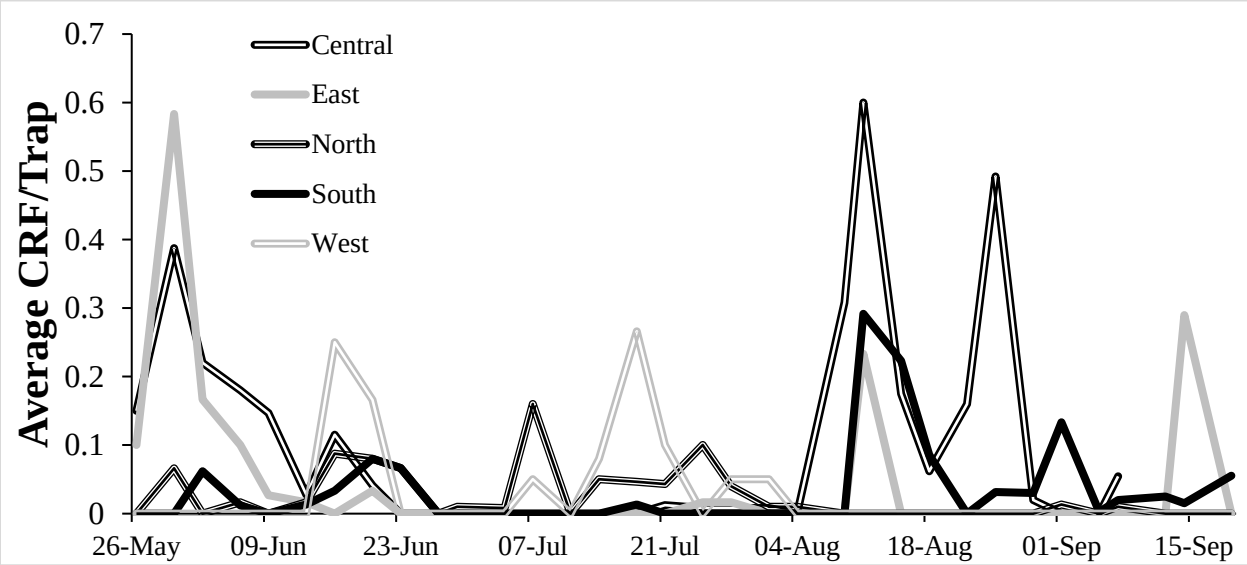

Figure 2. Average carrot rust flies (CRF)/trap/day in different regions of the Holland Marsh, 2023.

Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhoppers were first found on orange sticky traps on 23 May in carrots and celery (Fig. 3). Sticky traps and sweepnetting (100 sweeps per field) were used to estimate populations occurring within fields. Counts peaked around end of June to early July during which only 14% of fields were above the 20 ALH/trap threshold at some point.

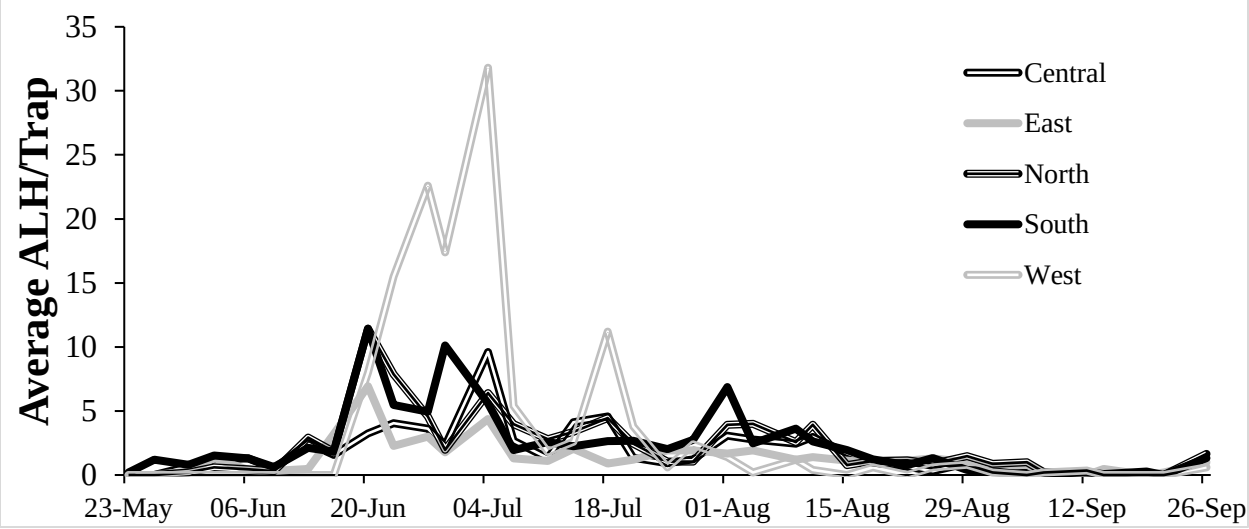

Figure 3. Average aster leafhoppers/trap in different regions of the Holland Marsh, 2023.

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 27 July. Throughout the season, 23% of scouted carrot fields reached the leaf blight threshold of 25% of plants infected.

Samples of 100 carrots were taken from each scouted field and roots were assessed for diseases (Table 2). All fields had multiple diseases; however, disease severity was generally low. Cavity spot (*Pythium* spp.)

was the most common throughout carrot fields. Crater rot, forking/stubby, lesion nematode, Fusarium dry rot, aster yellows and crown gall were also present.

Table 2. Disease incidence on carrot samples collected from commercial fields in the Holland Marsh, Ontario in 2023.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Cavity Spot	*Pythium* spp.	100	6-49
Crater Rot	*Rhizoctonia* spp.	95	0-30
Crown Gall	*Agrobacterium tumefaciens*	86	0-46
Forking/Stubby	Nematodes and/or *Pythium* spp.	86	0-17
Fusarium Dry Rot	*Fusarium* spp.	71	0-28
Aster Yellows	*Candidatus* Phytoplasma asteris	29	0-17

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 model predicted first generation onion fly emergence on 10 May and first onion flies were found on yellow sticky traps on 18 May. Counts remained low in general, but some fields experienced higher activity and some transplants were damaged by onion maggot feeding (Fig. 4).

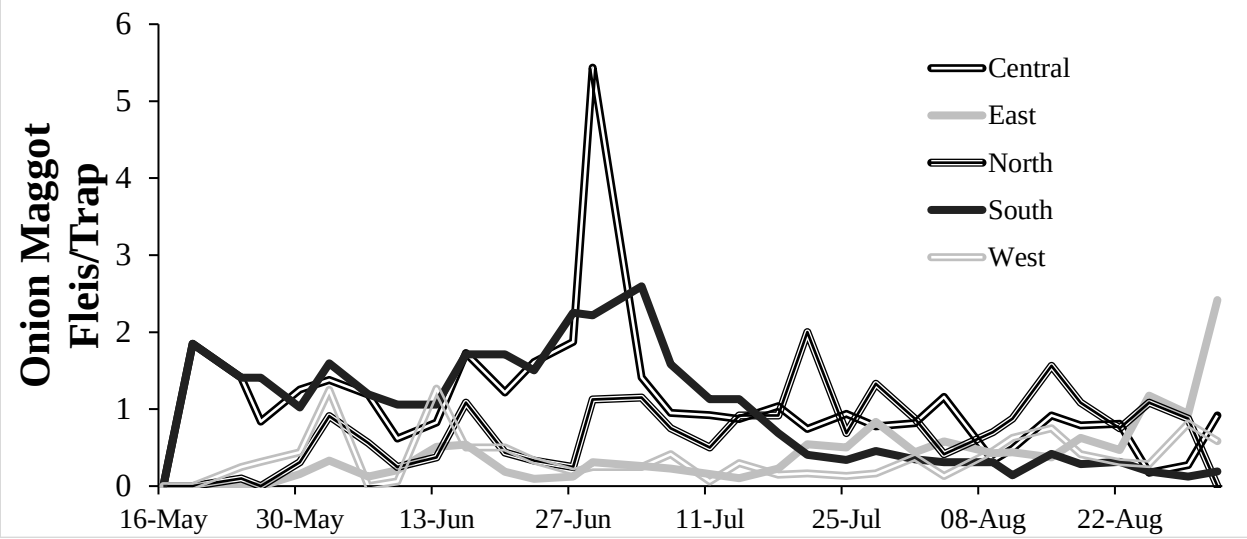

Figure 4. Average onion flies/trap/day in different regions of the Holland Marsh, 2023.

Thrips were firsts identified on 8 June and populations fluctuated throughout the season. Thrips counts peaked from mid- to late-July. Only one onion field surpassed the 3 thrips/leaf threshold during the season.

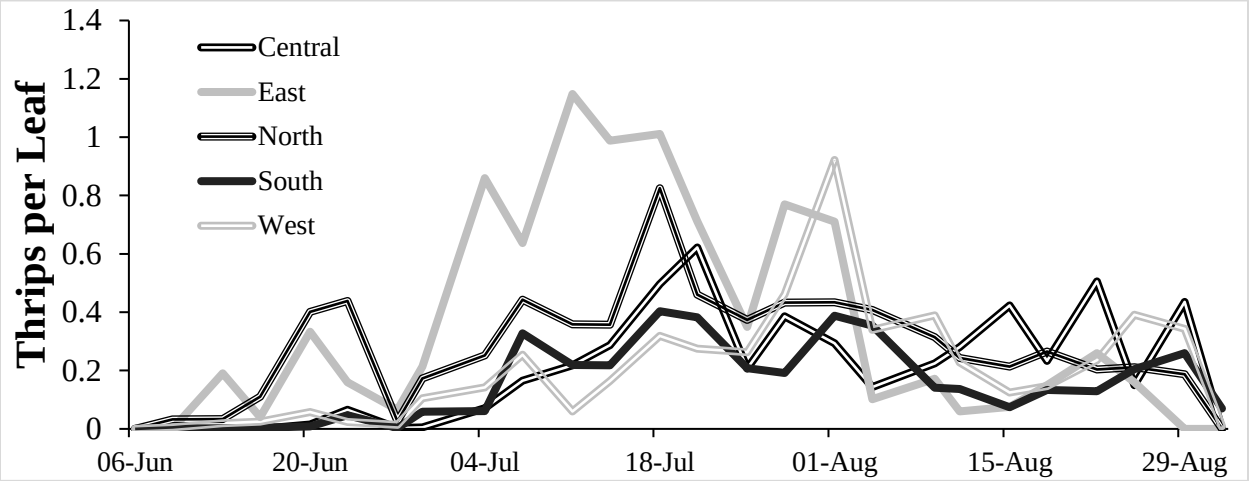

Figure 5. Average thrips/leaf in different regions of the Holland Marsh, 2023.

Diseases

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

During the growing season there were higher amounts of precipitation than usual throughout July, along with some long periods of reduced sun intensity and air quality due to smoke from forest fires during this timeframe as well. The increased precipitation resulted in longer leaf wetness periods and higher relative humidity which was favourable for disease development.

Stemphylium leaf blight continued to be the main disease on onions in 2023 (Table 3). First symptoms of Stemphylium leaf blight in scouted fields were seen on 22 June. Symptoms became severe in many fields and all scouted onion fields showed symptoms of the disease by the end of the season.

Conditions were also quite favourable for the development of onion downy mildew. Starting at the beginning of July there were multiple sporulation-infection periods and sporangia were trapped in rotorod spore traps. Symptoms were first identified on 20 July and a total of eight scouted onion fields were found to have the disease. Most fields experienced minor onion downy mildew severity; however, a couple fields in the marsh had moderate to high disease severity.

Pink root was found in all onion fields, but disease severity was generally low. Bacterial rot was found in a number of fields due to the warm and wet conditions. Smut, white rot, purple blotch and fusarium basal rot were also present.

Table 3. Disease incidence on onion samples examined in commercial fields in the Holland/Bradford Marsh, Ontario in 2023.

DISEASE	CAUSAL AGENT	FIELDS INFECTED (%)	INCIDENCE (%)
Stemphylium leaf blight	*Stemphylium vesicarium*	100	5-100
Pink root	*Setophoma terrestris*	100	7-84
Purple blotch	*Alternaria porri*	71	0-54
Bacterial rot/soft rot	*Pectobacterium carotovorum* subsp. *carotovorum*	67	0-11
Fusarium basal rot	*Fusarium oxysporum* f. sp. *cepae*	43	0-6
Downy mildew	*Peronospora destructor*	38	0-2
White rot	*Stromatinia cepivora*	33	0-18
Smut	*Urocystis cepulae*	19	0-4

CELERY

Insects

In 2023, three 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. Tarnished plant bugs were found in all fields but populations and damage remained low. No carrot weevil damage was found. Aster yellows was very low this year. Only very minor cutworm, aphid and caterpillar damage was seen and no leaf miner damage was reported.

Diseases

Celery leaf curl, or celery anthracnose (*Colletotrichum fioriniae*), was found in two fields and severity was very low overall with only a couple plants per field infected with the disease. Leaf blights (*Cercospora apii* and *Septoria apiicola*) were common but disease severity remained low.

This project was funded in part through the Knowledge Translation and Transfer (KTT) Funding Program, a program of the Ontario Agri-Food Innovation Alliance. Funding for the IPM program was also provided by the Bradford Co-operative Storage Ltd., growers participating in the program, FS Partners, Bayer Crop Science, BASF, Corteva, FMC and Syngenta Crop Protection.