A 2016 Hop Disease Status and Research Update

Hop Production for the Wisconsin Craft Brew Industry
7th Annual Seminar

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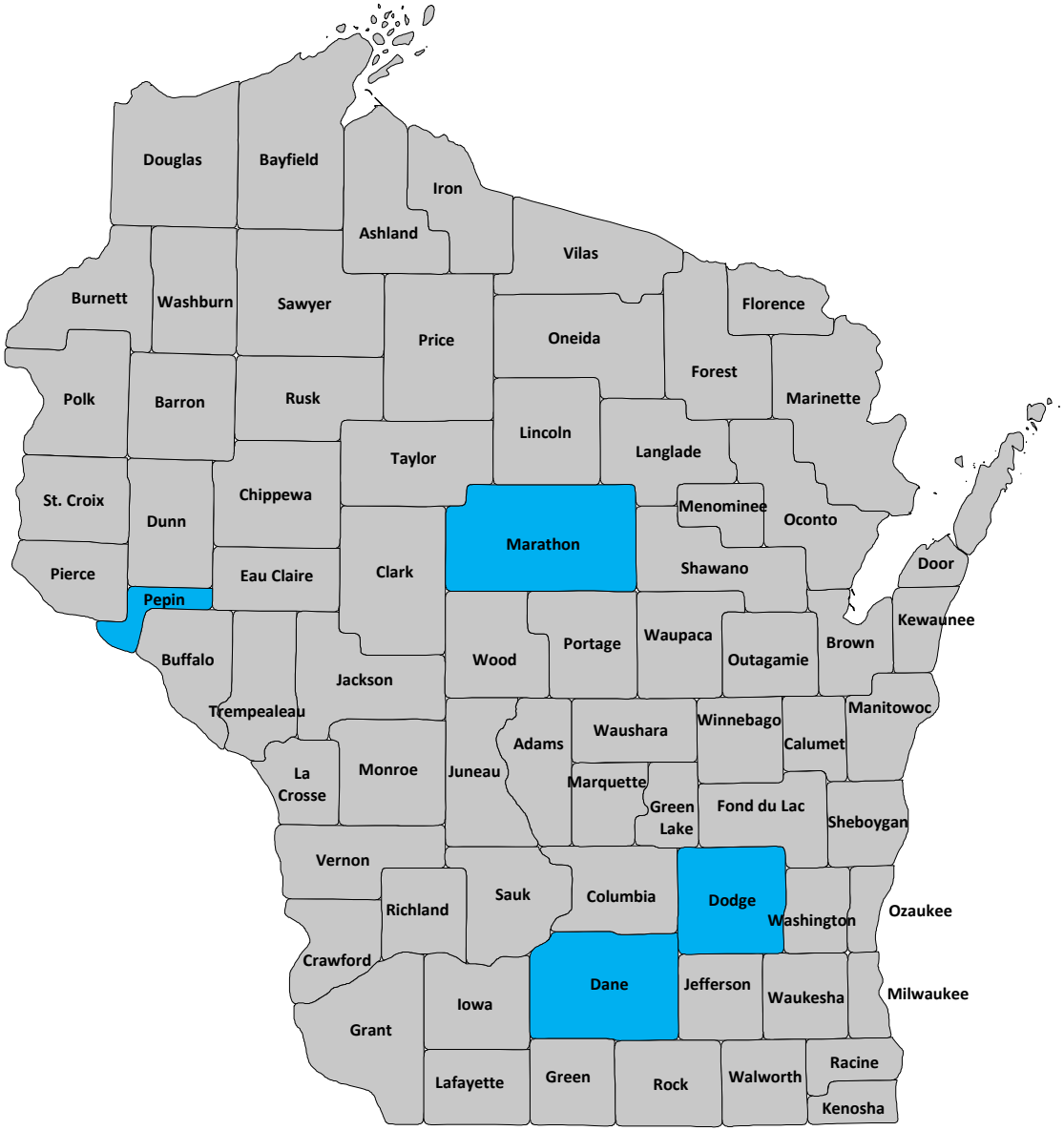
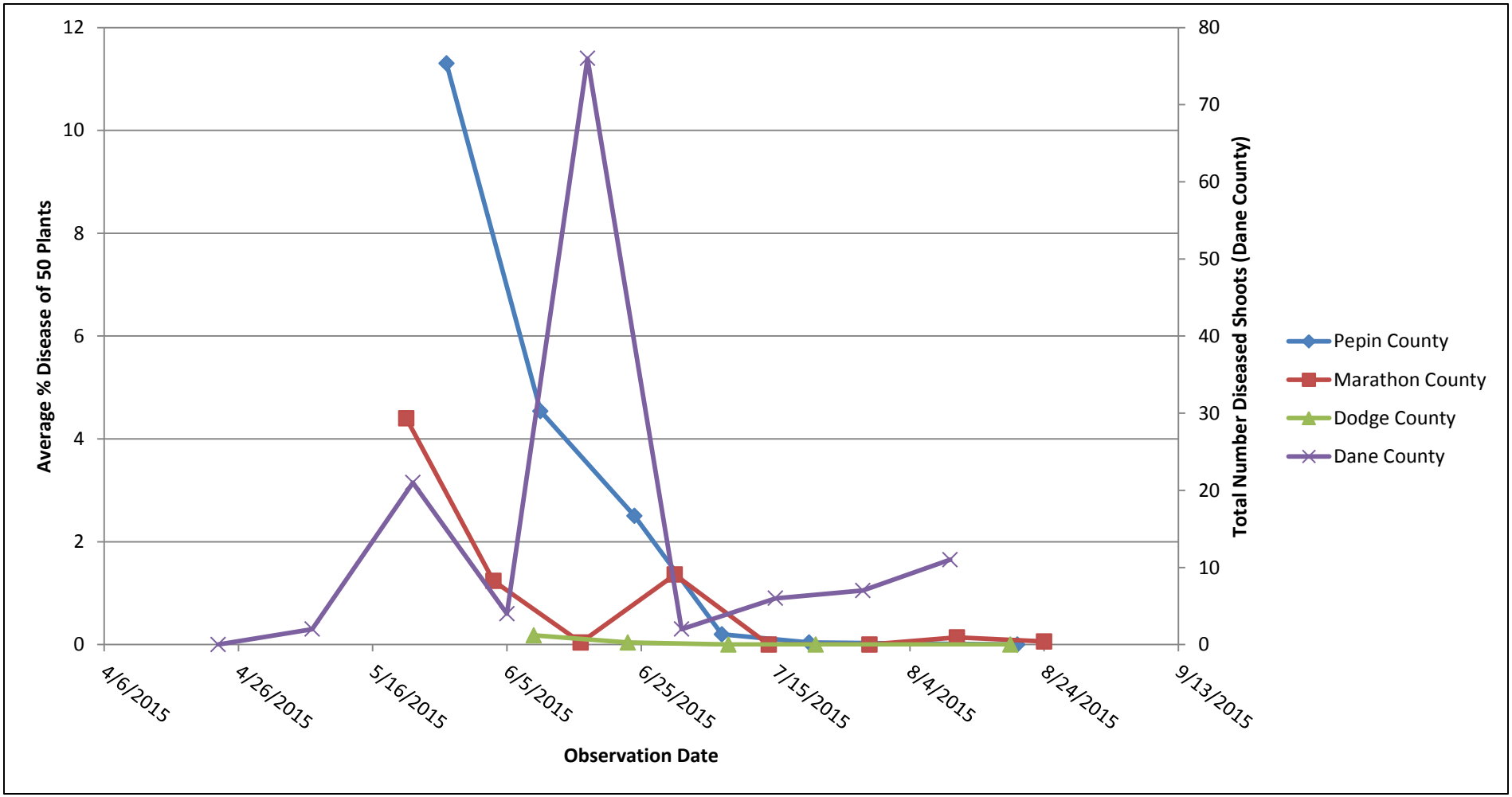
Grower Collaborator Locations



What was out there in 2015?

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

Summer 2015 Downy Mildew 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

Clean Plant Propagation Field Trials

- Plants generated from tissue culture → grow in greenhouse → move to field
- Several varieties tested including Willamette, Galena, Cascade, Fuggle
- Test performance in field
  - Survival
  - Growth rate
  - General health and disease status

How'd they look?

Pepin County – August 20

Propagation Trials - Summary

- Planted early May – Dane County
- Planted mid/late May – Pepin County
- Needed TLC at first
  - Hand watering
- Dane County: all reached top wire, cone production, downy mildew (especially on Galena) in early July through end of season
- Pepin County: none reached top wire, many did not reach trainable height, few cones
  - Cool weather and planting date a factor?
- Virus tests all came back negative

Downy mildew oospores: here in Wisconsin!

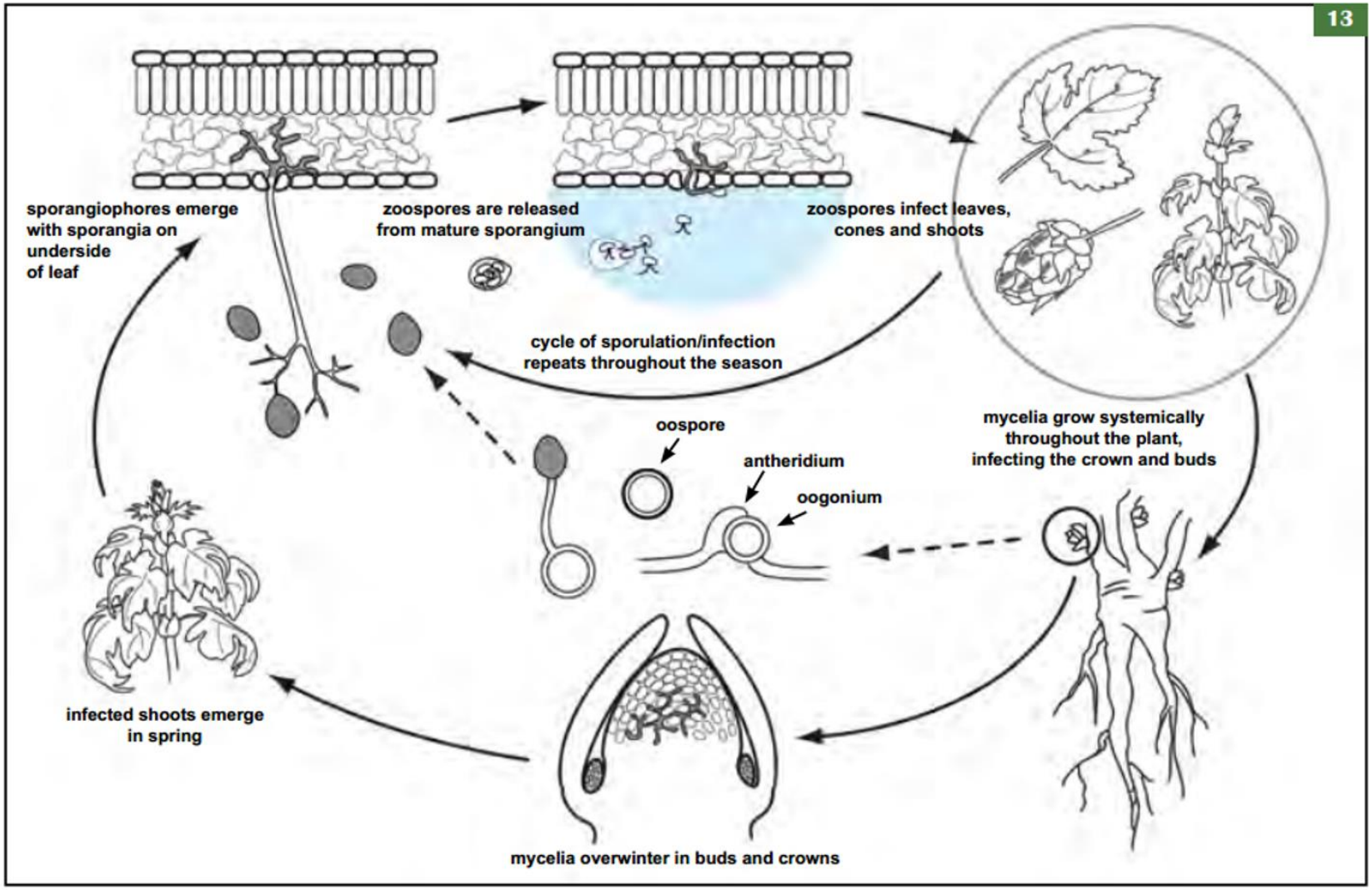
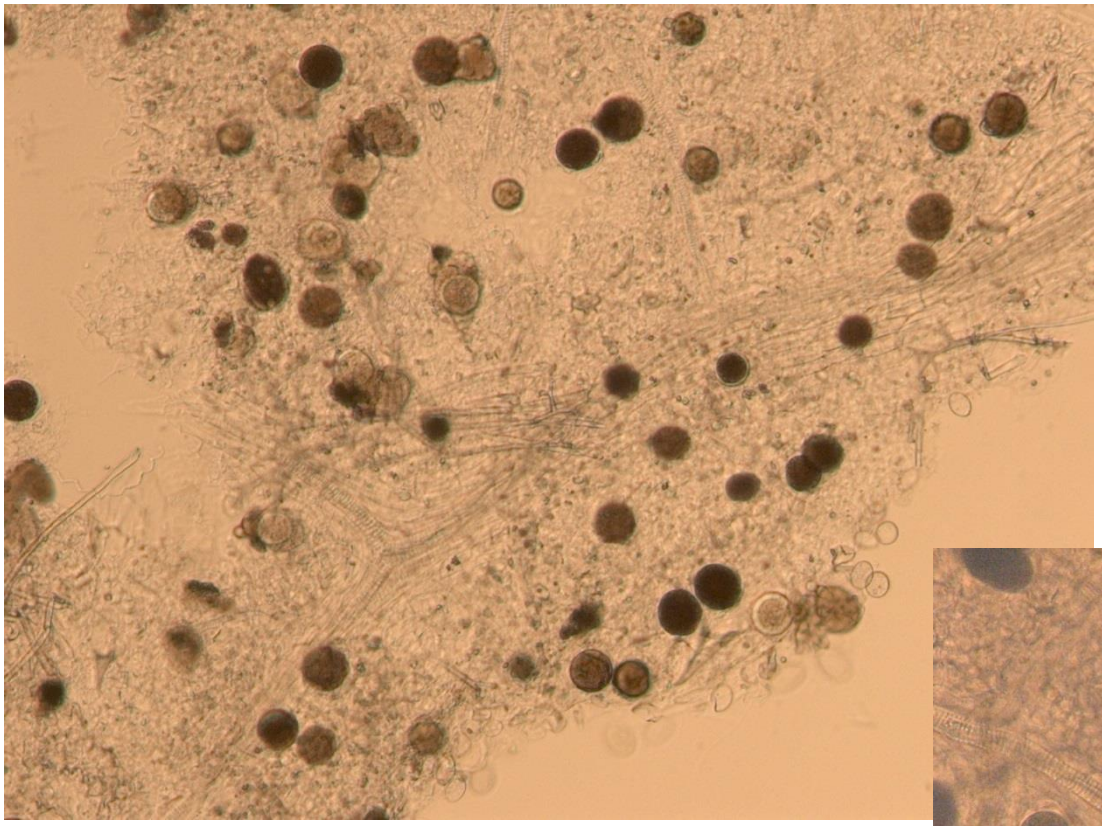
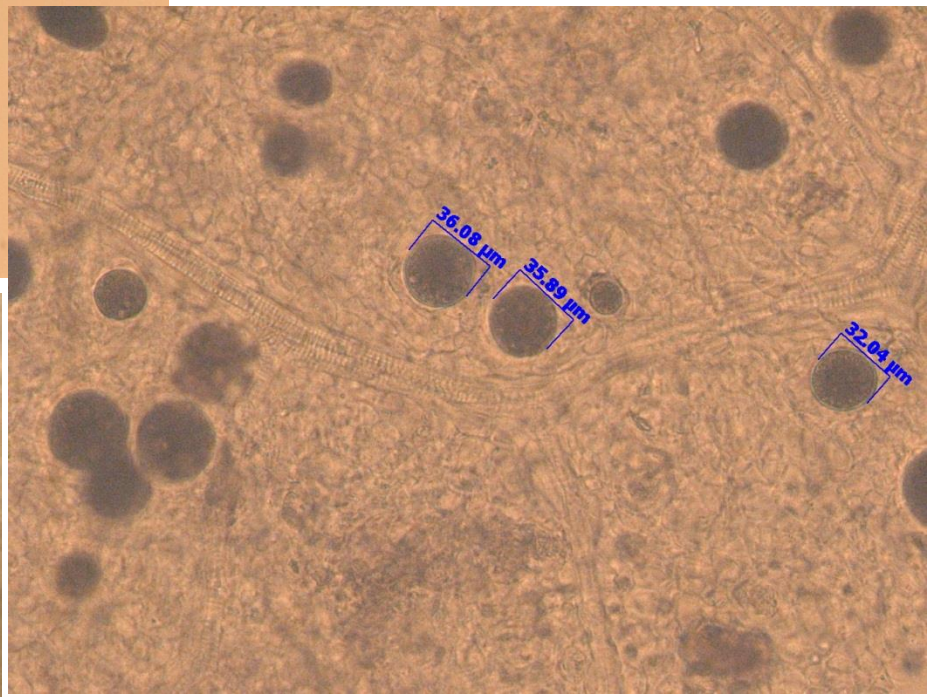


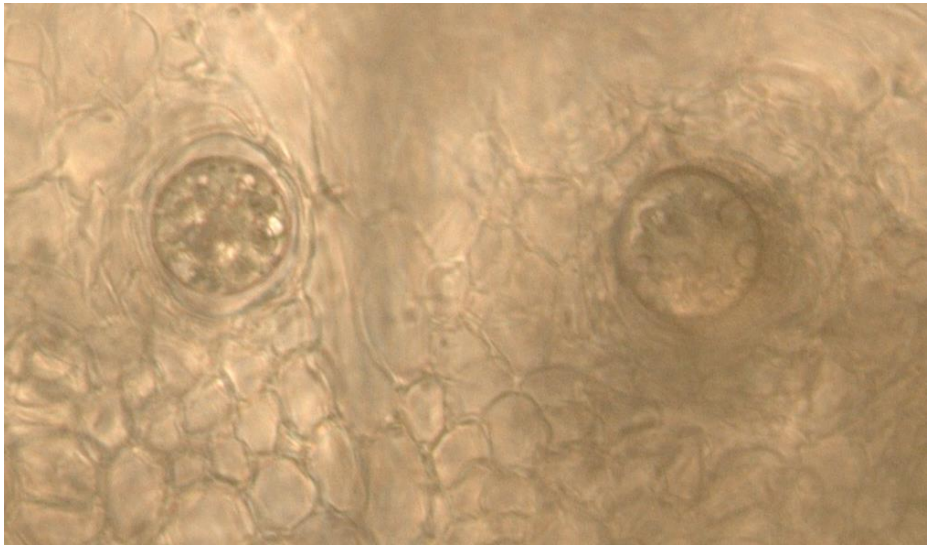
Photo credit: V. Brewster, Compendium of Hop Diseases and Pests.

Oospore Scouting Protocol

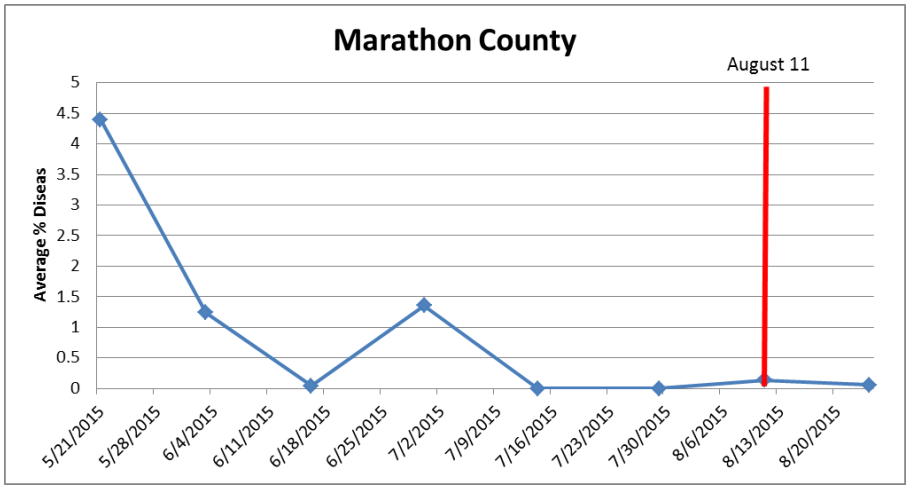
- Collect leaf tissue showing visible infection
  - Collection protocol to be refined for next season
- Cut small leaf disc from infected area
- Clear leaves by boiling in ethanol, short bleach soak
- View under microscope
- Soil detection?
  - In progress

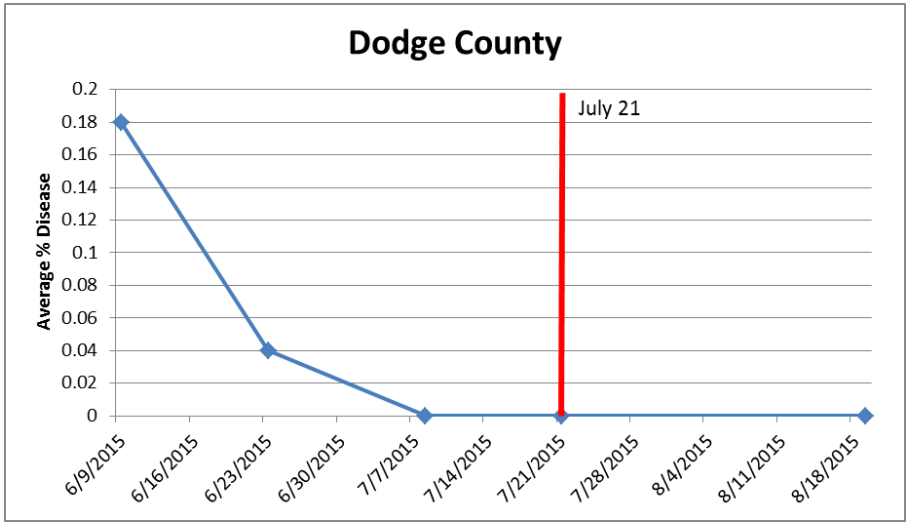


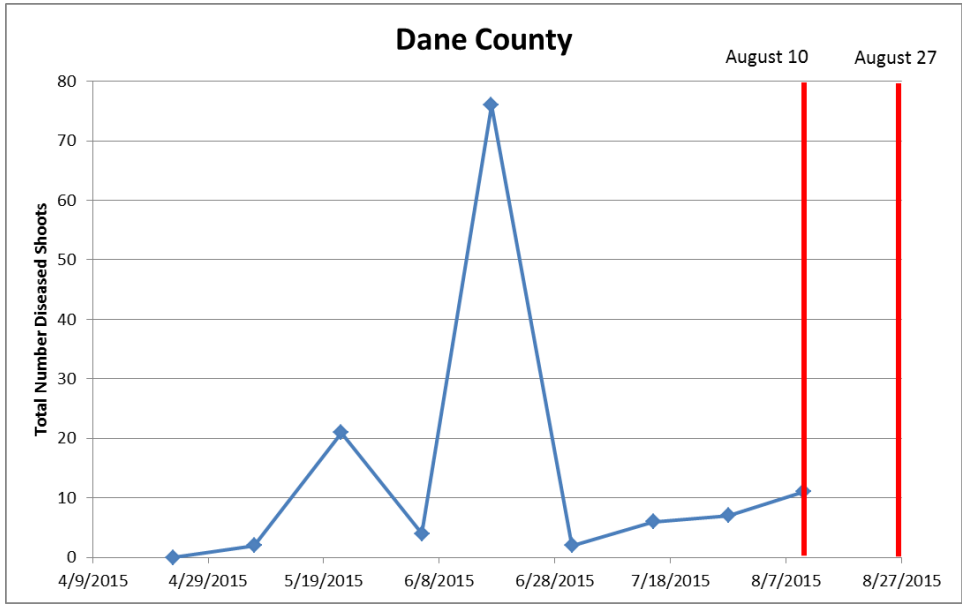

36.08 µm
35.89 µm
32.04 µm



Oospore Detections







What does this mean?

- Pathogen is persisting season long
  - Soil?
  - Leaf debris?
- Source of primary infection in spring?
  - Mixed evidence in the literature for this
- Sexual reproduction?
  - New genotypes = diversity!
  - Opportunity for differing virulence, fungicide resistance, etc.

Phenylamide (Ridomil) Sensitivity Assay

Why test for (in)sensitivity?

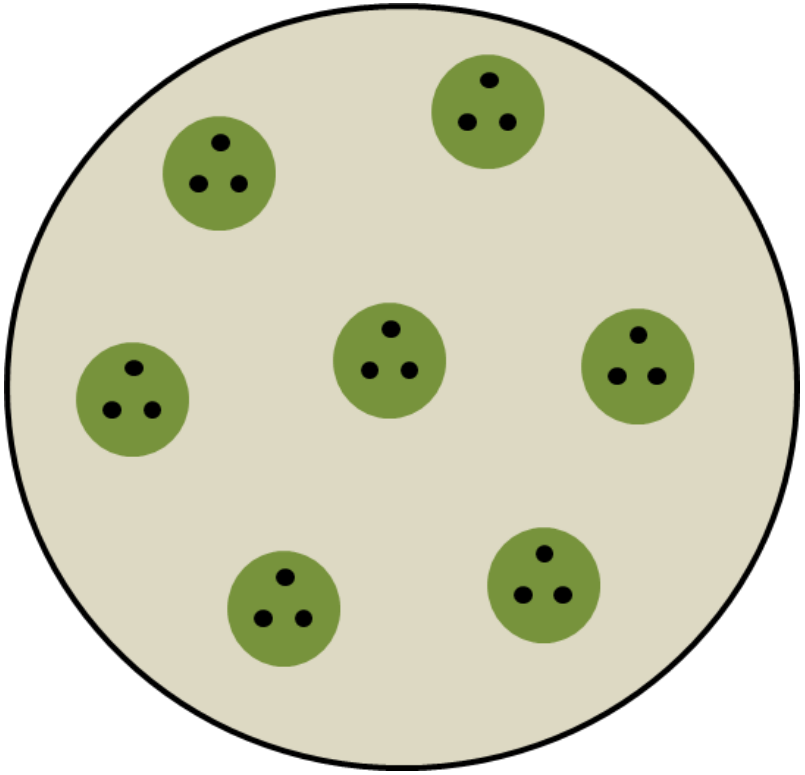
- Mefenoxam (active ingredient of Ridomil) known to be very effective against downy mildew & there is interest in use of this product
  - Single-site mode of action however = high risk for resistance development
- Insensitivity to mefenoxam is known to occur in the Pacific Northwest
- Some planting material in WI sourced from PNW → potential to introduce insensitive strains of pathogen
  - It's also possible that insensitive isolates occur naturally
- Need to know the status here to estimate product efficacy

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

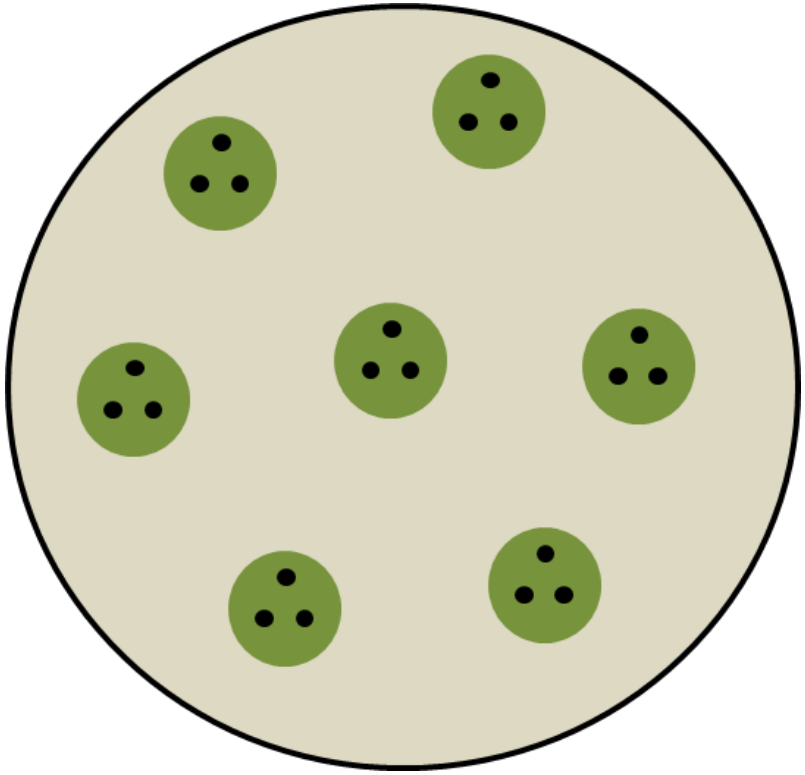
Control Plates (water agar)

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 (Dane County) at one time point
  - Resistance needs to be screened on a site-by-site basis
- Extensive sampling & testing planned for next season
- No sporulation was seen on leaf discs on plates amended with fungicide
- Indicated that the population sampled is still sensitive to mefenoxam
- Opportunity to test other active ingredients
  - Aliette, others?

Thank you! Questions?

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