Onion Downy Mildew
Biology and Control

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Onion research in Ontario

- Over half of the onion production is located in the Holland/Bradford Marsh – on both muck (40 %+ organic matter) and mineral soils.
- There is about 9,500 acres of muck soil in the area, mostly carrots and onions
- Research is conducted at the Muck Crops Research Station

Holla

Muck Crops Research Station

Onion downy mildew

(Peronospora destructor)

caused by a water mold, not a true fungus

Attacks only onion and related crops, such as chives

Grows systemically in the plant

3 or 4 cycles can destroy a crop

Downy mildew of onion

Survives in onion bulbs in cull piles, on perennial onions, such as Egyptian onions and chives

- May survive as oospores in soil

Onion downy mildew: Sporulation

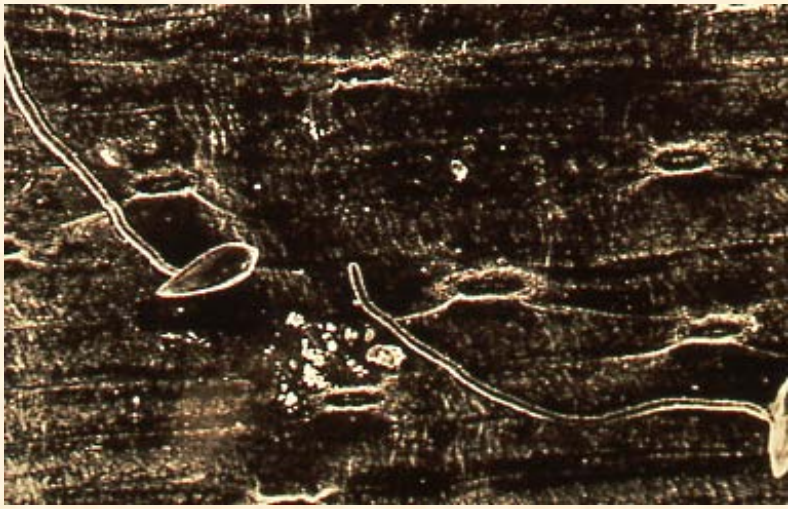
- **Temperatures below 75 ºF, (24 ºC) previous day**
- **Temp 38-75 ºF (4 – 24 ºC) at night**
- **Humidity above 95% at night**
- **No rain after 1:00 am**

Onion downy mildew: Sporulation

- Spores dispersed in the morning
- Spread in air and especially water
- Stay out of infected fields when leaves are wet

Onion downy mildew: Infection

- **Spores survive for 1-3 days after sporulation**
- **Infection occurs when there is water on the leaves**
- **Occurs in 3-6 hours, temp 38- 78 ºF (4- 26 C)**



Onion downy mildew

- **Infected onions are small, soft and don’t store well**
- **Can’t apply MH,(maleic hydrazide) so they sprout in storage**

Onion downy mildew

- **Takes 10 to 12 days from infection until sporulation**
- **NO symptoms until sporulation occurs**
- **3-4 cycles can completely destroy a crop**

Managing Downy Mildew

- Crop rotation and sanitation may help
- Identification is important: the spores are easy to identify under the microscope

Onion downy mildew

is very destructive during cool, humid weather.

Effective controls are needed:

Fungicides

Resistance

Fungicides registered for onion downy mildew

- Dithane DG, Manzate, Penncozeb (mancozeb)
- Ridomil Gold MZ

  (metalaxyl-m + mancozeb)
- Aliette (fosetyl-Al)
- Cabrio (pyraclostrobin)

Fungicides registered for downy mildew on onions- continued

- **Quadris (azoxystrobin)**
- **Pristine (pyraclostorbin+boscalid)**
- **Acrobat (dimethomorph)**
- **Serenade (Bacillus subtilis)**
- **Kumulus (sulphur)**
- **NuCop and other coppers (copper)**
- Not registered: new material, Presidio, controls downy mildew on cucumbers
-

Fungicides registered for other diseases of onion

- **Bravo (chlorothalonil)**
- **Rovral (iprodione)**
- **Endura (boscalid)**

Botrytis leaf blight

None of these materials will provide control of downy mildew

Downy mildew of onion

- **TIMING IS EVERYTHING**
- **Fungicides need to be applied at the correct time**
- **Disease Forecasting as part of IPM is useful**
- **IF the weather is hot and dry, downy mildew won't be a problem**

Fungicides for control of onion downy mildew

- Trials in 2009
- Onion cv. Pulsar
- Fungicide sprays began based on disease forecasting

- Five sprays
- TeeJet D-2 hollow cone nozzles at 690 kPa (boom) in 500 L/ha of water (50 gal/acre).

Fungicides for downy mildew of onion

Treatment	Rate/ha	Lesions per leaf	
		14 August	26 August
RIDOMIL	2.5 kg	0.0 a[2]	0.2 a
PRESIDIO + DITHANE	292 ml + 3.25 kg	0.2 a	0.3 a
DITHANE	3.25 kg	0.1 a	0.3 ab
RANMAN	200 ml	0.8 abc	0.4 ab
REVUS + non-ionic adjuvant	600 ml + 0.125% v/v	0.4 ab	0.4 ab
RIDOMIL alternated with ALIETTE	2.5 kg or 2.8 kg	0.6 abc	0.5 ab
Check	--	2.0 de	0.7 abc
REASON	400 ml	1.2 bcd	1.0 bc
CABRIO	840 g	1.5 cd	1.2 cd
PRESIDIO	292 ml	1.7 d	1.2 cd
PRESIDIO	146 ml	0.7 abc	1.3 cd
ALIETTE	2.8 kg	2.6 e	1.9 d

Fungicides for downy mildew control on onions 2009

Treatment	Rate/ha	Green Leaves/plant	MarketableYield (t/ha)
RIDOMIL	2.5 kg	5.8 a	49.7 abc
PRESIDIO + DITHANE	292 ml + 3.25 kg	5.6 ab	53.7 a
DITHANE	3.25 kg	5.8 a	53.3 a
RANMAN	200 ml	5.4 abc	51.1 ab
REVUS + non-ionic adjuvant	600 ml + 0.125% v/v	5.3 abc	42.5 c
RIDOMIL alternated with ALIETTE	2.5 kg or 2.8 kg	5.8 a	52.0 ab
Check	--	5.4 abc	44.8 bc
REASON	400 ml	5.0 bc	54.0 a
CABRIO	840 g	5.5 ab	52.8 a
PRESIDIO	292 ml	4.9 c	47.7 abc
PRESIDIO	146 ml	5.2 bc	48.0 abc
ALIETTE	2.8 kg	5.0 bc	46.7 abc

Managing Downy Mildew

The standards, Ridomil MZ and Dithane are still very effective.

Newer materials Revus and Ranman were also effective.

Resistance management is important.

Alliette and Presidio were not effective alone, but worked well in rotation (Aliette) or combination (Presidio)

Timing of the first spray is critical!

Managing Downy Mildew

When yield is considered, onions sprayed with Reason and Cabrio had higher yields than the untreated check

Yield of onions sprayed with Revus were not higher than the check

Onion downy mildew

Resistance

in bulb and green bunching onions?

Bejo has introduced 2 new resistant bulb onions ‘Yankee’ and BGS 255

Downy mildew resistance in bulb onions

Variety	Lesions/plant Aug 5 2008	% diseased lvs at lodging 2008
Yankee	**0.03 n.s**	**0 a**
Stanley	3.2	94.1 c
Fortress	2.7	89.2 bc
Hamlet	2.6	87.6 bc
Tahoe	2.6	87.1 bc
Ricochet	3.1	89.2 bc
Mars	1.8	83.1 b
Nebula	1.9	84.3 b

Screening for resistance to onion downy mildew- 2009

Cultivar	DM Lesions/plant		2 September (Harvest)		
	4 August	14 August	DM Lesions/ plant	Green Leaves/ plant	Lesions/ Leaf
BGS 255	0.1a[1]	0.0 a	0.0 a	6.6 ab	0.0 a
Yankee	0.1 a	0.1 ab	0.1 a	5.9 bc	0.0 a
Mars	0.2 a	2.9 bc	0.4 ab	6.7 a	0.1 ab
Hamlet	0.5 b	3.1 c	0.8 bc	5.3 c	0.2 b
Stanley	0.3 ab	3.2 c	0.9 c	5.4 c	0.2 b
Ricochet	0.3 ab	3.2 c	1.0 c	6.0 abc	0.2 b

Yield of onions in downy mildew resistance trial-2009

Cultivar	Marketable Yield		Yield (%)		
	t/ha	bu/A	Small (< 44 mm)	Medium (44 - 76 mm)	Large (> 76 mm)
Ricochet	**59.2 a[1]**	**959.5 a**	5.6 a	87.2 ns[2]	7.3 bc
Hamlet	**44.6 ab**	**721.7 ab**	24.0 d	75.0	1.1 c
Stanley	**43.6 ab**	**705.5 ab**	19.2 bcd	78.9	1.9 c
BGS 255	**34.8 bc**	**564.2 bc**	11.3 abc	73.3	15.4 ab
Mars	**30.0 bc**	**486.4 bc**	7.7 ab	76.7	15.6 a
Yankee	**21.4 c**	**347.1 c**	20.6 cd	79.4	0.0 c

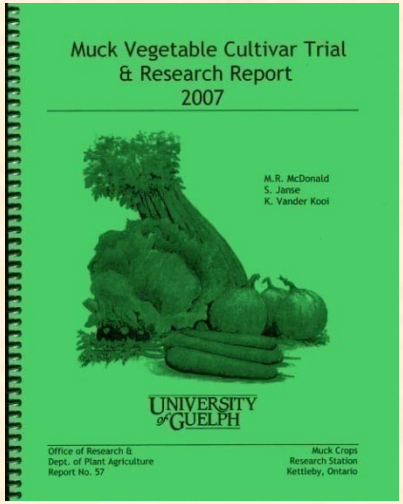
Yield of downy mildew resistant 'Yankee' in comparison to other onions in the MCRS cultivar trial, 2007

Variety	Yield (bu/a)	% Mkbl
Yankee	**1327 f-k**	**97.6 abc**
Ricochet	1596 abc	99.1 ab
Braddock	1471 b-f	96.9 a-e
Fortress	1317 f-l	98.7 abc
Hamlet	1464 b-f	99.0 ab

Onion Yankee

formerly BGS 236

Quality score in 2007 trials was 3.7 out of 5 = good



Downy mildew on green bunching onions: 2007

Percent leaves with lesions

Variety	26 Sept	6 Oct	Height (in)
Performer	20 a	48 ab	18 cd
Parade	24 ab	58 b	20 b
Emerald Is	28 ab	54 b	20 b
Tokyo LW	28 abc	58 b	19 bc
SP W G	37 bc	30 a	15 de
Gr Banner	41c	54b	29 a

SP W G = Southport white globe

Resistance to onion downy mildew

Both Yankee and BGS 255 were highly resistant to onion downy mildew in the Bradford area

The quality of these onions was good, but yield was low, because they are not adapted to Ontario conditions
They need a longer growing season
Resistance looks very promising!!

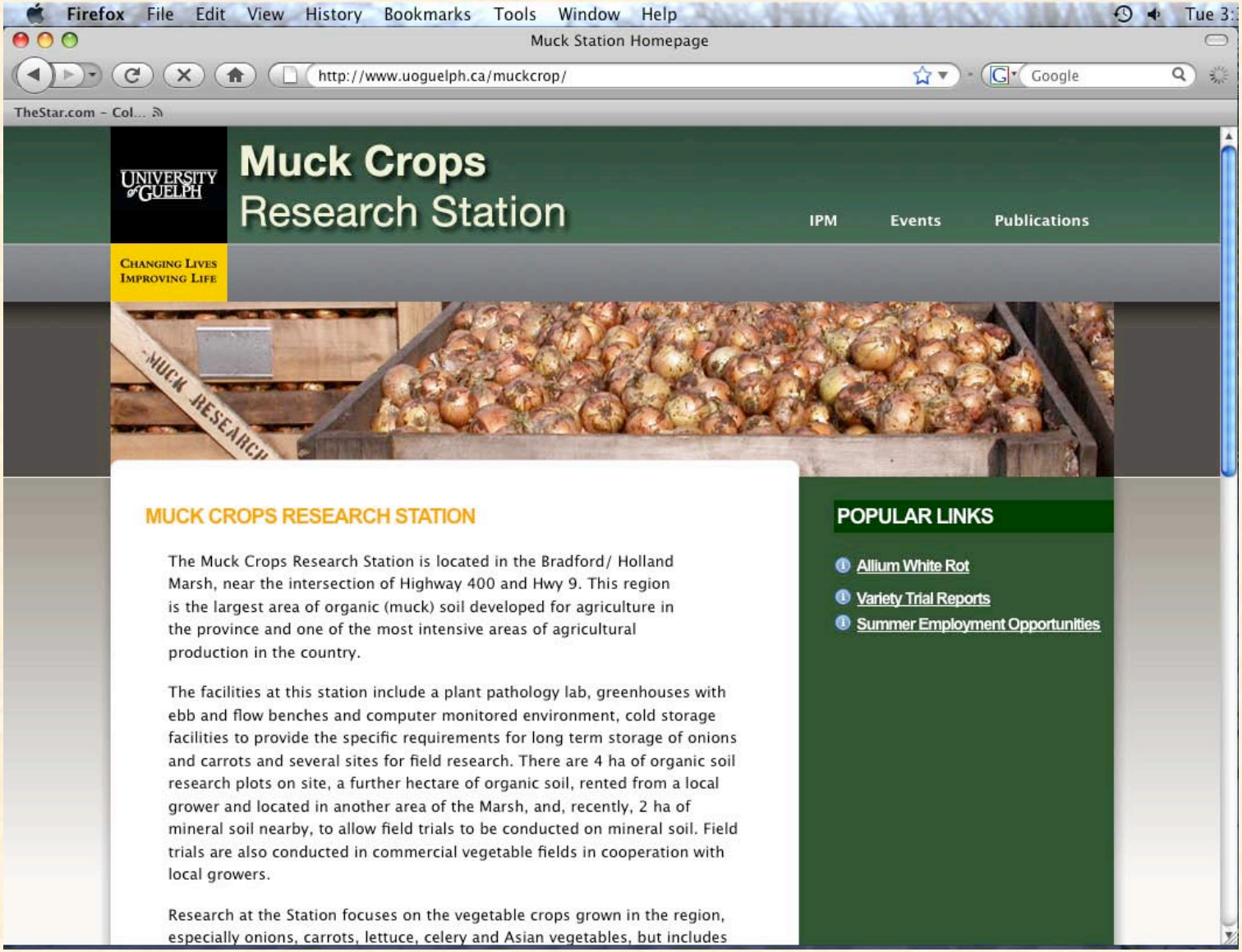
Forecasting Downy Mildew

- Downcast - developed in Ontario at the U of Guelph. Indicates when conditions are right for sporulation and infection: Time to Spray!
- Other research in New York State, the Netherlands, other regions of Europe, Australia and New Zealand
- Newest program: MILIONCAST- developed in the U.K., not as effective in the U.S.

Conclusions: downy mildew of onion

- **TIMING IS EVERYTHING**

- **The forecasting program can't give much warning, warns when to spray and records how many days have been favorable for downy mildew**



New web site **www.uoguelph.ca/muckcrop**

Check for the Agriphone, research reports, publications

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Questions?