Managing Phytophthora Crown & Fruit Rot in Cucurbits, Peppers, and Tomatoes



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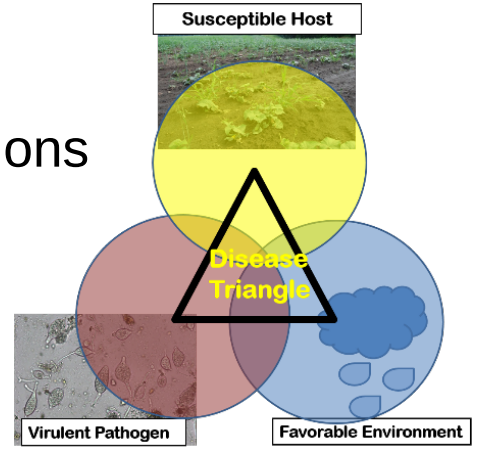
Alliant Energy Center, Madison Wisconsin

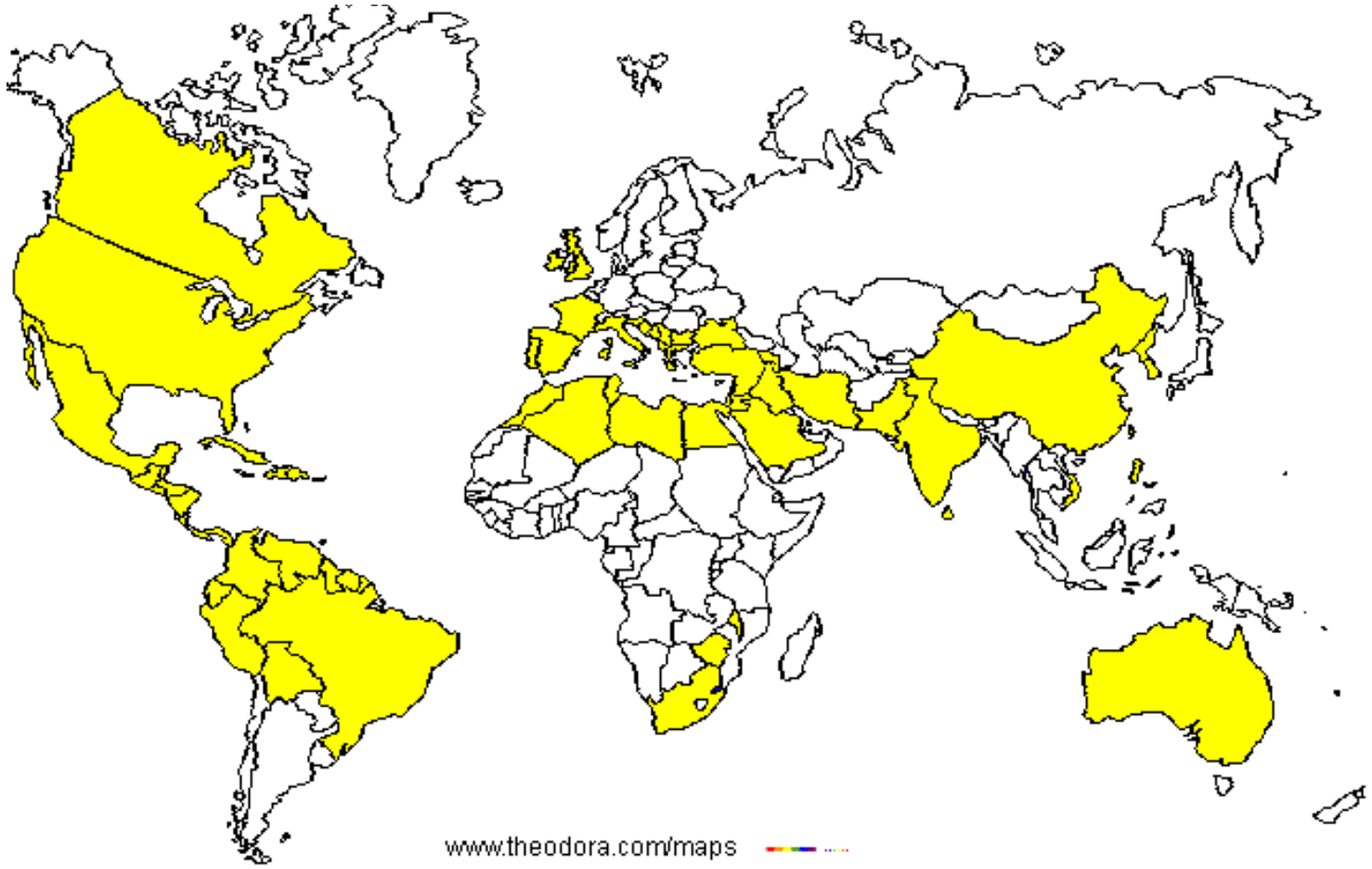
Phytophthora Crown & Fruit Rot
Phytophthora capsici

- Phytophthora is a sporadic, soilborne disease caused by an oomycete or ‘water mold’ pathogen similar to the late blight or downy mildew pathogens
- Disease affects cucumber, pepper, tomato, eggplant, squash, watermelon, pumpkin
- Phytophthora was initially problematic in 1990s primarily in processing cucumber crops of Central Sands WI
- Some recent years with above average precipitation and warm conditions have promoted this disease
- Many fields with disease problems in 2010-17 had no known history of the pathogen and were irrigated from wells

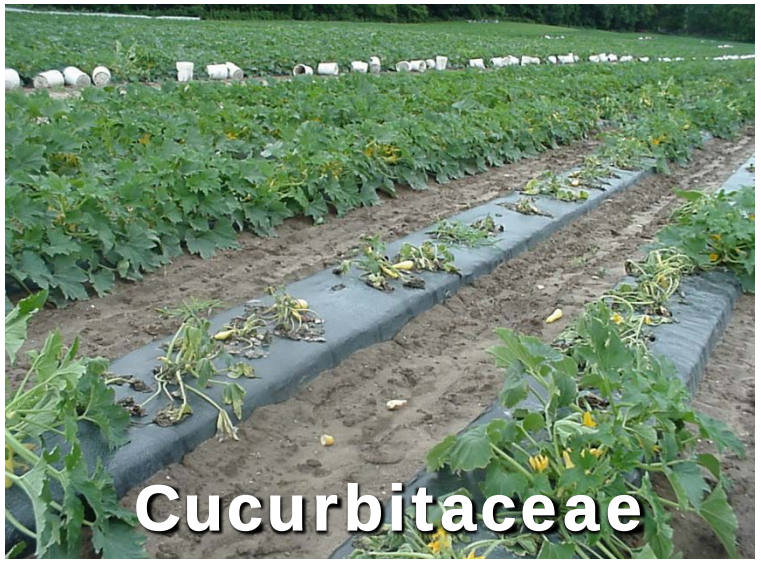


Unlike late blight and downy mildew, spores of* P. capsici *do not move long distances by air

Worldwide Distribution of *P. capsici*



Phytophthora Crown & Fruit Rot



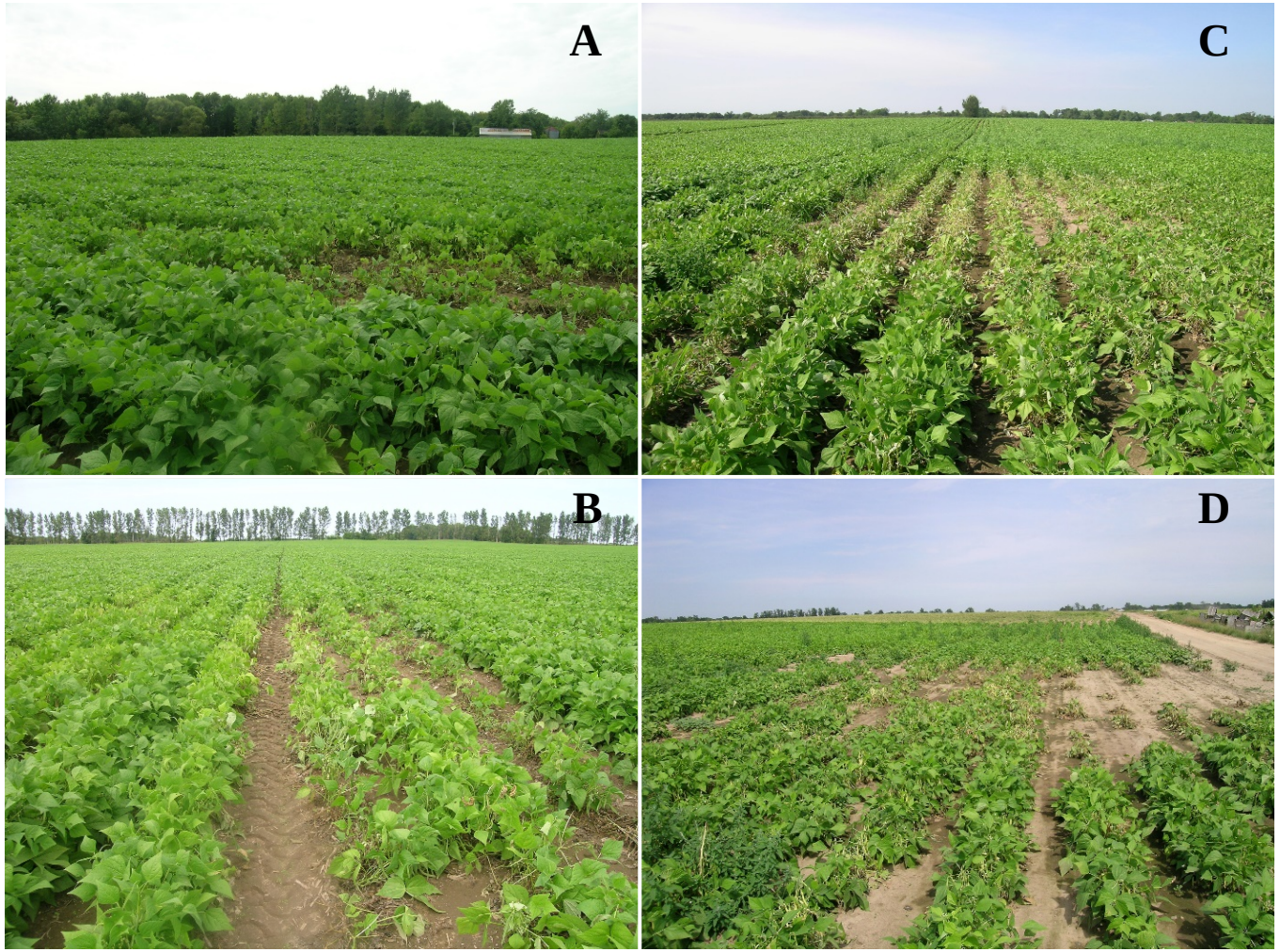
Phytophthora Crown & Fruit Rot

Phytophthora Blight & Pod Rot on Bean






Phytophthora Blight & Pod Rot on Bean



Bean types susceptible to *P. capsici* under laboratory conditions

Bush Contender	Cranberry Soup Bean	KY Wonder Pole
Soybean	Pole Bean	Fordhook Standard
Blue Lake White Seed Pole	Black Turtle	Gold Mine Yellow
Bush Tenderpod	Bush Lima	Snap Bean

Wisconsin Vegetable Crop Production

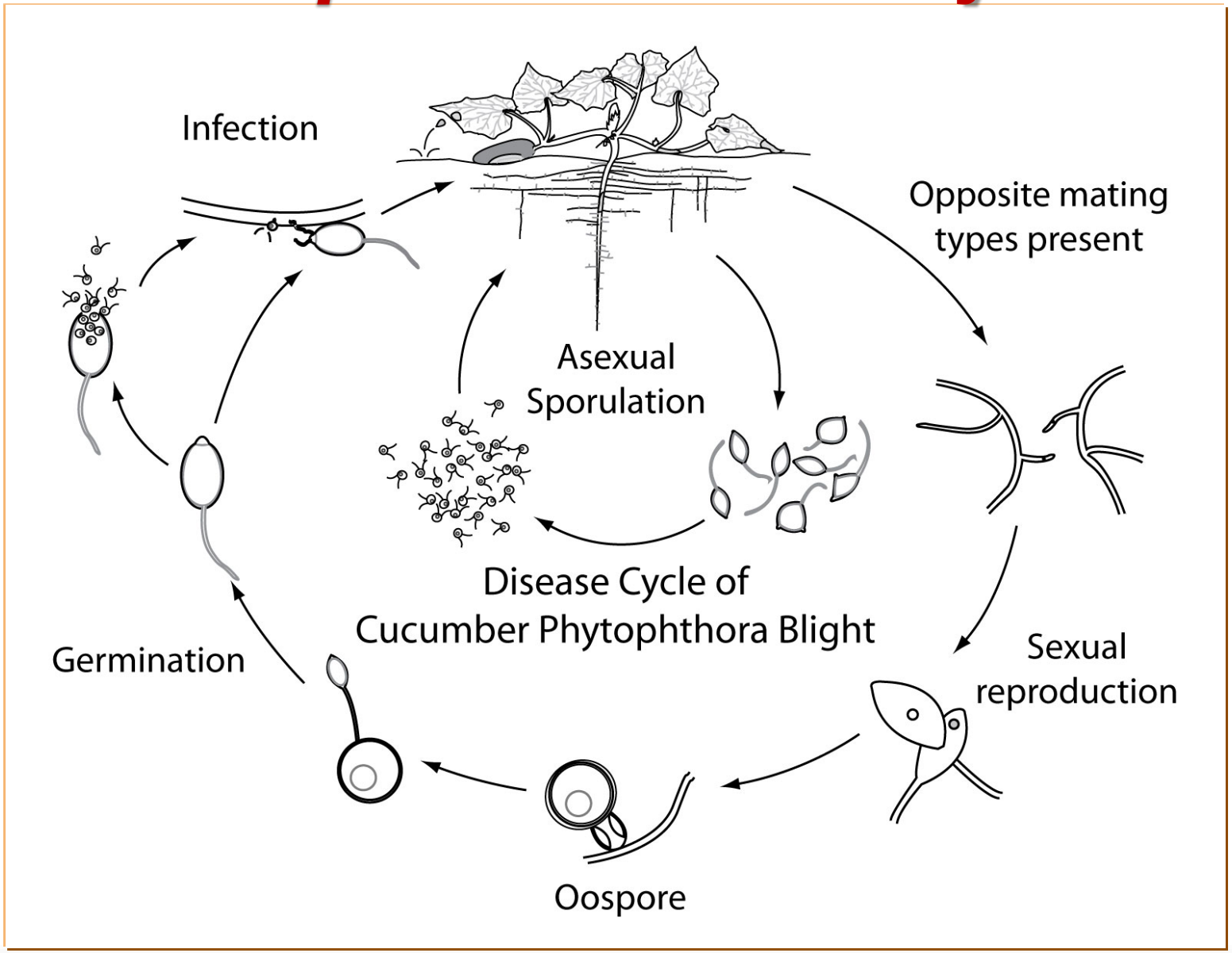
Processing cucumbers – 5600 acres (2017)
Processing peppers – 2000 acres (2017)

Sum of additional susceptible vegetables – ~15,000 acres (2017)
(squash, melon, pumpkin, tomato)

Also at risk – snap beans – 363,552 acres (2017)
And – soybeans – 1.95 million acres (2017)

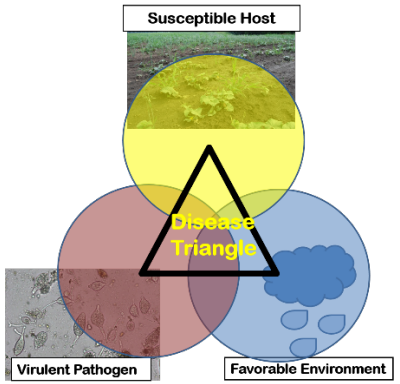
Nationally, WI is second to CA in # of certified organic farms

P. capsici Disease Cycle



Vegetable Disease Timeline for WI

April-May	June	July	August	September	October
Poor emergence Phytophthora Root Rot					
	Early blight, Septoria blight, Phytophthora				
		Late blight , Downy mildew, Powdery mildew, Phytophthora			
				Post-harvest Phytophthora Fruit rots	



No single management practice is 100% effective in controlling soilborne pathogens

- Cultivar resistance (peppers: Paladin, Turnpike, Archimedes; little resistance in cucurbits across whole plant)
- Do not distribute sporulating culls across fields
- Irrigate conservatively (avoid surface water, carbon-based filters can reduce *P. capsici* introduction)
- Plant in well-drained fields
- Scout and pull/kill diseased plants to avoid spread, plow under infected and surrounding plants
- Raised beds, plastic mulch, drip irrigation if possible
- Increase row spacing
- Rotate crops (non-host rotations, cover crops)

Water source *P. capsici* contamination risk

Water Source	History of Nearby Field Infestation	Incidence of Water Infestation
River	Yes	Frequent
Creek	Yes	Frequent
Nat. Fed Pond	Yes	Frequent
Well Fed Pond	Yes	Rare/None
Retention Pond (treated)	Yes	None
Run-off Ditch	Yes	Frequent

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No single management practice is 100% effective in controlling soilborne pathogens

- Apply fungicide preventively and frequently (pickles at 1, 3, 5” fruit)
- Consider soil drench, drip irrigation-applied, or in furrow applications
- Rotate fungicides classes to mitigate resistance
- Soil fumigation (chloropicrin, metam sodium, 1,3-dichloropropene)
- Harvest healthy fruit from field as quickly as possible and store under warm and dry conditions
- Power wash equipment after it has been in infested fields to limit introduction of pathogen to clean fields

Limitations of current management strategies

- Identifying sources of infestation (water, planting material, relocated soil or contaminated equipment)
- Limited number of rotational crops
- Persistence of oospores in field soil
- Fungicide resistance risk
- Little cultivar resistance across crops
  - Pepper ‘Paladin’ has some resistance but with silvering concern
  - Cucurbit root resistance doesn’t indicate fruit resistance
- Hard to get good fungicide coverage of susceptible plant parts

Fungicides for *P. capsici* control in cucumber, winter squash & pumpkin

	Fungicide	a.i.	FRAC	PHI	Activity and notes
Base protectants/tank mix partners	Bravo, Equus, Echo	chlorothalonil	M5	0-3 days	protectant
	Dithane, Mancozeb	mancozeb	M3	3-5 days	protectant
	Kocide, Champ	copper	M1	0 days	protectant
Good Efficacy	Forum 4.18SC	dimethomorph	40	0 days	systemic, use tank mix
	Gavel 75DF	zoxamide + mancozeb	22+M3	5 days	protectant
	Zing	chlorothalonil + zoxamide	M5 + 22	0 days	protectant
	Zampro 4.4SC	ametoctradin + dimethomorph	45+40	0 days	systemic, drip or foliar
	Ranman 400SC	cyazofamid	21	0 days	protectant, systemic
Highest Efficacy	Presidio 4SC	fluopicolide	43	2 days	locally systemic, drip or foliar
	Elumin	Ethaboxam	22	2 days	systemic, drip or foliar
	Revus 2.08SC	mandipropamid	40	0-1 days	systemic, surfactant needed
	Ridomil Gold	mefenoxam	4	5 days	systemic, resistance known to occur
	Orondis Ultra	oxathiapiprolin + mandipropamid	49 + 40	0 days	systemic

Based on efficacy trials M.K. Hausbeck MSU

Fungicides for *P. capsici* control in pepper

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	Dithane, Mancozeb	mancozeb	M3	3-5 days	protectant
	Kocide, Champ	copper	M1	0 days	protectant
Good Efficacy	Phostrol	phosphorous acids	33	0 days	upregulates resistance
	Tanos	famoxadone + cymoxanil	11 + 27	3 days	protectant, curative
	Ranman 400SC	cyazofamid	21	0 days	protectant, systemic
Highest Efficacy	Forum 4.18SC	dimethomorph	40	0 days	systemic, use tank mix
	Elumin	ethaboxam	22	2 days	systemic, drip or foliar
	Presidio 4SC	fluopicolide	43	2 days	locally systemic, drip or foliar
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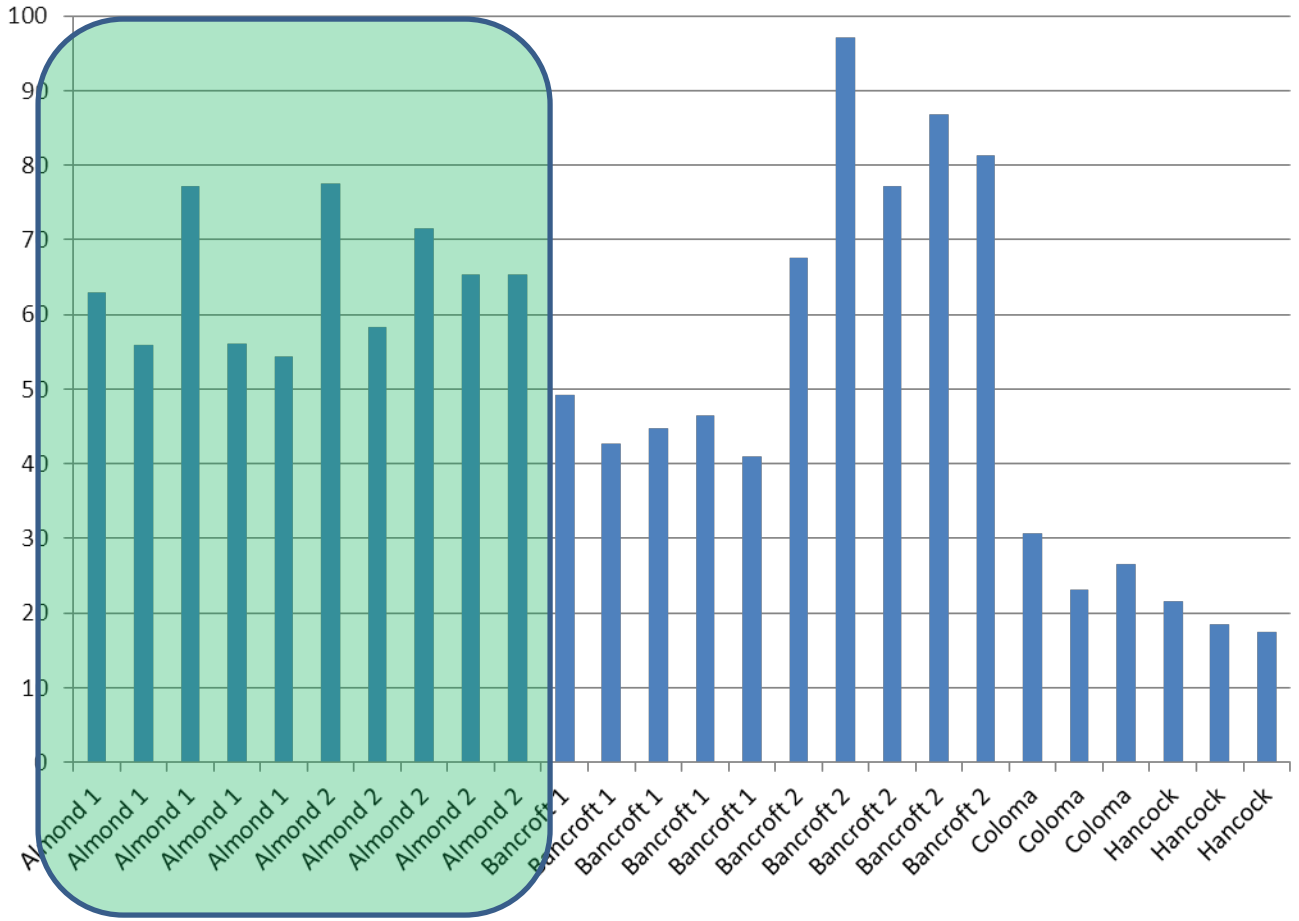
Fumigants for reducing *P. capsici* inoculum

Effective fumigants	Application comments
DMDS (dimethyl disulfide)	-must be applied when ideal soil temperature and moisture conditions maintained during fumigation -well aerated soil at 50-80% moisture capacity at moderate temperature -fall fumigation recommended for northern states -fumigants can be applied via injection into soil or through drip irrigation system -fumigants need to be 'sealed' with plastic film or mechanical soil seal -in FL soil solarization as effective as methyl bromide in top 10 cm of soil (not at 25 cm)
metam sodium	
metam potassium	
1,3-dichloropropene/ chloropicrin	
iodomethane/ chloropicrin	
chloropicrin	

Granke, Ocampo, Lamour, Hausbeck. 2012. Plant Disease

Mefenoxam resistance in WI *P. capsici*

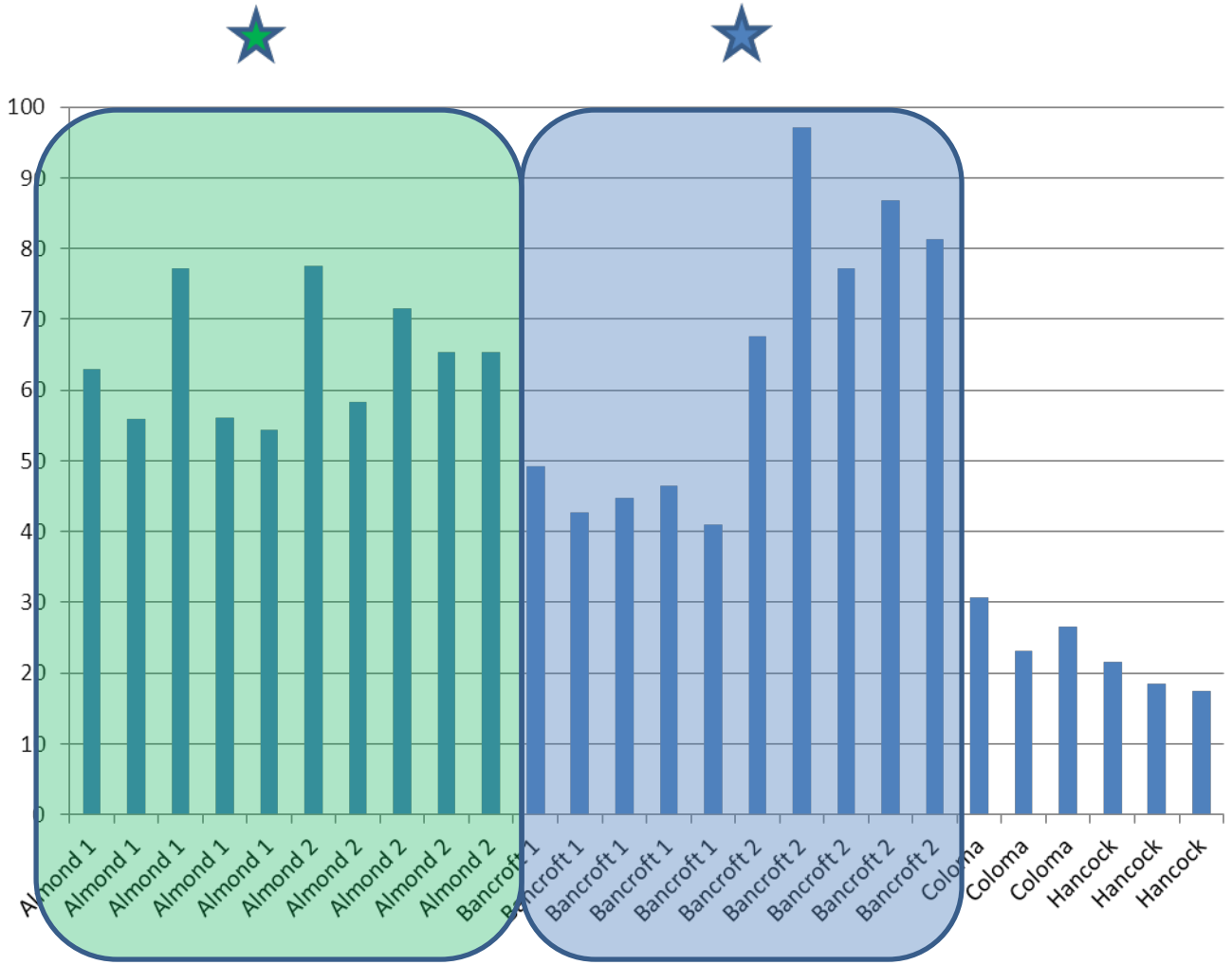
Almond WI, 2011
2 fields sampled in region of concentrated processing cucumber production



Mefenoxam resistance in WI *P. capsici*

Bancroft WI, 2011

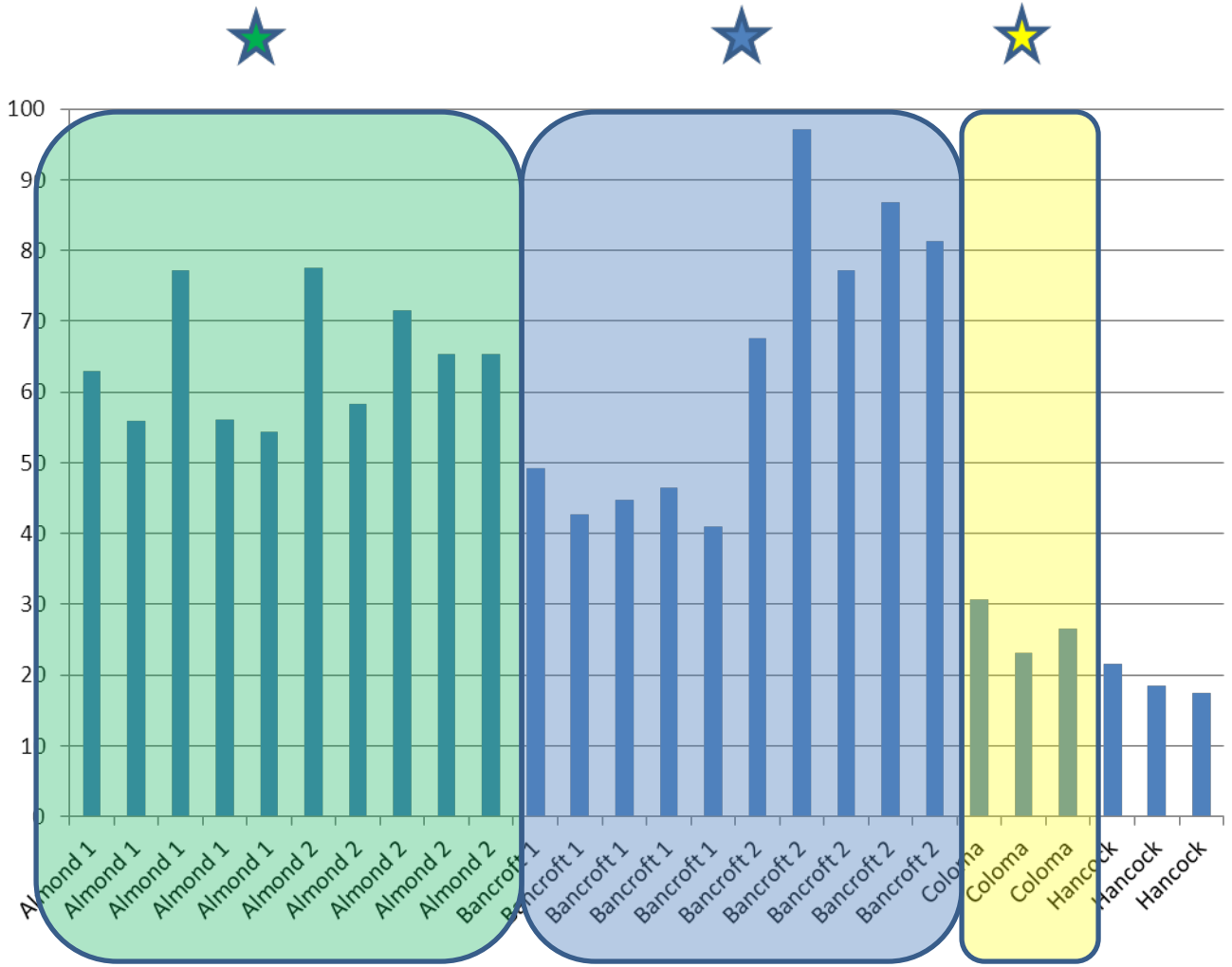
2 fields sampled in region of concentrated processing cucumber production



Mefenoxam resistance in WI *P. capsici*

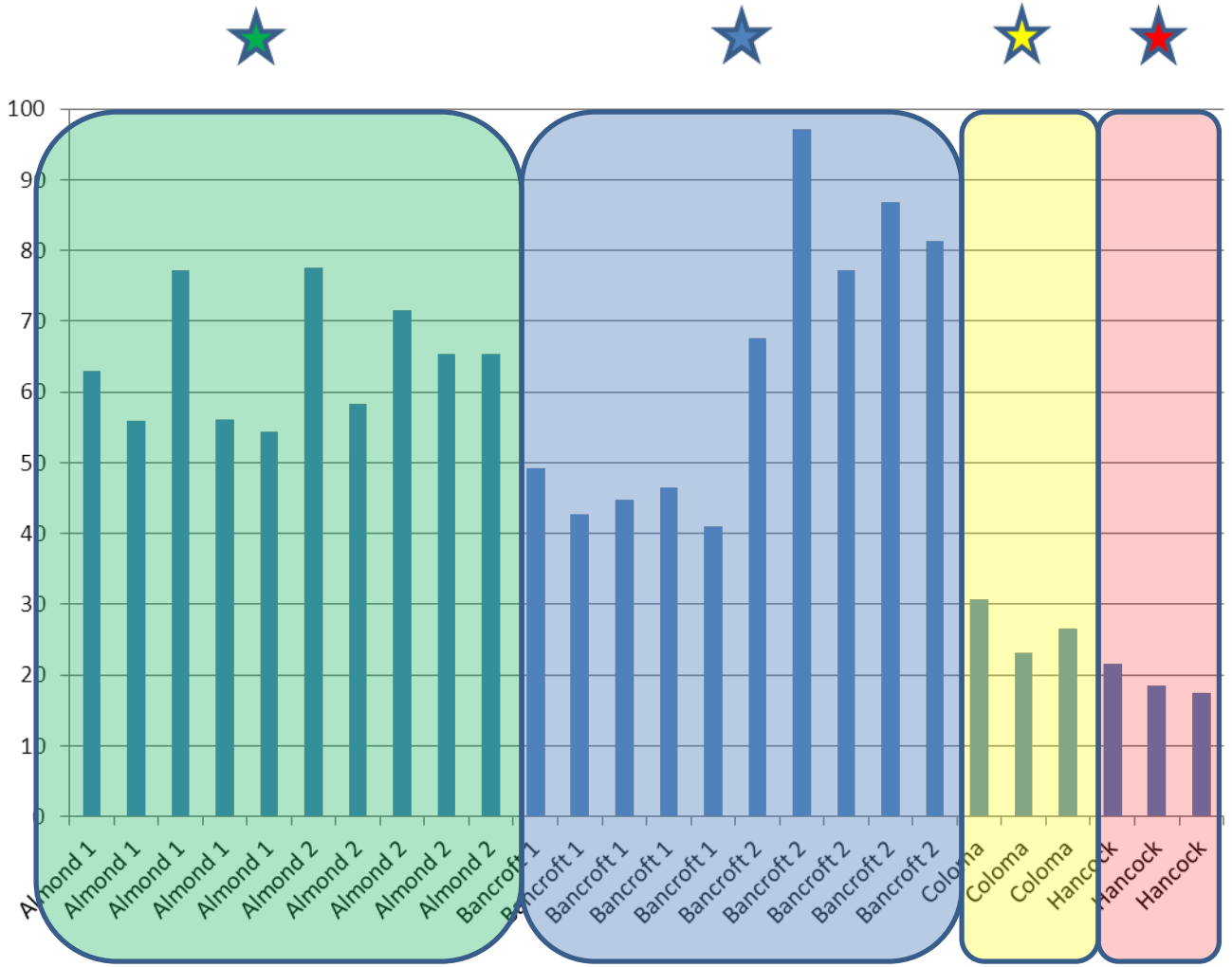
Coloma WI, 2010

1 large field sampled in region of corn, potato, small grown rotation – in processing peppers in 2010 without recent history of Phytophthora crown & fruit rot



Mefenoxam resistance in WI *P. capsici*

Hancock WI, 2011
4 fields sampled on one 10 acre vegetable farm – Phytophthora present in mid-1990's in low levels – good crop rotation plan



Thank you!

Information Resources

Wisconsin Specialty Crops Block

University of Wisconsin
Agricultural Research Stations

Wisconsin Muck Farmers Association

University of Wisconsin Vegetable Disease Website (newsletter access)
http://www.plantpath.wisc.edu/wivegdis/

www.usablight.org

Plant Pathology
at the University of Wisconsin - Madison

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