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**TITLE:** **THE INTEGRATED PEST MANAGEMENT PROGRAM SUMMARY FOR  
MUCK VEGETABLE CROPS, 2012**

Integrated pest management (IPM) is an integrated approach to crop management with the primary aim of protecting crops from significant damage from pathogens, weeds and insect pests, while minimizing pesticide use. An IPM program is provided to growers in the Holland/Bradford Marsh, Ontario, by the Muck Crops Research Station (MCRS). This project is funded through the Agricultural Biosecurity Program (ABP), part of the Best Practices Suite of programs under Growing Forward, a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of several Growing Forward programs in Ontario. Funding was also provided by the Holland Marsh Growers' Association, the Bradford Co-Operative Storage Ltd. and chemical company sponsors. 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 rotorod spore traps to trap and analyze spores of various vegetable crop pathogens.

#### SCOUTING

In 2012, 74 commercial vegetable fields, totalling 831 acres (onion 404 A., carrot 311 A., celery 106 A. and lettuce 10 A.), were intensively scouted for 31 growers. Fields were scouted twice a week during the growing season and growers received scouting reports after each field survey.

#### DIAGNOSTICS, EXTENSION & DISSEMINATION OF INFORMATION

Any grower, whether on the IPM program or not, could bring in samples (plant and/or insect) for diagnosis. On-site tools available for diagnosis were visual inspection and laboratory inspection using a microscope and culturing. Diagnoses were 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 OMAFRA recommendations for pesticides

In 2012, the diagnostic laboratory of the MCRS received 239 samples for diagnosis. Of these, 58% were plant pathogens and 27% physiological disorders. These samples were associated with the following crops: onion (33.3%), carrot (21.7%), celery (17.9%), lettuce (5.8%), and other vegetable crops (22.3%). A total of 27 samples of insects or insect damage were assessed and 8 weed samples were identified. Other samples were diagnosed in-field during scouting and not brought in for analysis, thus the numbers mentioned above do not include these samples.

For extension services, data collected from growers' fields and the MCRS research plots were compiled twice per week, analyzed and summarized. The results (IPM report) were updated twice per week and circulated to participating growers, academia, industry, OMAFRA experts, posted at the MCRS web site ([www.uoguelph.ca/muckcrop](http://www.uoguelph.ca/muckcrop)), and a copy was displayed at the Bradford Co-op. During the 2012 growing season, more than 100 phone inquiries and email requests for information concerning plant problems and recommendations were addressed.

#### PEST PREDICTIVE MODELS

The IPM program provides disease and insect forecasting based on spore traps, the disease forecasting models BOTCAST (for botrytis leaf blight of onion), DOWNCAST (for onion downy mildew), and BREMCAST (for lettuce downy mildew), and degree day models and insect traps. The disease and insect forecasts alerted growers to the potential for disease and insect pest in order to prepare ahead.

## CROP PEST SUMMARIES

At the end of the scouting program, carrot samples were collected from each scouted field and assessed for damage from insects (Table 1) and diseases or physiological disorders (Table 2). Similarly, onions were assessed in mid-season and at the end of the scouting program for onion maggot damage and incidence of smut.

### CARROT

#### Insects

In 2012, carrot fields were scouted for carrot weevil (*Listronotus oregonensis*), carrot rust fly (*Psila rosae*) and aster leafhopper (*Macrosteles quadrilineatus*). Degree day models were used to predict the occurrence of different life stages of these insects.

**Table 1.** Average percent carrot rust fly and carrot weevil damage on carrots at harvest in scouted fields around the Holland Marsh (HM), 2012.

Location	% Damaged Carrots	
	Weevil damage	Rust fly damage
South HM	0.0	0.0
West HM	0.5	1.8
North HM	3.6	2.3
Center HM	0.7	1.1
East HM	1.0	2.3

Carrot weevil adults were first found in wooden traps on 19 May in carrot fields. The threshold of 1.5 or more weevils/trap was reached by the end of May.

Orange sticky traps and degree day models were used to monitor and estimate carrot rust fly and aster leafhopper numbers. Aster leafhoppers are pests of carrots, celery, lettuce and leafy greens. Aster leafhopper adults were first found on orange sticky traps on 11 June in carrots, lettuce and celery. In 2012, aster leafhopper numbers and aster yellows, the disease caused by the infestation, were higher than in the previous 2 years in carrots, celery and lettuce.

Carrot rust flies were first found on sticky traps on 24 May. The spray threshold for fresh market carrots (0.1 flies/trap/day) was reached by the end of May.

#### Diseases

Carrot fields were scouted for all the important diseases of carrots around the Holland Marsh. Leaf blight, which is caused by the fungi *Alternaria dauci* and *Cercospora carotae*, was first seen in mid-July and certain fields reached the spray threshold within one week. The timely announcement of leaf blight incidence helped to keep the disease pressure at the threshold of 25% disease incidence.

Weather conditions in the 2012 growing season were conducive for most pathogens such as *Pythium*, *Sclerotinia* and *Rhizoctonia*. The above average rainfall in July generally resulted in excessive soil moisture. This excessive soil moisture in turn created ideal conditions for soil borne pathogens, particularly *Pythium* and *Rhizoctonia* spp., resulting in a high incidence of cavity spot, pythium root dieback and crater rot. Carrots from all of the surveyed fields had cavity spot (*Pythium* spp.) with incidence ranging from 9 to 34% and carrots in 96% of the fields had pythium root dieback (*Pythium* spp.) with disease incidence of 1-13%. High incidence of heat canker was observed in carrot fields due to a heat wave and shortage of rain in June.

Crater rot (*Rhizoctonia carotae*) occurred in 15 of the 28 carrot fields surveyed, compared to 3 fields (46%) surveyed in 2011.

In 2012, a high aster leafhopper infestation was observed, which resulted in a higher incidence of aster yellows compared to the 2010 and 2011 growing seasons. Of the fields surveyed, 64% had aster yellows.

Carrots in thirteen (47%) of the fields sampled had crown gall (*Agrobacterium tumefaciens*) with disease incidence ranging from 1 to 16%. Weather conditions were ideal for sclerotinia rot (*Sclerotinia sclerotiorum*) development and incidences were observed in carrot fields around the Holland/Bradford Marsh during the growing season. Sclerotinia rot was found on carrots from 5 sampled fields. Fusarium rot (*Fusarium* spp.) was found on carrots from 3 fields with disease incidence of 1-3%.

Carrot roots from 96% of the fields surveyed showed splitting (growth cracks) and forking with mean incidence of 4.1 and 3.9% respectively. These results are similar to those reported in 2011 growing season.

**Table 2.** Disease incidence on carrot samples collected from 28 commercial fields in the Bradford/Holland Marsh, Ontario, 2012.

Disease	Mean incidence (%) (n= 28)	# fields affected
Cavity spot	19.2	28
Pythium root dieback	3.4	27
Crown gall	2.1	13
Crater rot	1.0	15
Aster yellows	0.9	18
Sclerotinia rot	0.2	5
Fusarium rot	0.2	3
Splitting (Growth cracks)	4.1	27
Forking	3.9	27

## ONION

### Insects

Onion fields were scouted for onion maggot (*Delia antiqua*), onion thrips (*Thrips tabaci*) and cutworms. Predicted emergence of first generation onion flies was 15 May and flies were found on traps on 17 May. Damage plots were assessed after first and second generation peaks.

In 2012, high infestation rates of onion thrips were observed in all onion fields. Thrips were first found in onion plants in scouted fields on 28 May, 10-12 days earlier than in 2011. Several scouted fields reached the threshold of one thrips per leaf in early July. Thrips thrive in hot, dry conditions and the weather conditions in the 2012 growing season were favourable for thrips infestation.

### Diseases

Onions 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.

In 2012, stemphylium leaf blight and pink root were the main diseases that affected onions. Spores of *Botrytis* spp., *S. vesicarium* and *Alternaria* spp. were detected with the spore traps during the growing season. A few incidence of botrytis leaf blight were reported. No downy mildew was found in any scouted onion fields.

## CELERY

### Insects

In 2012, celery fields were scouted for carrot weevil, aster leafhopper, tarnished plant bug (*Lygus lineolaris*), the pea leafminer (*Liriomyza huidobrensis*), 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. The scouting results of carrot weevil and aster leafhopper were as discussed in the carrot crop section. Tarnished plant bugs are pests of celery, lettuce and leafy greens. Tarnished plant bug

populations were assessed using plant inspections, orange sticky traps, and sweep nets. A few fields reached the damage threshold of 6% around early to mid-August. More tarnished plant bug infestation and damage was observed in 2012 than the 2011 growing season. Aphid, carrot weevil and leafminer infestations remained low throughout the growing season.

### **Diseases**

Celery leaf blights in Ontario are caused by the fungi *Cercospora apii* (early blight) and *Septoria apiicola* (late blight) and the bacteria *Pseudomonas syringae* pv. *apii* (bacterial blight). The threshold for pesticide application is disease presence. Similar to the 2011 growing season, in 2012 the main issue for celery was bacterial blight. Incidence of early blight was observed in a few scouted fields. No late blight was observed in any scouted celery fields. Pink rot (*Sclerotinia sclerotiorum*) incidence remained low throughout the season. Blackheart (calcium deficiency) and symptoms related to boron and magnesium deficiency were seen in most celery fields.

### **LETTUCE**

#### **Insects**

In 2012, lettuce fields were scouted for aster leafhopper, tarnished plant bug, aphids and other insects. The degree day model used to predict the occurrence of various life stages of the aster leafhopper and the scouting results were as discussed in the carrot crop section. The occurrence of tarnished plant bugs and leaf hoppers was higher this year resulted in more tarnished plant bug damage and aster yellows than the 2011 growing season. Aphid numbers were low in lettuce fields.

#### **Diseases**

The lettuce fields were scouted for downy mildew (*Bremia lactucae*), Sclerotinia drop (*Sclerotinia sclerotiorum* and *S. minor*), grey mould (*Botrytis cinerea*) and other diseases. BREMCAST, the lettuce downy mildew forecasting model, predicted sporulation infection periods (SIP) during the growing season starting mid-July and the risk of developing downy mildew remained moderate to high until September. Lettuce downy mildew symptoms started to develop around mid to late August in the Holland Marsh. Downy mildew incidence was low in all scouted fields. Sclerotinia drop, botrytis grey mould and pythium stunt were all first noted around mid-June.

#### **WEEDS**

In 2012, broad-leaved weed, grass and sedge weed pressure differed among fields mainly depending on field location and management practices. In most fields, weeds were controlled during the critical weed-free period for each crop. Some herbicide resistant redroot pig weed has started to appear in a few fields. Yellow nutsedge was a problem for a number of growers in all crops around the Holland Marsh.

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