

Is DOWNCAST an effective model for predicting onion downy mildew in Ontario, Canada?

Introduction

Onion downy mildew, caused by the Oomycete *Peronospora destructor*, is a highly destructive foliar disease of onion, but does not occur every year in the Holland Marsh, Ontario, Canada. Symptoms develop 10 – 14 days after infection and fungicides must be applied prior to infection to be effective. Disease forecasting is used to indicate when no fungicides are needed and to properly time protective fungicide applications when there is disease risk. The integrated pest management program uses DOWNCAST to predict the risk of sporulation and infection based on temperature, relative humidity, leaf wetness duration and temperature in the days after infection. When all weather parameters are conducive for downy mildew DOWNCAST triggers a sporulation infection period (SIP) or high risk. Fungicide sprays are also recommended if downy mildew is found in the region. Spore trapping was added to detect sporangia of *P. destructor* in the air. Rotorod spore traps are assessed three times a week.

Weather Data and Spore Trapping



Fig 1. Portable weather station by a seeded onion field.

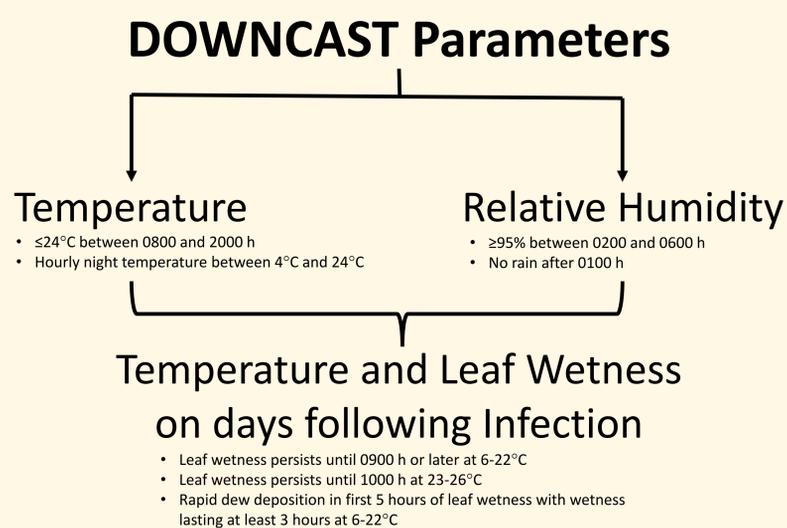


Fig 2. Rotorod spore trap in an onion plot.

Summary

Table 1. DOWNCAST SIPs, sporangia of *P. destructor* and downy mildew (DM) occurrences over the past 10 years.

Year	DOWNCAST SIP	Sporangia Identified	DM Identified in Fields
2012	x	n/a	x
2013	✓	n/a	✓
2014	✓	✓	✓
2015	✓	✓	✓
2016	✓	x	x
2017	✓	n/a	✓
2018	✓	n/a	✓
2019	x	n/a	x
2020	✓	✓	x
2021	✓	✓	✓

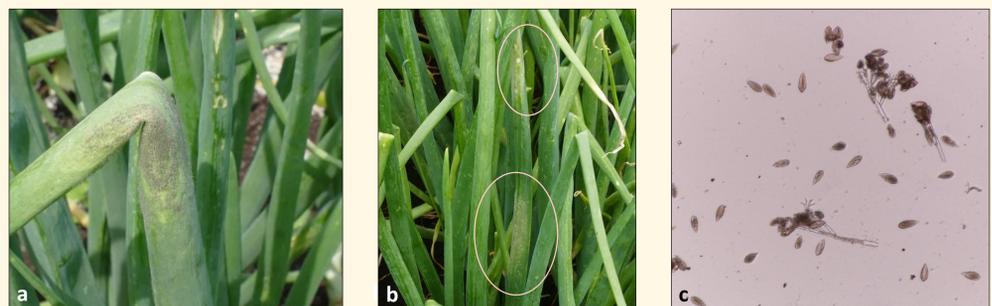


Fig 3. Onion downy mildew lesions (a, b) and sporangia (c) identified on onion leaves in 2021.

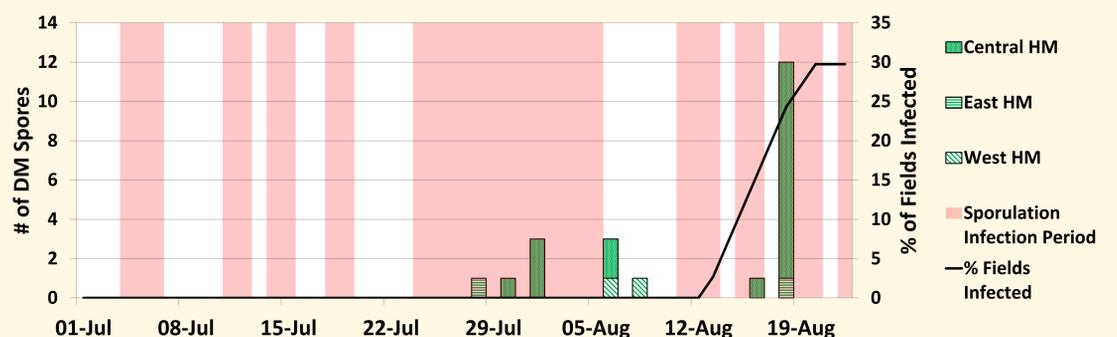


Fig 4. Onion downy mildew sporangia counts in regions on the Holland marsh (HM) and disease development in fields related to DOWNCAST SIPs in 2014.

Table 2. Identification of *P. destructor* on a rotorod ~14 days after first DOWNCAST SIPs of July, 2021.

DOWNCAST SIP	July																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Rotorod # of Sporangia Identified	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1			

Conclusions

From 2012 to 2021, the forecasting program was accurate in eight of the 10 years, including two years where there was no disease risk, and no disease was found. Most years downy mildew developed 14 – 17 days after sporangia were found. While mostly effective, DOWNCAST can be improved with trapping of sporangia.