Stemphylium leaf blight of onion in Ontario, Canada – Difficult to understand and challenging to control

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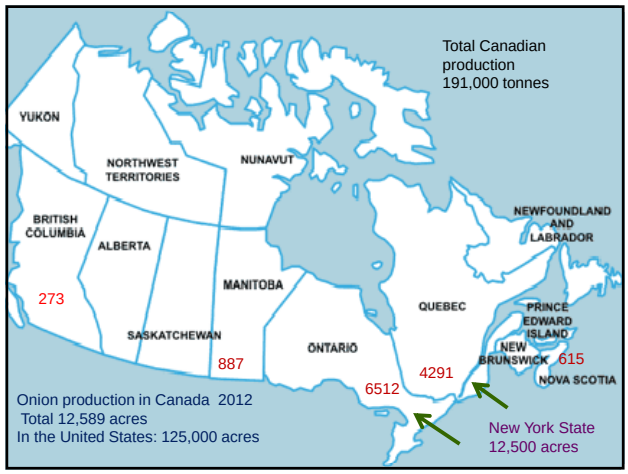
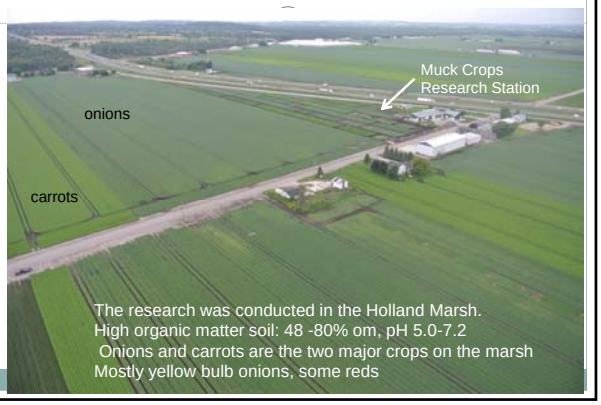


The Holland Marsh



The research was conducted in the Holland Marsh.
High organic matter soil: 48 -80% om, pH 5.0-7.2
Onions and carrots are the two major crops on the marsh
Mostly yellow bulb onions, some reds

Stemphylium leaf blight

Caused by *Stemphylium vesicarium.*

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.

Develops under conditions of long leaf wetness (8- 24 hours or more) and relatively warm temperatures.

Stemphylium leaf blight in Ontario

- A severe leaf blight reported in 2008 in a few fields, Holland Marsh, ON.
- The pathogen was confirmed as *Stemphylium vesicarium* .
- It was found in a few more fields in 2009.
- High incidence in 2010 and was found in all scouted fields.
- 2010 observed yield losses associated with the disease.

Stemphylium severity over years
Untreated check plots in fungicide trials

Objectives

- Improve the management of Stemphylium leaf blight on onion:
  - **Evaluate efficacy of fungicides on incidence and severity of Stemphylium leaf blight**
  - Test **disease forecasting models to improve timing of fungicide sprays**
  - **Screen onion cultivars for susceptibility to Stemphylium**
  - **Determine if surfactants increase the susceptibility of onions to Stemphylium**

Efficacy of fungicides

- Trials conducted at the Muck Crops Resarch Station in the Holland Marsh, Ontario, Canada in 2011- 2015
- 8 fungicides were evaluated
- Disease pressure was relatively high in 2011, similar in other years, but varied from trial to trial.
- Disease started to develop in mid June to mid July
- Cultivars: Tahoe, Patterson, La Salle

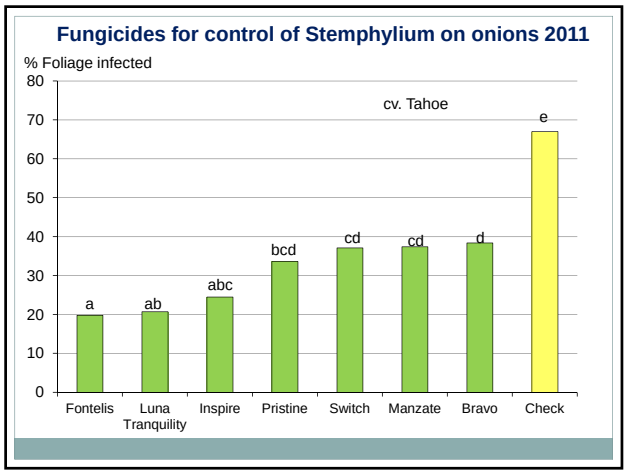
Treatment	Active Ingredient	Rate/A
Quadris Top	azoxystrobin + difenoconazole	13.7 oz
Luna Tranquility	fluopyram + pyrimethanil	16.4 oz
Inspire	difenoconzole	7.0 oz
Fontelis	penthiopyrad	19.2 oz
Pristine	pyraclostrobin + boscalid	1.2 lb
Manzate/Dithane	mancozeb	2.9 lb
Switch	cyprodinil + fluodioxinil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

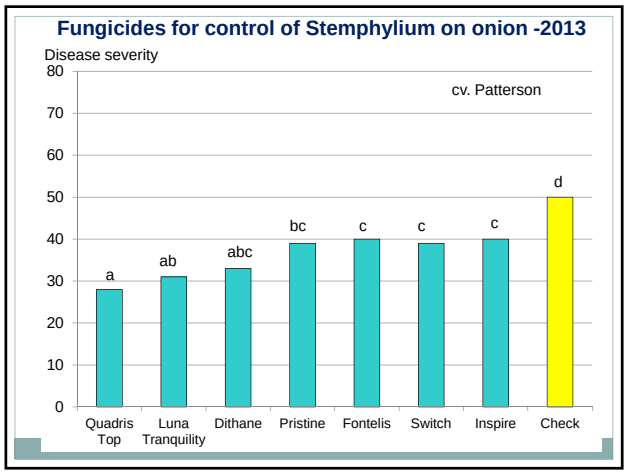
Disease assessment

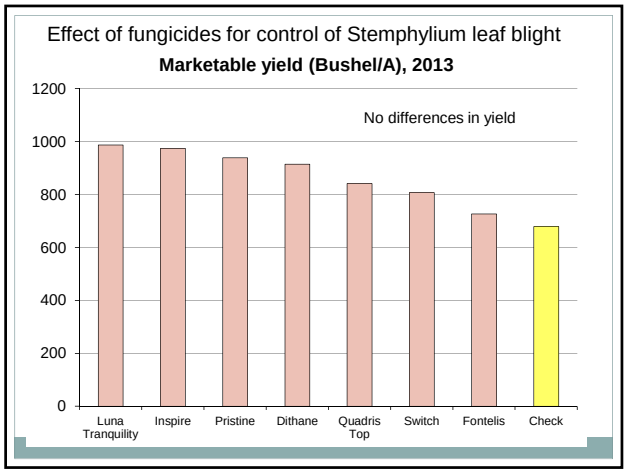
- Randomized complete block with 4 reps
- Once symptoms were observed, an overall plot assessment of leaf area diseased was done weekly, using a 0-9 scale and converted to percent
- Just before tops lodged, 10 or 20 plants per rep were pulled and assessed for per cent leaf area diseased. A disease severity index was calculated (0 – 100)
- Total and marketable yield was assessed

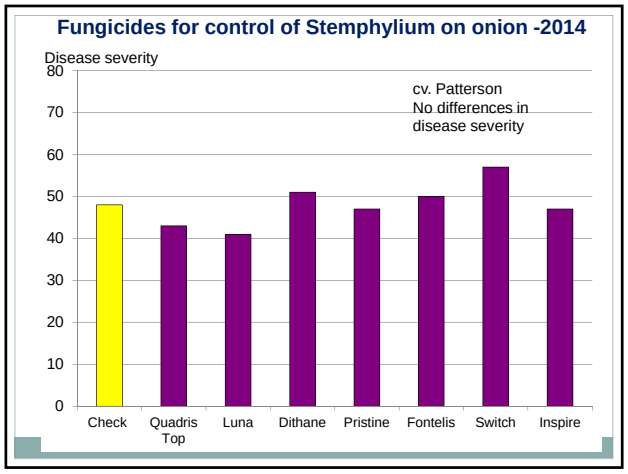
Differences in leaf colour could be detected in late July 2013

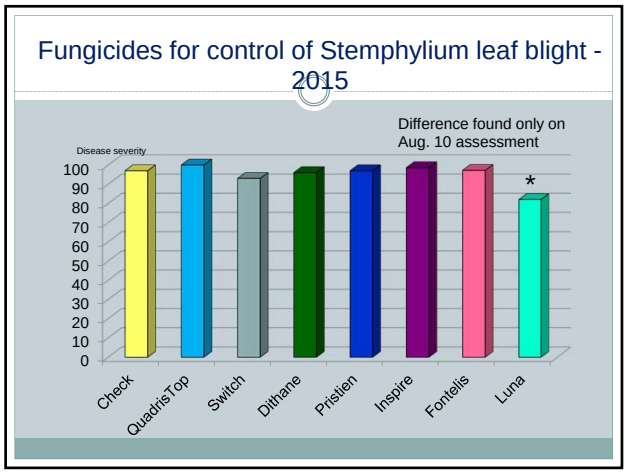
It is important for the onions to have at least 3- 5 green leaves per plant when the onions start to lodge. This is for uptake of the sprout inhibitor, maleic hydrazide.











Efficacy of fungicides

- All of the fungicides reduced disease in 2011- 2013
- No differences in 2014
- Only Luna Tranquility was effective in 2015, and only on one assessment date
  - Disease developed earlier some years?
- No differences in marketable yield or size distribution were found among the treatments except the percent of cull onions increased ($r = 0.39$; $P = 0.02$) with an increase in disease symptoms.
- Green leaves when onions are starting to lodge are very important for application of sprout inhibitor (maleic hydrazide)

Fungicide spray timing for Stemphylium leaf blight management, 2013 & 2014

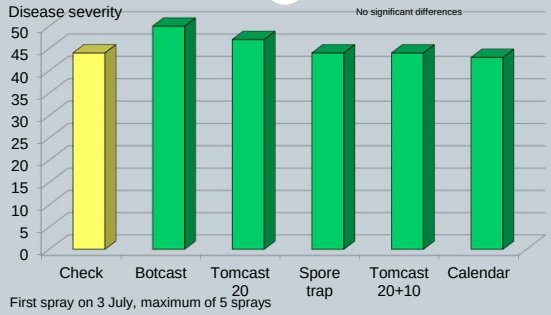
- Disease forecasting systems were tested
  - Botcast – used to forecast Botrytis leaf blight
  - Tomcast with Disease Severity Value 20 and 30- 2013
  - Tomcast with a DSV of 20 then spray at DSV 10 or weekly sprays
    - All based on temperature and leaf wetness duration
  - Spraying following first time a Stemphylium spore is found on spore trap (rotorod trap, also used to monitor for Botrytis squamosa)
  - Standard calendar spray schedule – 5 sprays, 7-10 days apart, beginning 15 July, 2013 and 10 July , 2014
  - Calendar schedule in 2015 – 10 sprays starting 29 June

Comparison of spray timing for Stemphyllium leaf blight control and marketable yield 2013.

Treatment	Spray date	% Total Leaf Length with Symptoms	Marketable Yield (Bushel/A)
TOMCAST 30	**Jul 12, 25** Aug 2, 9, 19	**16 a**[1]	889.4 ns[1]
TOMCAST 20	**Jul 3, 22** Aug 2, 9, 19	**16 a**	1044.4
Calendar spray	**Jul 15, 25** Aug 2, 9, 19	**16 a**	986.7
Spore trap	**Jul 15, 25** Aug 2, 9, 19	**17 a**	728.8
BOTCAST	Aug 2, 9, 19	**18 a**	720.9
Check	Not sprayed	**24 b**	794.8

Fungicide: Quadris Top

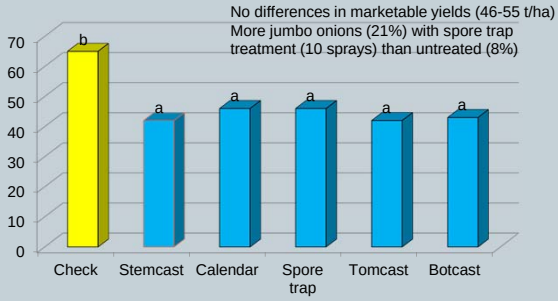
Spray timing for Stemphylium control- 2014



First spray on 3 July, maximum of 5 sprays

Quadris Top plus Sylgard

Spray timing for Stemphylium control - 2015



Assessed 13 August, **6 to 10 sprays, starting June 13, 2015**

Luna Tranquillity

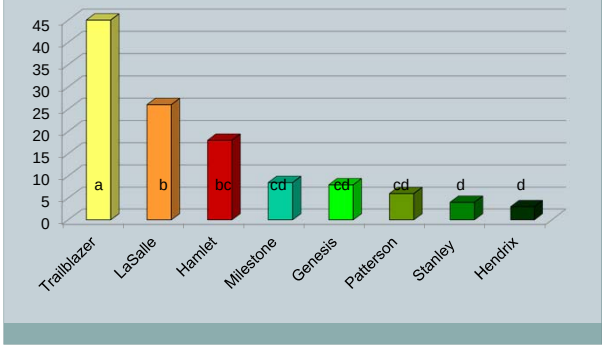
Fungicides for Stemphylium control

- Fungicides were not as effective as expected
- Should fungicide application start even earlier?
- It would be unusual for a pathogen to develop resistance to several fungicides all at once and so quickly
- What led to the sudden explosion of Stemphylium in onions in Ontario?

Cultivar differences

- Some differences in susceptibility to Stemphylium were observed in growers' fields and cultivar trials in 2013
- In 2014: assessment of 8 yellow bulb onion cultivars in the field followed by growth room assessments.
- Assessments continuing in 2015

Cultivar susceptibility to Stemphylium Aug.19, 2014



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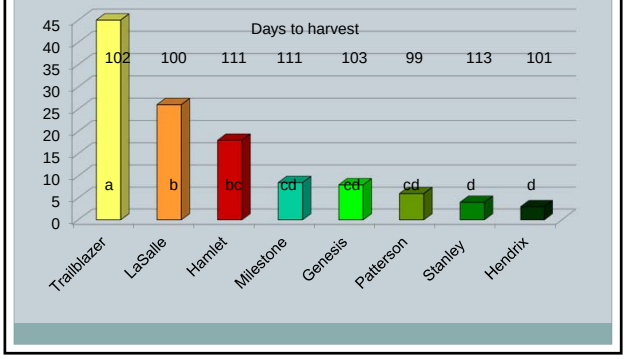
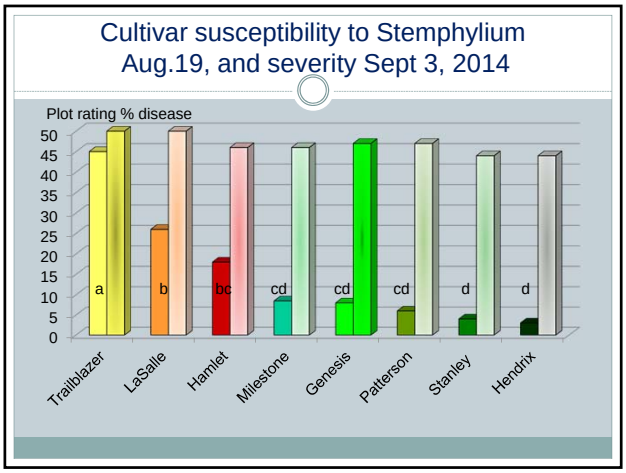
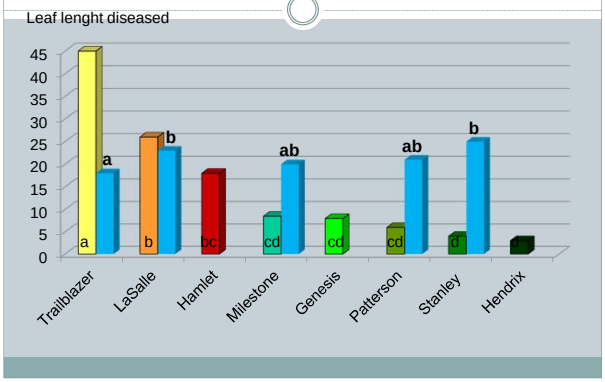


Part of Stemphylium cultivar trial - 2015

Cultivar susceptibility to Stemphylium Aug.19, and severity Sept 3, 2014



Cultivar susceptibility to Stemphylium Aug.19, 2014 and in growth room trials



Susceptibility to Stemphylium blight

- All cultivars were susceptible to Stemphylium
- Susceptibility to Stemphylium in the field may be partly related to maturity of the cultivars:
  - Some (but not all) early maturing cultivars rate as most susceptible.
- Some differences in susceptibility identified in controlled environment trials
- Not consistent with the field trials in some cases (Trailblazer, Stanley)

What is contributing to Stemphylium outbreaks?

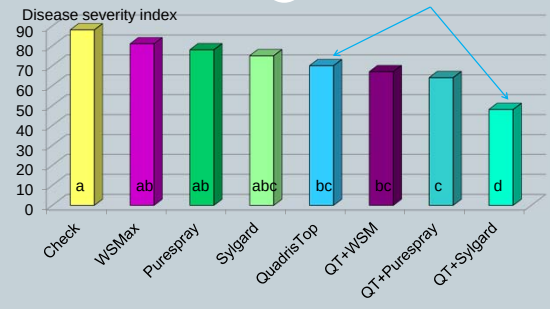
- Increased use of surfactants for thrips control and with fungicides?
- Higher temperatures?
- Physiological stress?
- More susceptible cultivars?

Stemphylium on onions 2014 Related to soil conditions or stress?

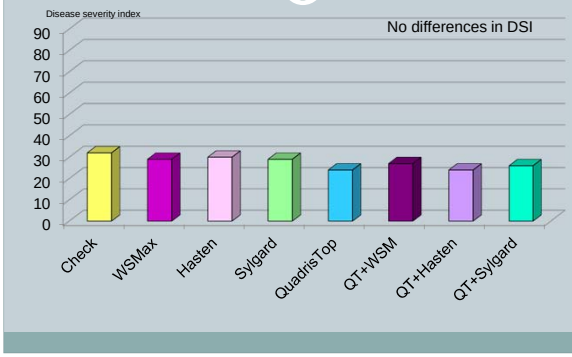
Surfactants/Spray Adjuvants

- SYLGARD 309 (siloxylated polyether 76%)
- PURESPRAY GREEN (99% mineral oil)
- WIDESPREAD MAX (polyether- polymethysiloxane-copolymer, polyether 100%)
- Alone and combined with QUADRIS TOP
- In 2014 Purespray Green was replaced with HASTEN (a blend of esterified vegetable oil and non-ionic surfactants)
  - 5 sprays, starting July 22 and applied every 7-10 days

Effects of surfactants and Quadris Top on Stemphylium severity, 2013



Effects of surfactants and Quadris Top on Stemphylium severity, 2014



Conclusions

- Fungicide application reduced disease severity in some years but efficacy is lower than desired
- Can we improve spray timing?
  - Stemphylium produces phytotoxins. It may be extremely important to prevent the first infections.
- Differences in cultivar susceptibility, but all are susceptible
- Surfactants did not increase susceptibility to Stemphylium

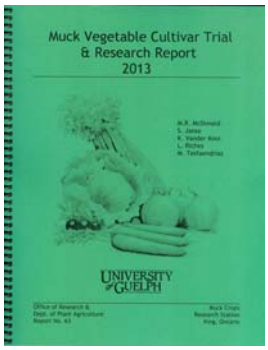
Future Research on Stemphylium

- Improved disease forecasting?
- Pathogen biology – overwintering and initial inoculum
  - Is infection associated with rainfall?
  - Are the first spores of the season infective?
  - Do spores on dead leaf tissue mature over the winter?
- Investigate the role of stress on susceptibility to Stemphylium?
- Differences in cultivar susceptibility
- Fungicide screening with surfactants
- Alternative hosts, especially weeds

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 243

Acknowledgements

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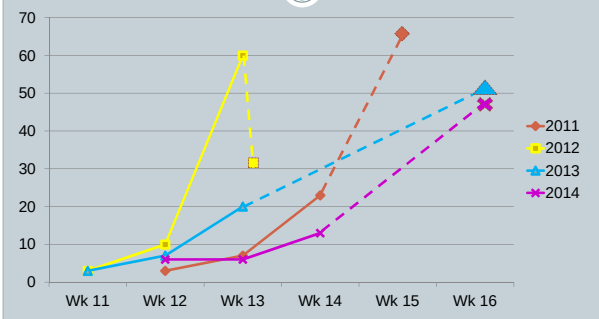
Weather Data 2011-2014

	Mean Temperature (C)					Rainfall (mm)			
Month	2011	2012	2013	2014		2011	2012	2013	2014
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

Management Recommendations

- Practices used to manage purple blotch generally reduce losses to Stemphylium leaf blight.
  - Fungicide sprays (different fungicides in rotation)
- Maintain healthy plant stands
  - Control other common foliar diseases such as downy mildew and botrytis leaf blight.
  - Avoid damage to plants.
- Long term rotation with unrelated crops may reduce losses.
- Good field drainage and reduced plant density (?).
- Bury infected plant debris and remove cull onions.

Stemphylium development over time
Untreated check, fungicide trial: 2011-2014



Onions in Ontario, Canada

- Yellow bulb onions, mostly
- 2,600 acres in Ontario
- Over half the crop placed in cold storage
- Onions dug and windrowed for 2 days – 3 weeks
- May be kept in the field for 2- 3 weeks (plastic covers on boxes)
- Artificial curing is very common

- **Many of the same insect and disease problems as other parts of the world, including onion maggot, seed corn maggot, thrips, downy mildew and white rot**

Muck Crops Research Station, Ontario, Canada
44º 5' N, 79º 35' W

Disease cycle

- The pathogen infects dead and dying onion tissues as a result of other diseases or insect, mechanical or physiological damage
- Healthy leaf tissue can also be infected
  - during warm weather when leaves remain wet for long periods
  - 10- 25 ºC and 8- 24 hours of leaf wetness, probably also higher temperatures
  - Infection increases with increasing leaf wetness duration
- The pathogen can overwinter in onion debris

Fungicides for control of Stemphylium on onion -2014