Hop Research Summary & Updates for 2015

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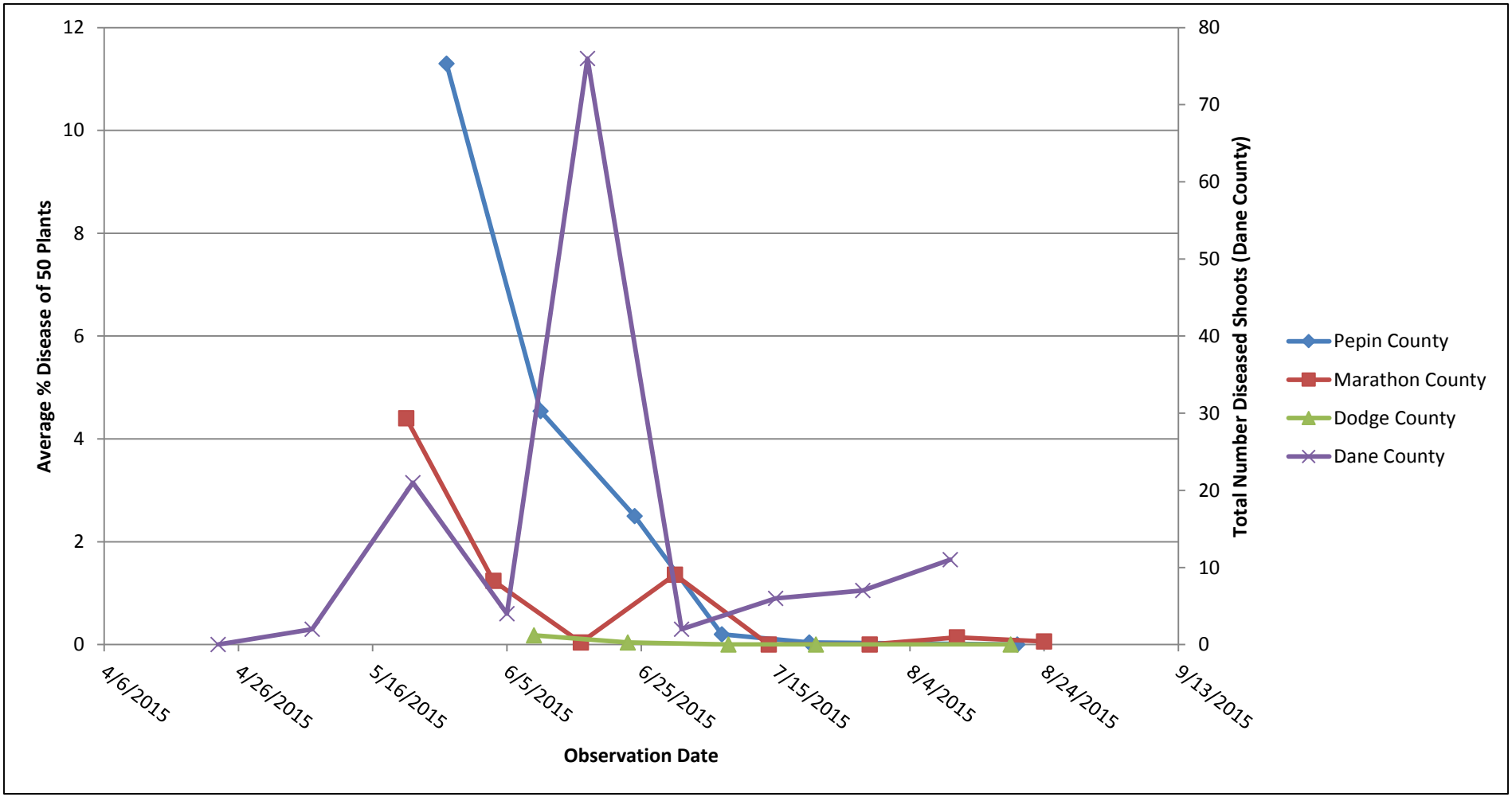
Michelle Marks, Graduate Research Assistant
Amanda Gevens, Associate Professor
Plant Pathology
University of Wisconsin-Madison

What was out there in 2015?

County	March	April	May	June	July	August
Dodge	First buds (30th)	Downy (21st)	Downy	Downy		
Dane		First buds (1st)	Downy (7th)	Downy	Downy	Downy
Pepin		First buds (1st)	Downy (27th)	Downy	Carlavirus Downy	
Marathon		First buds (3rd)	Downy (21st)	Leafhoppers Downy	Leafhoppers (early) **European corn borer** Spider mites	**Cabbage loopers (cones)** Downy

Summer 2015 Disease Progression



*Some late season (late August) infection on young plants not reflected here

Overall trends

- Earlier detection of Downy mildew than last year
- Fairly heavy disease pressure early
- Peak disease from late May to mid-June
- Active sporulation significantly reduced in most locations from late June onward
- Active sporulation found as late as August 27 in young planting
- Scouting for first downy mildew detection and season-long disease progression will continue into 2016 season

Propagation Trials – how'd they look?

Propagation Trials

Albers – August 20

Propagation Trials - Summary

- Planted early May – Davali
- Planted mid/late May? – Albers
- Needed TLC at first
  - Hand watering
- Davali: all reached top wire, cone production, downy mildew in early July through end of season
- Albers: none reached top wire, many did not reach trainable height, few cones
- Virus tests all came back negative

Downy mildew oospores: here in Wisconsin!

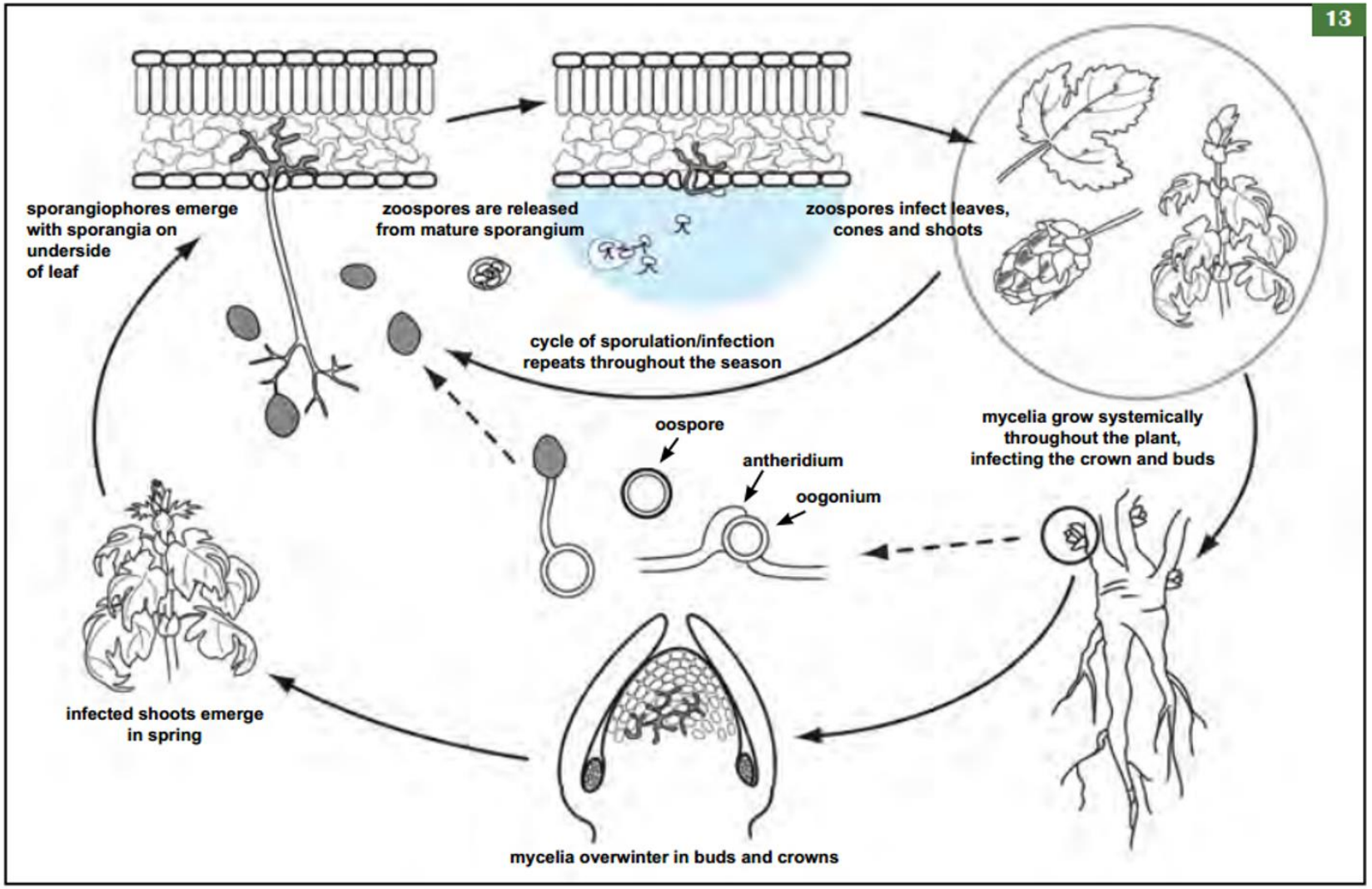
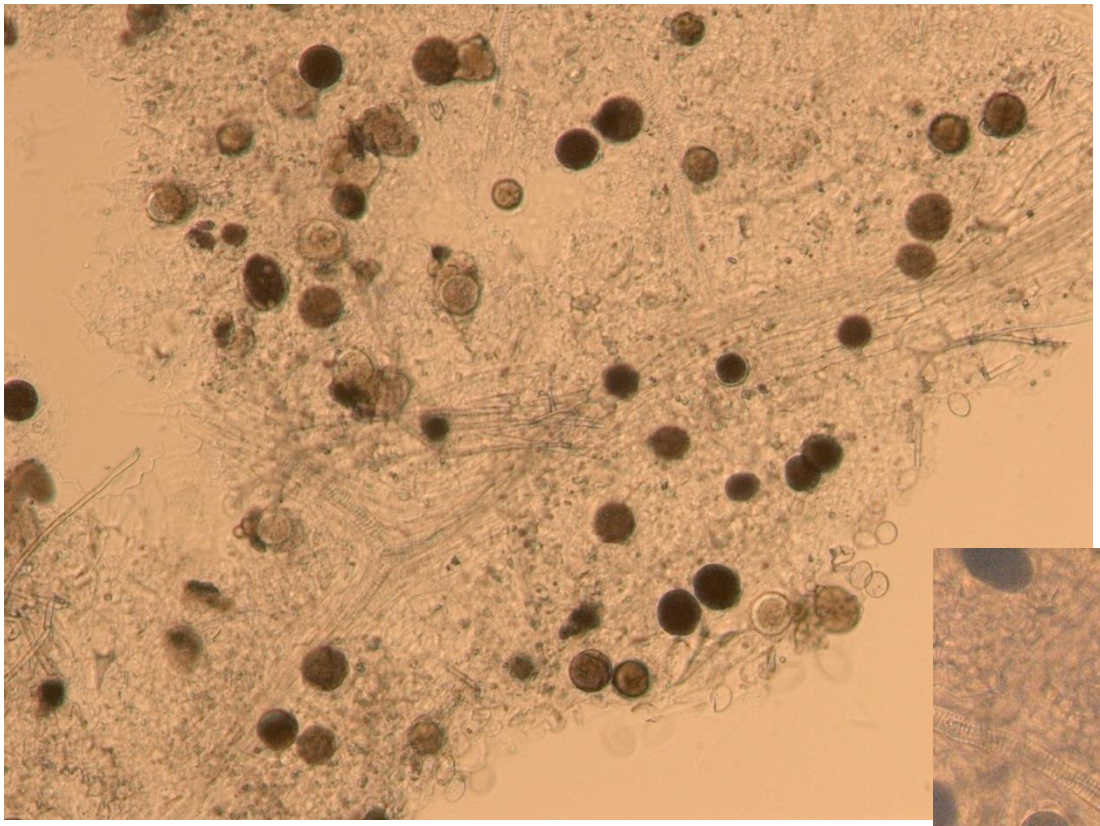
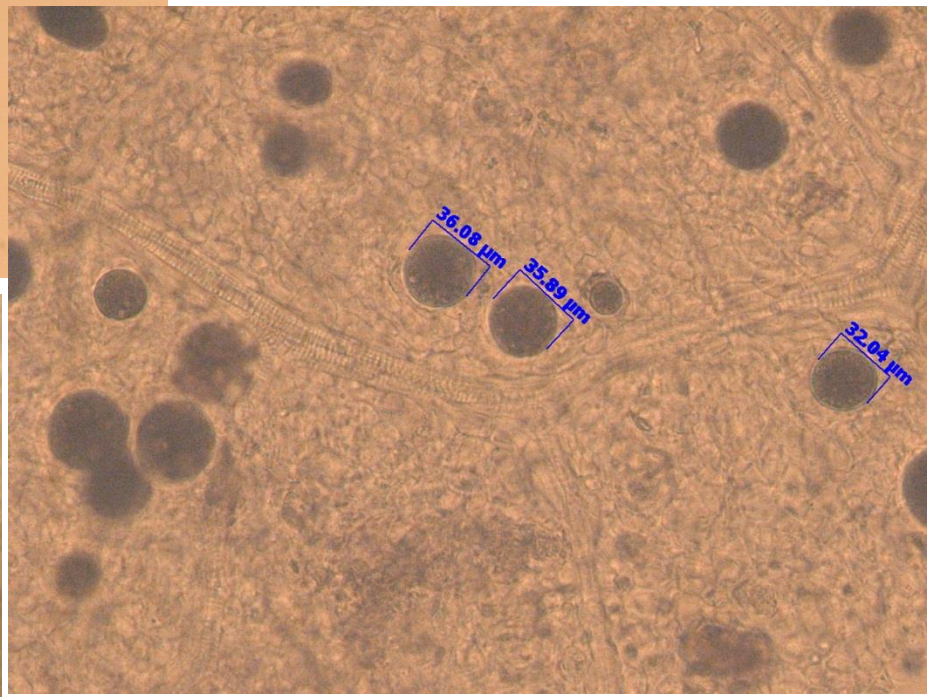


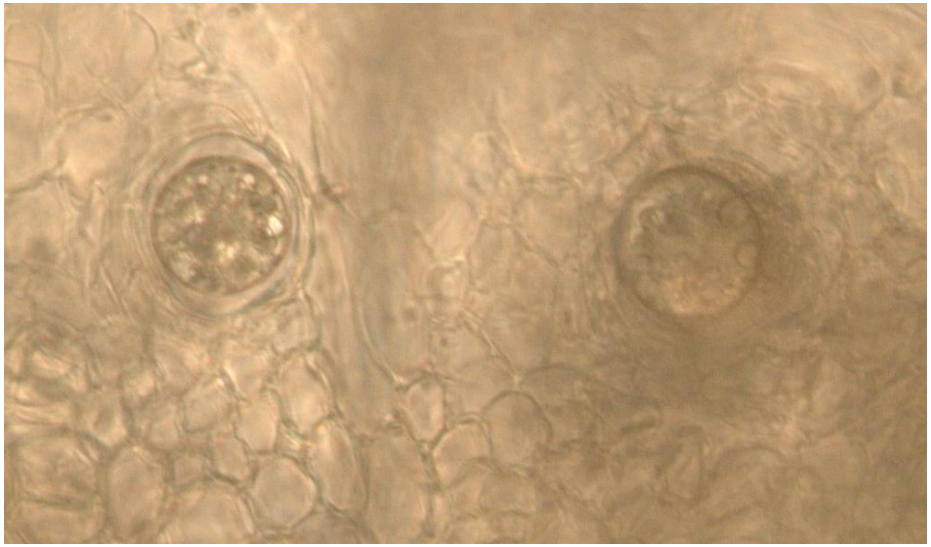
Photo credit: V. Brewster, Compendium of Hop Diseases and Pests.

Oospore Scouting Protocol

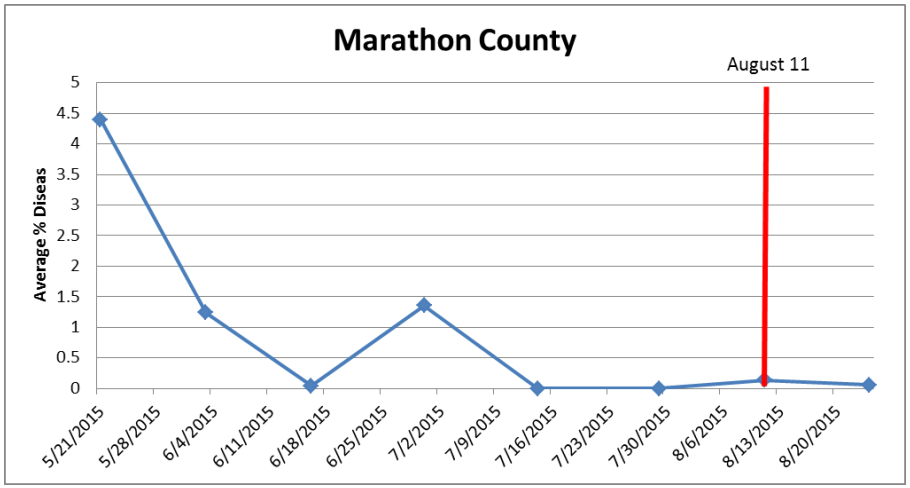
- Collect leaf tissue showing visible infection
  - Collection protocol to be refined for next season
- Cut small leaf disc from infected area
- Clear leaves by boiling in ethanol, short bleach soak
- View under microscope
- Soil detection?
  - In progress

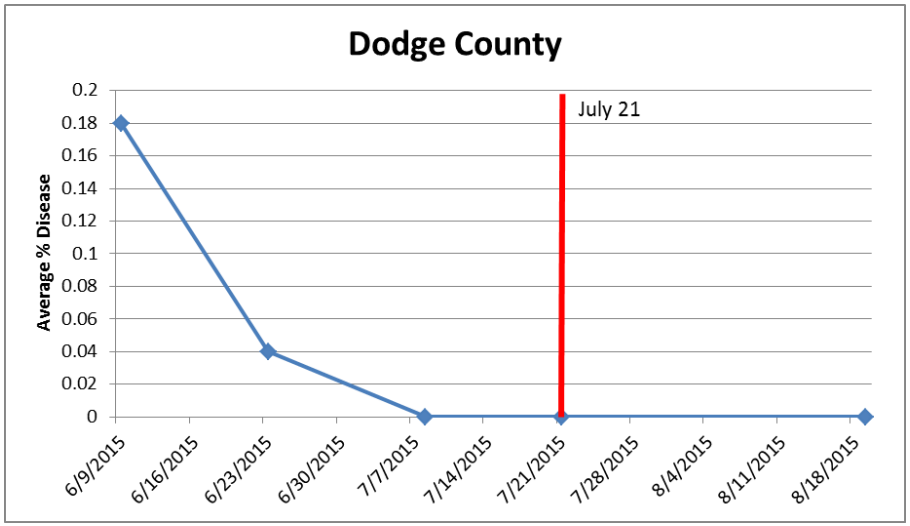


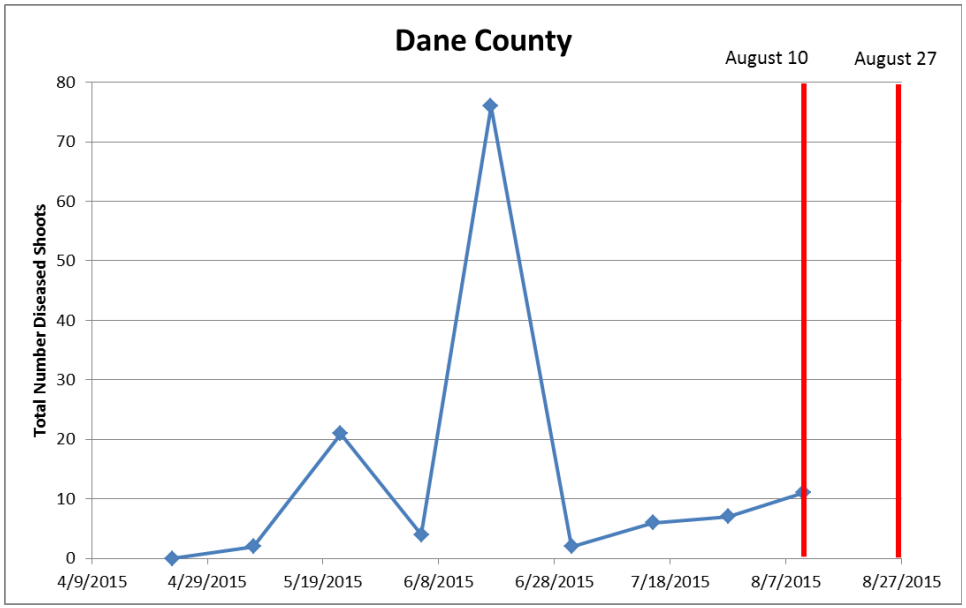

36.08 µm
35.89 µm
32.04 µm



Oospore Detections







What does this mean?

- Pathogen is persisting season long
  - Soil?
  - Leaf debris?
- Source of primary infection in spring?
  - Little evidence in the literature for this
- Sexual reproduction?
  - May not be necessary to produce oospores

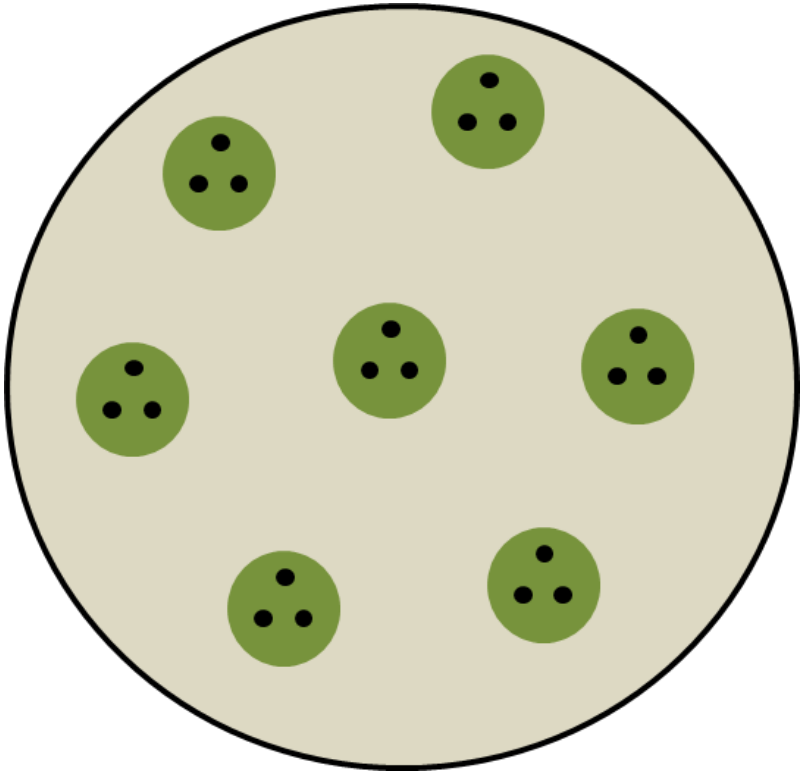
Phenylamide (Ridomil) Sensitivity Assay

Methods

- Sporulating shoots were collected from the field
- Sporangia removed & collected in tubes by shaking infected leaves in sterile water
- Plates made with water agar and water agar amended with Ridomil Gold SL at 25 µg/ml
- Leaf discs cut from ‘Nugget’ variety plants maintained in greenhouse

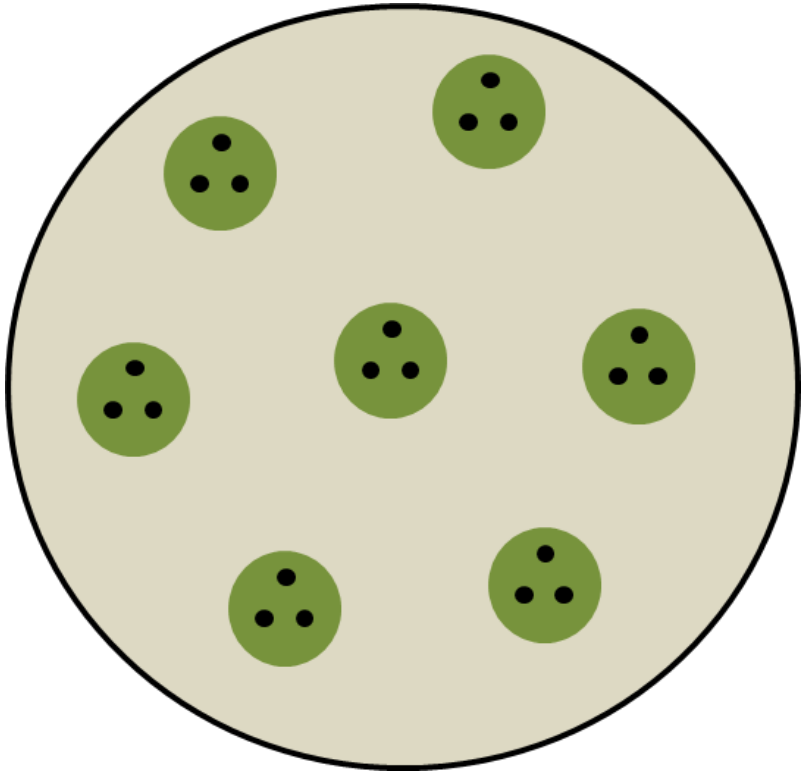
Control Plates (water agar)

x2



Treatment Plates (fungicide amended)

x2



- 7 leaf discs on each plate with 3 inoculation sites (10 µl inoculum each)
- 2 plates per each treatment
- 42 total “replication sites”
- Need at least 50% (21) of sites sporulating for viable isolate comparison (simple yes/no)

	Isolate	Sporulating Sites (control)	Percent (control)	Sporulating Sites (treatment)	Percent (treatment)
1	Ph33	32/42	**76**	0/42	**0**
2	Ph35	23/42	**54**	0/42	**0**
3	Ph36	29/42	**69**	0/42	**0**
4	Ph37	32/42	**76**	0/42	**0**
5	Ph38	13/42	**30**	0/42	**0**
6	Ph39	36/42	**86**	0/42	**0**
7	Ph40	28/42	**66**	0/42	**0**
8	Ph41	42/42	**100**	0/42	**0**
9	Ph42	34/42	**80**	0/42	**0**
10	Ph44	1/42	**2**	0/42	**0**
11	Ph45	0/42	**0**	0/42	**0**
12	Ph47	17/42	**40**	0/42	**0**
13	Ph48	11/42	**26**	0/42	**0**
14	Ph49	0/42	**0**	0/42	**0**
15	Ph51	6/42	**14**	0/42	**0**
16	Ph52	9/42	**21**	0/42	**0**
17	Ph54	0/42	**0**	0/42	**0**
18	Ph55	0/42	**0**	0/42	**0**
19	Ph56	32/42	**76**	0/42	**0**

Conclusions from phenylamide (Ridomil) assay

- Limitation: data from one location at one time point
- Extensive sampling & testing planned for next season
- No sporulation was seen on leaf discs on plates amended with fungicide
- Indicated that the population sampled are still sensitive to mefenoxam
- Opportunity to test other active ingredients
  - Aliette, others?