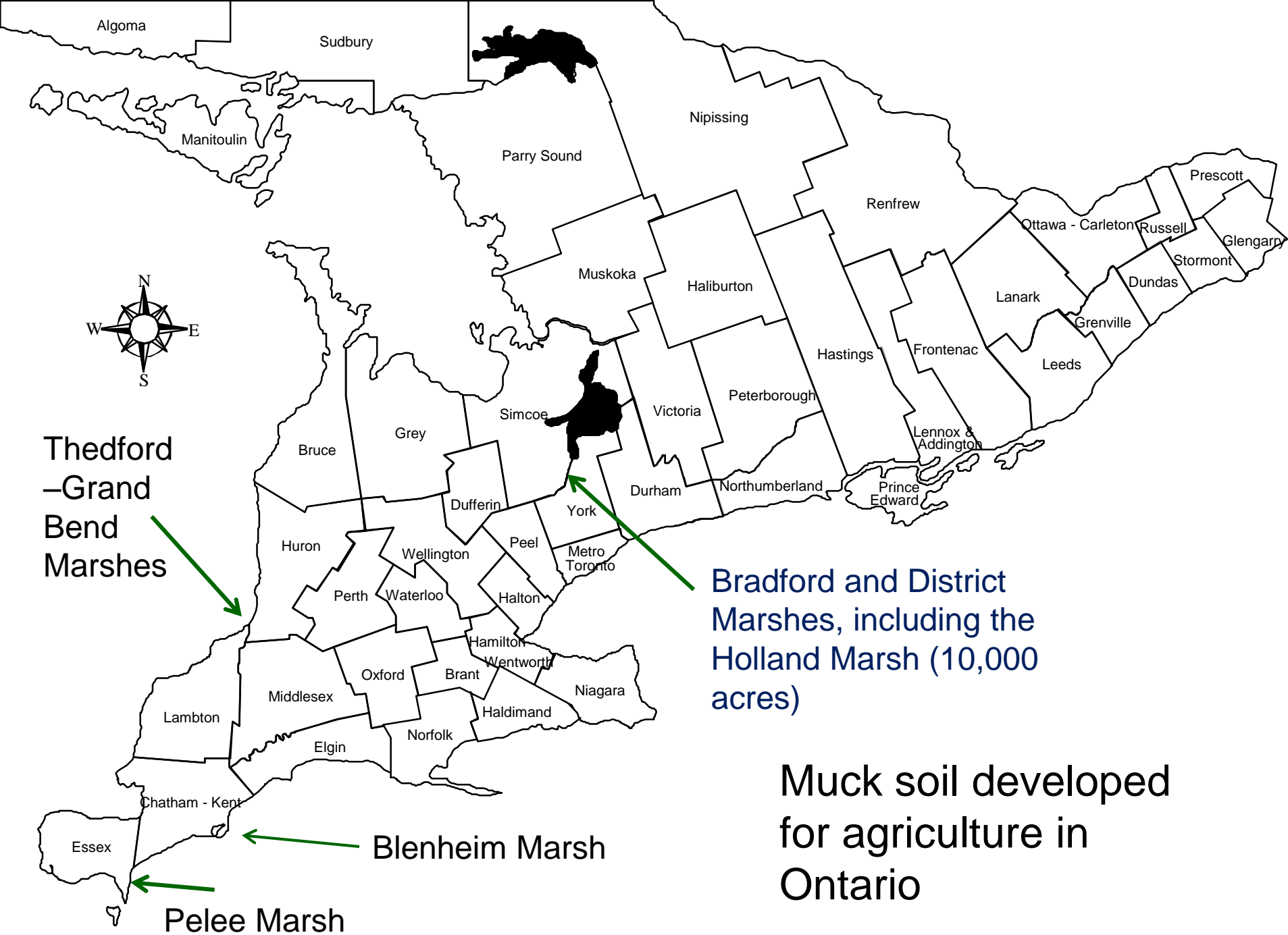


Muck Vegetable Production in Ontario

Mary Ruth McDonald



UNIVERSITY
of GUELPH



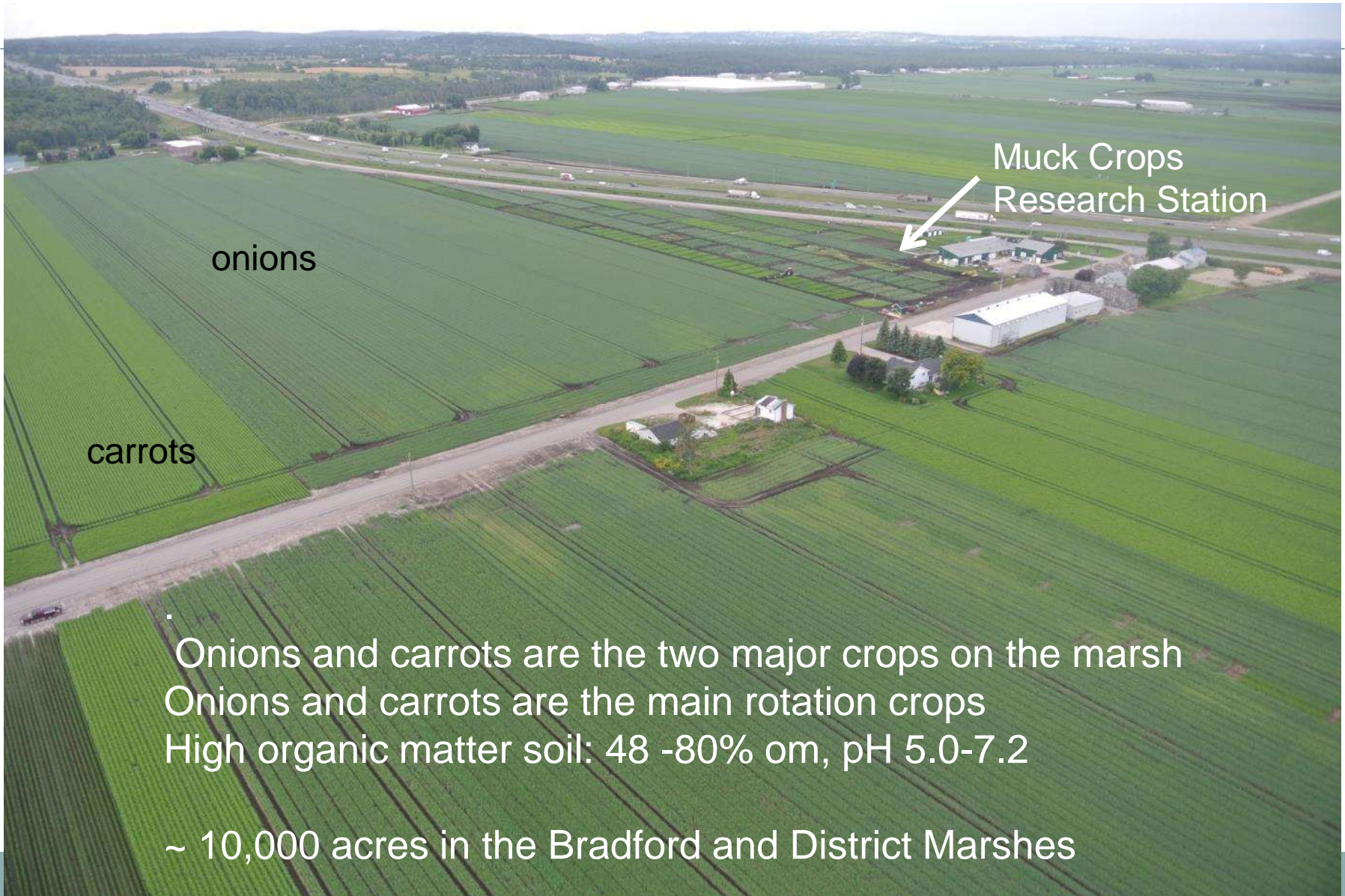
Muck soil developed for agriculture in Ontario



The Holland Marsh is the largest continuous area of muck soil in Canada – about 7,000 acres

First drained in the late 1920's, most dyked and drained in the 1930's

The Holland Marsh



onions

carrots

Muck Crops
Research Station

Onions and carrots are the two major crops on the marsh
Onions and carrots are the main rotation crops
High organic matter soil: 48 -80% om, pH 5.0-7.2

~ 10,000 acres in the Bradford and District Marshes



**Keswick Marsh located
at the south end of
Cook's Bay, Lake
Simcoe**

Muck Soil in Ontario

Depth of organic soil: over 20 ft to less than 2 ft.

Underneath there is a range of soils, from blue clay to sand

Protected from development because it is a flood plane. However, there are other pressures with increasing urbanization

Wetlands are protected, no more draining for agricultural use.

Pesticide residues and nitrate nitrogen are within drinking water levels

Phosphorous in the water is the big issue.



Clearing muck soil in Cookstown Marsh

Muck Vegetable Production in Ontario (acres)



- **Carrots - 7750 acres**
 - Half on muck soil
- **Onions - 5600**
 - All on muck soil
- **Chinese cabbage- 3197**
- **Other Asian veg ?**
- **Red beets- 1428**
- **Celery - 619**
- **Green onions- 522**
- **Lettuce - 430**
- **Radishes- 327**
- **Leeks- 166**



Carrots in Ontario

- Bunched (minor)
- Packaging cello pack
- Jumbo
- Processing- mineral soil
- Cut and peel (baby cut) carrots, also minor
- Some interest in multicoloured “heirloom” carrots



Onions in Ontario

- Yellow bulb onions, mostly
- Some production of red bulb onions- harder to grow and store
- Some Spanish onions- grown on mineral soil, from bare-root transplants from the U.S.
- Shallots- very low acreage
- Green bunching onions



Transplants



- About 10 % of the bulb onions are grown from transplants.
- Usually 2- 3 plants per plug
- Growers receive more money for the early onions. If more early onions were produced, then the price would decrease.



Asian vegetables

- At least 30 different crops:



Baby bok choy

Other crops grown on muck soil in Ontario

Other Asian vegetables:

Flowering Chinese cabbage

Pak choy

Chinese chives

Chinese broccoli

Water spinach

Edible chrysanthemum

Mustard greens

Other vegetables:

Root celery (celeriac)

Herbs: dill, parsley, root parsley

Artichokes (occasionally)

for buds and flowers

Amaranth (calaloo)



Chinese chives



Flowering Chinese cabbage and bok choy

celeriac





Amaranth



Artichokes



Cover crops

Spring wind abatement crops
Mostly barley in onions and carrots

Fall cover crops are used after onions and wherever possible

Barley is the most common cover crop. Oilseed radish has been used, and other combinations for fall cover crops.

We need a fall cover crop that can grow in October, for use after carrots



Barley as a spring cover crop on onions

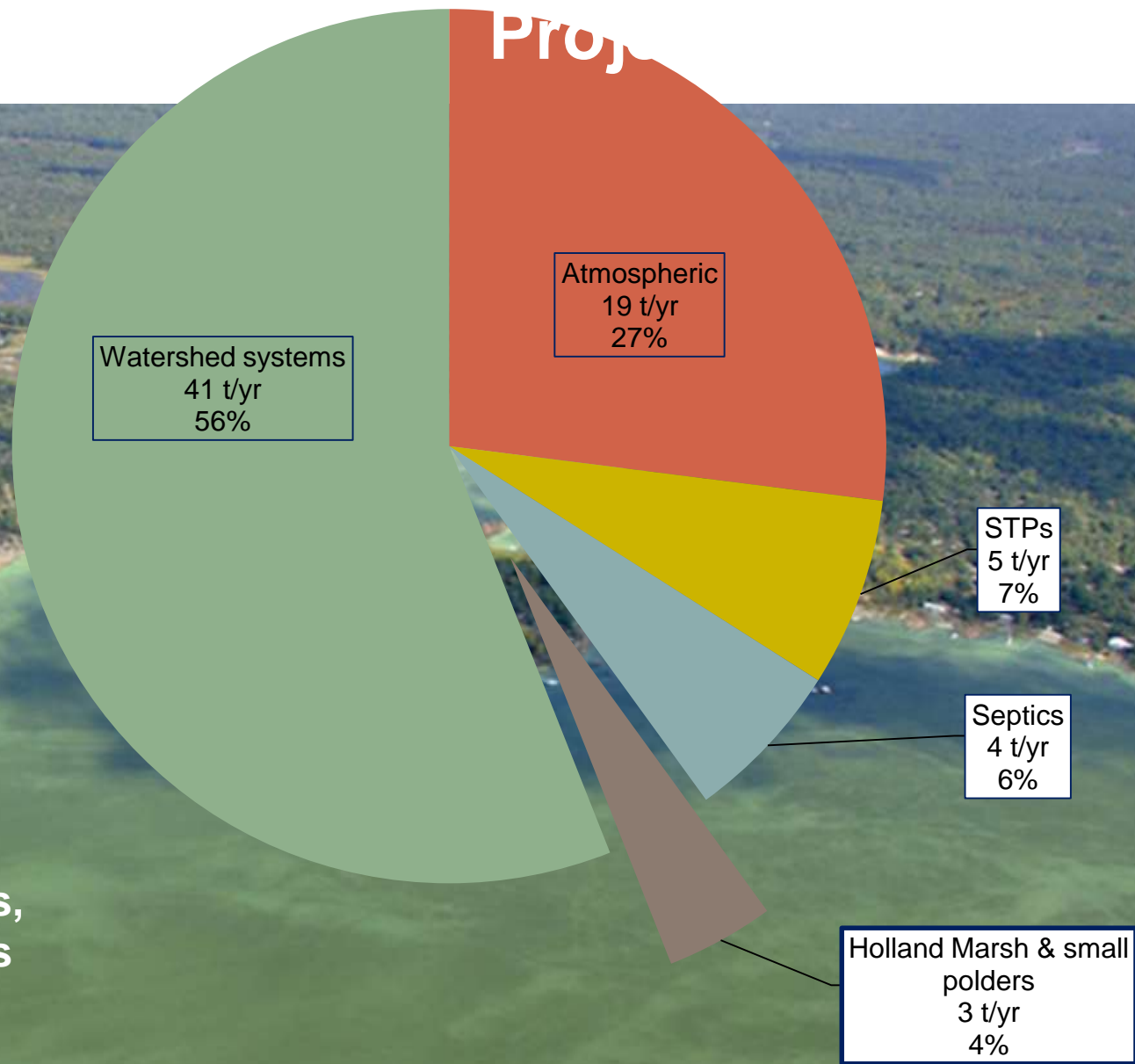


Barley as a fall cover crop

Muck Veg Challenges

- **Marketing – low Canadian dollar helps**
- **Labour**
 - ✦ **Family farms plus mostly off-shore labour**
- **Crop Protection**
 - ✦ **Effective pest management**
 - ✦ **Registration of Crop Protection Materials**
- **Other issues-**
 - ✦ **Phosphorous use**
 - ✦ **Permits to take water**
 - ✦ **Carrot Washwater treatment**





Lots of research ,
not many
recommendations,
except to use less
P fertilizer

Source: Lake Simcoe Protection Plan, 2009

Carrot washwater treatments

Concerns to reduce phosphorous and organic material from going in to water ways



Some water treatment approaches

Smith
Gardens
Keswick
Marsh



Production Challenges

- Onions-
 - Weed control
 - Onion thrips
 - Downy mildew
 - Onion maggot
 - Onion smut
 - Allium white rot
 - Botrytis leaf blight
 - Bacterial diseases



The Weather!



Production Challenges

- **Carrots-**

- **Weed control- Linuron resistant pigweed**
- **Carrot weevil and carrot rust fly**
- **Cavity spot**
- **Carrot leaf blights**
- **Aster yellows**
- **Sclerotinia rot (white mold)**



Production Challenges

- **Celery**

- Late blight (*Septoria*)
- Early blight (*Cercospora*)
- Leaf curl (*Colletotricum*)
- Tarnished plant bug
- Aphids

- **Lettuce**

- Downy mildew
- Drop (*Sclerotinia*)
- Aphids
- Tarnished plant bug

- **Asian Brassica crops**

- Flea beetle
- Clubroot
- Swede midge



Pest management program for muck vegetables

- **Onion downy mildew**
 - DOWNCAST and spore traps
- **Botrytis leaf blight**
 - BOTCAST
- **Carrot leaf blights**
- **Lettuce downy mildew (Bremcast and spore trap)**
- **Onion maggot –degree days and traps**
- **Carrot weevil and rust fly – degree days and traps**
- **Onion thrips- field scouting**

- **Fields are scouted twice each week and information provided to individual growers and summarized for the region**



The program is supported by the local grower Coop, by the Holland Marsh Growers' Assoc., through sponsorship by chemical companies and through research projects. The university provides expertise and office space

A photograph of an onion field showing signs of downy mildew. The onions are in various stages of growth, with some showing yellowing and wilting of the leaves. The plants are arranged in neat rows, and the soil between them is dark. The overall appearance is one of a healthy crop that is beginning to show signs of stress or disease.

Onion downy mildew

Onion downy mildew

(Peronospora destructor)

- **Occurs only some years – disease forecasting very useful**
- **Starts in “hot spots”**
- **Grows systemically in the plant, no symptoms until it sporulates**

Forecasting with DOWNCAST

Indicates weather favourable for sporulation and infection



A few cycles of downy mildew sporulation and infection can destroy a crop
In 2015, downy mildew developed in August. The DOWNCAST program correctly predicted the first sporulation and infection periods.

This crop was not sprayed on time.

Stemphylium leaf blight

spores



Caused by fungus *Stemphylium vesicarium*. First identified in the Bradford area in 2009

Typically attacks leaf tips, other lesions, and injured or dying onion leaves

Starts with small light brown lesions, these expand and black conidia develop

Infection may kill entire leaves.

Fungicides are only partly effective. Better spray timing needed?



Fusarium root rot

A new, or emerging, disease of carrots in Ontario

Fusarium infection that develops in the field is unusual- it is most often seen as Fusarium dry rot in storage.

No effective controls, fumigation can reduce disease incidence



Brown to black, leathery lesions



Source: Howard et al. Diseases and Pests of Vegetable Crops in Canada



Celery leaf curl

Caused the fungus *Colletotricum fioriniae*

Relatively new disease (2011)
Curling of leaves and dark lesions on petioles

Wide host range? Apples, strawberries, weeds?

Spread in water- rain splashes, irrigation

No fungicides registered, but some may be effective

Some differences in susceptibility

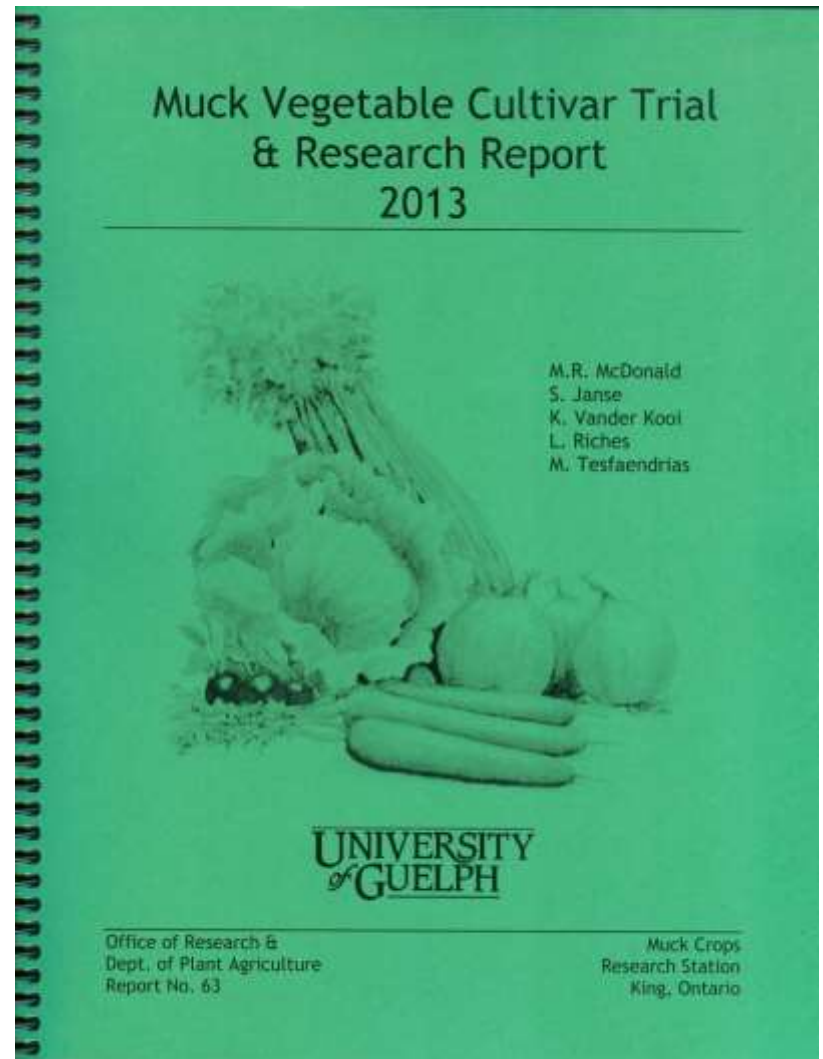


Celery leaf curl

All research trials are summarized in the Annual Report

Download at the Muck Station web site:

www.uoguelph.ca/muckcrop



Annual Muck
Vegetable Growers
Conference: Bradford,
Ontario, Canada

2016 conference June
22 and 23

Carrot day- June 22

Onion day - June 23

2015 Industry Directory



Muck Vegetable Growers

Meetings — Trade & Equipment Show

Acknowledgments

- Muck Crops Research Station Staff
- OMAFRA/University of Guelph Partnership





Questions?

Weather Data 2011-2014



	Mean Temperature (C)					Rainfall (mm)			
Month	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>		<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>
May	14.1	15.9	14.8	13.6		92	49	113	54
June	18.4	20.1	18.5	19.4		67	55	94	114
July	22.8	22.2	21.3	19.3		56	140	104	87
Aug	20.2	20.1	19.6	19.1		113	69	87	62
Ave	18.9	19.6	18.6	17.9	Total	328	313	398	317

Record yields (at least 20% above average) in 2014. Why? Even rainfall, a bit cooler?

Muck Crops Research Station

IPM Events Publications

CHANGING LIVES
IMPROVING LIFE

MUCK CROPS RESEARCH STATION

The Muck Crops Research Station is located in the Bradford/ Holland Marsh, near the intersection of Highway 400 and Hwy 9. This region is the largest area of organic (muck) soil developed for agriculture in the province and one of the most intensive areas of agricultural production in the country.

The facilities at this station include a plant pathology lab, greenhouses with ebb and flow benches and computer monitored environment, cold storage facilities to provide the specific requirements for long term storage of onions and carrots and several sites for field research. There are 4 ha of organic soil research plots on site, a further hectare of organic soil, rented from a local grower and located in another area of the Marsh, and, recently, 2 ha of mineral soil nearby, to allow field trials to be conducted on mineral soil. Field trials are also conducted in commercial vegetable fields in cooperation with local growers.

Research at the Station focuses on the vegetable crops grown in the region, especially onions, carrots, lettuce, celery and Asian vegetables, but includes

POPULAR LINKS

- [Allium White Rot](#)
- [Variety Trial Reports](#)
- [Summer Employment Opportunities](#)

Web site www.uoguelph.ca/muckcrop

Check for the Agriphone, research reports, publications



New Crops



Coloured carrots



amaranth



artichokes

Onion downy mildew



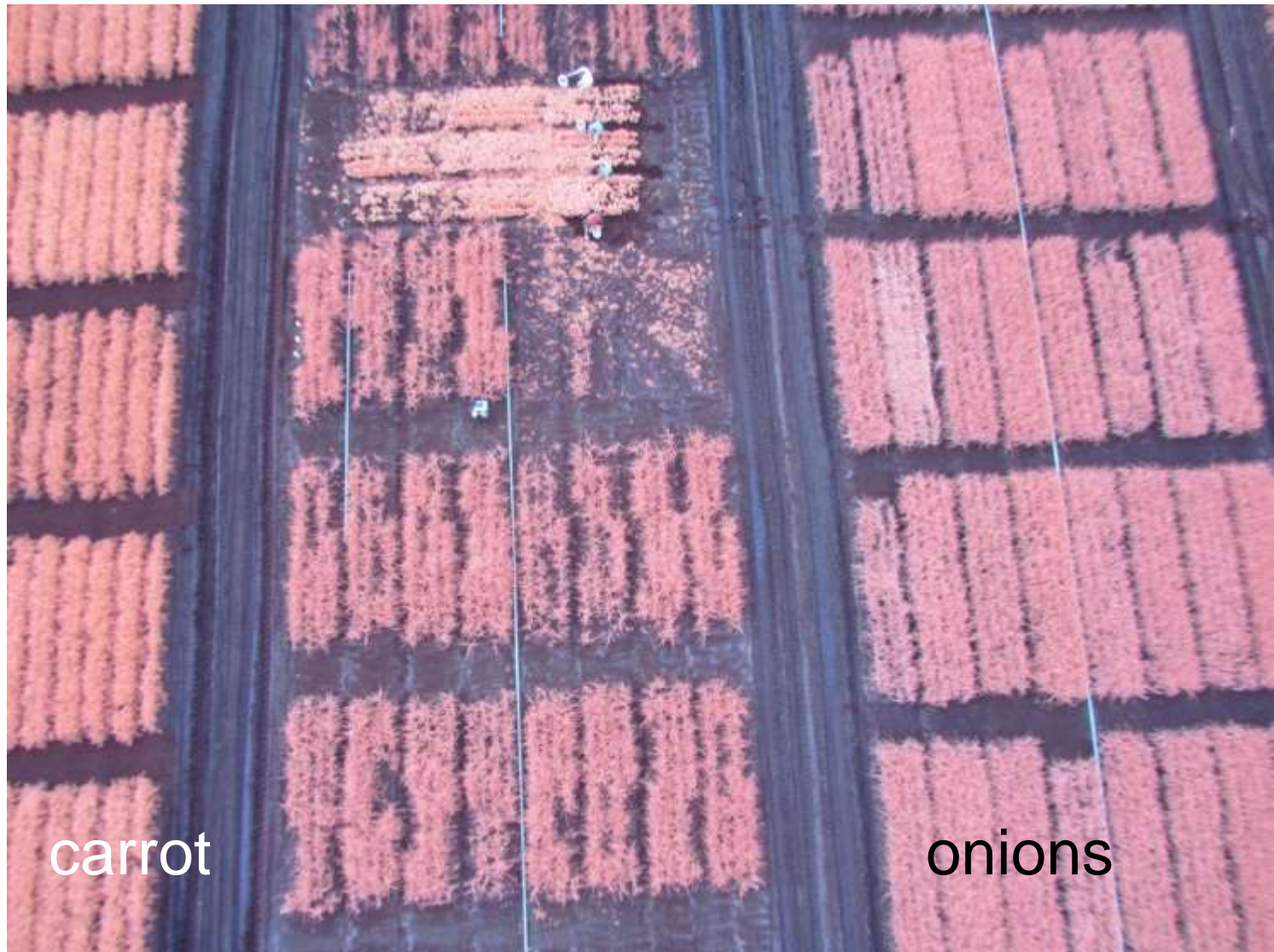
- Sporulates when temperatures below 75 °F, (24 °C) previous day
- Temp 38 - 75 °F (4 – 24 °C) at night
- Humidity above 95% at night, No rain after 1:00 am
- Infection occurs in 3-6 hours, temp 38- 78 °F (4- 26 C)
- Takes 10 to 12 days from infection until sporulation
- NO symptoms until sporulation occurs



Aerial photography for IPM and plot assessment



Infrared photographs for NDVI assessments





2010



Field plots on 2 Sept., 2010. A greenness rating (1-5) was conducted on 24 Aug.

The IPM Program of the Muck Crops Research Station

▣ Objectives:

- Provide growers with timely, accurate and convenient access to insect and disease pest information
- Scout growers' fields
- Disease and insect forecasting information
- Identify/diagnose diseases, insect pests and weeds
- Update and improve the IPM program







Fungicides for onion downy mildew in Canada

Treatment	Active Ingredient	Rate/A
Quadris Top	azoxystrobin + difenoconazole	13.7 oz
Luna Tranquility	fluopyram + pyrimethanil	16.4 oz
Inspire	difenoconazole	7.0 oz
Fontelis	penthiopyrad	19.2 oz
Pristine	pyraclostrobin + boscalid	1.2 lb
Manzate/Dithane	mancozeb	2.9 lb
Switch	cyprodinil + fluodioxinil	0.9 lb
Bravo	chlorothalonil	65.7 oz

Comparison of disease ratings for Stemphyllium leaf blight symptoms and marketable yield of onions treated with fungicide at different periods, 2013.

Treatment	Spray date	% Total Leaf Length with Symptoms	Marketable Yield (Bushel/A)
TOMCAST 30	Jul 12, 25 Aug 2, 9, 19	15.5 a¹	889.4 ns ¹
TOMCAST 20	Jul 3, 22 Aug 2, 9, 19	16.3 a	1044.4
Calendar spray	Jul 15, 25 Aug 2, 9, 19	16.3 a	986.7
Spore trap	Jul 15, 25 Aug 2, 9, 19	16.5 a	728.8
BOTCAST	Aug 2, 9, 19	17.9 a	720.9
Check	Not sprayed	23.7 b	794.8







Irrigation

Rainfall varies from year to year (313-398 mm May – Aug)
~ 40 in (101 cm) a year of precipitation

Sprinklers

Guns

Traveling guns or booms
-most common





Phosphorus flowing in to Lake Simcoe is a major issue

**Slides provided by
Deanna Nemeth and
Donna Speranzini**

Colletotricum on celery

Celery leaf curl





- Off-shore labour:
- Most from Mexico and the Caribbean
- Federal –provincial program
- Come to Canada for up to 8 months a year

Onions in Canada

- Yellow bulb onions, mostly
- Some production of red bulb onions- harder to grow and store
- Some Spanish onions- grown on mineral soil, from bare-root transplants from the U.S.
- Shallots- very small acreage
- Some green bunching onions



Managing Downy Mildew



- Crop rotation and sanitation
- Forecasting – Dwnncast- also spore trapping
- Very effective in Ontario
- Systemic fungicides timed according to forecasts
- Timing of the first spray is critical!



Harvest

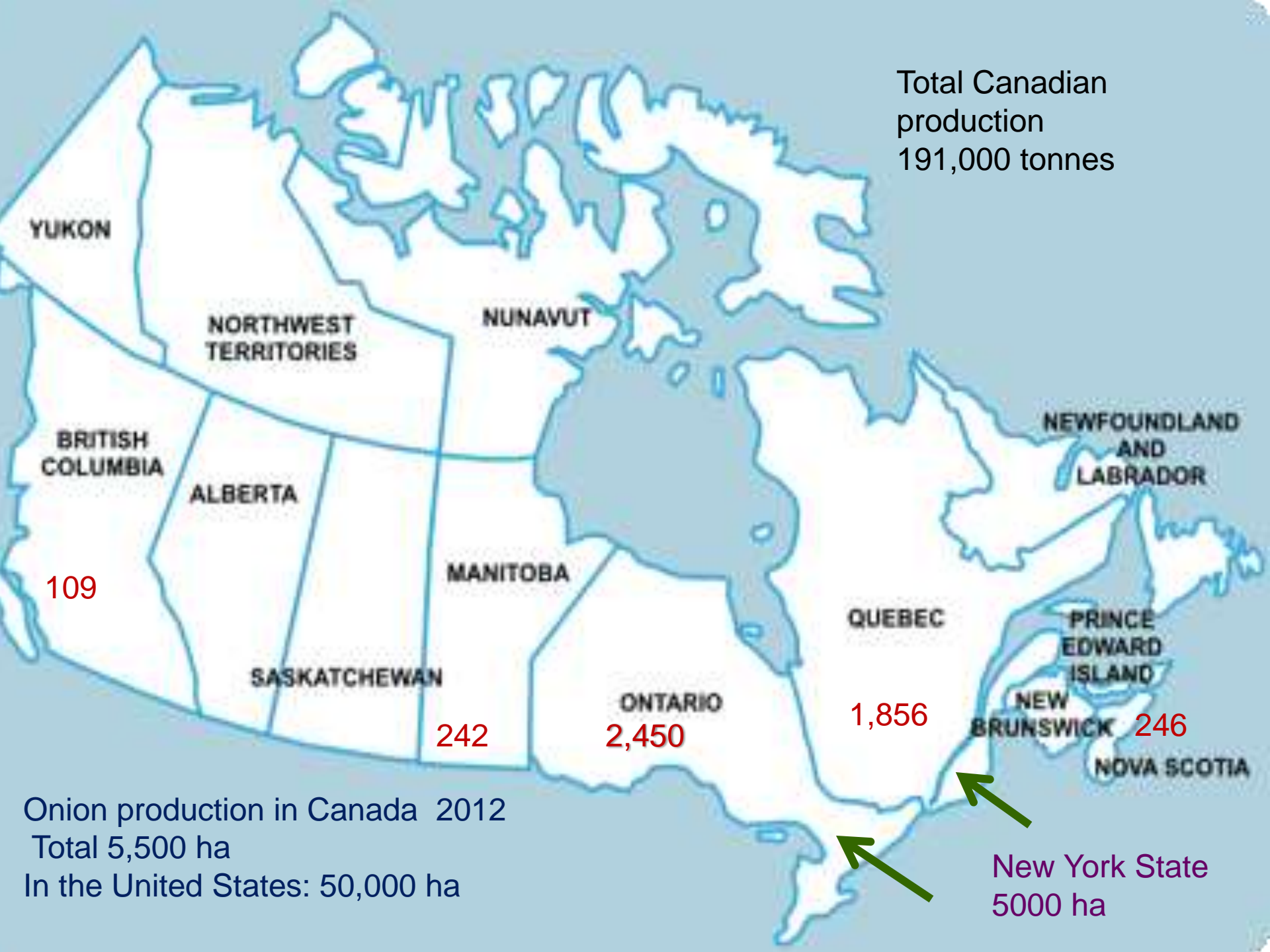
- Onions for storage sprayed with male hydrazide to inhibit sprouting
- Onions lifted and windrowed for 2 days – 3 weeks
- May be kept in the field for 2- 3 weeks (plastic covers on boxes)
- Over half the crop placed in cold storage- sold until April - June
- Artificial curing is very common (reduces neck rot and other problems)
- Average yields: 1000 – 1200 50 lb bags per acre (56- 67 tonnes/ha)



Weed control

**Yellow nutsedge
continues to be a
problem
Linuron resistant
pigweed is a newer
problem**





Total Canadian production
191,000 tonnes

Onion production in Canada 2012
Total 5,500 ha
In the United States: 50,000 ha

New York State
5000 ha