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COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

Major Vegetable Crop Production and Challenges 600 Level: Pumpkin

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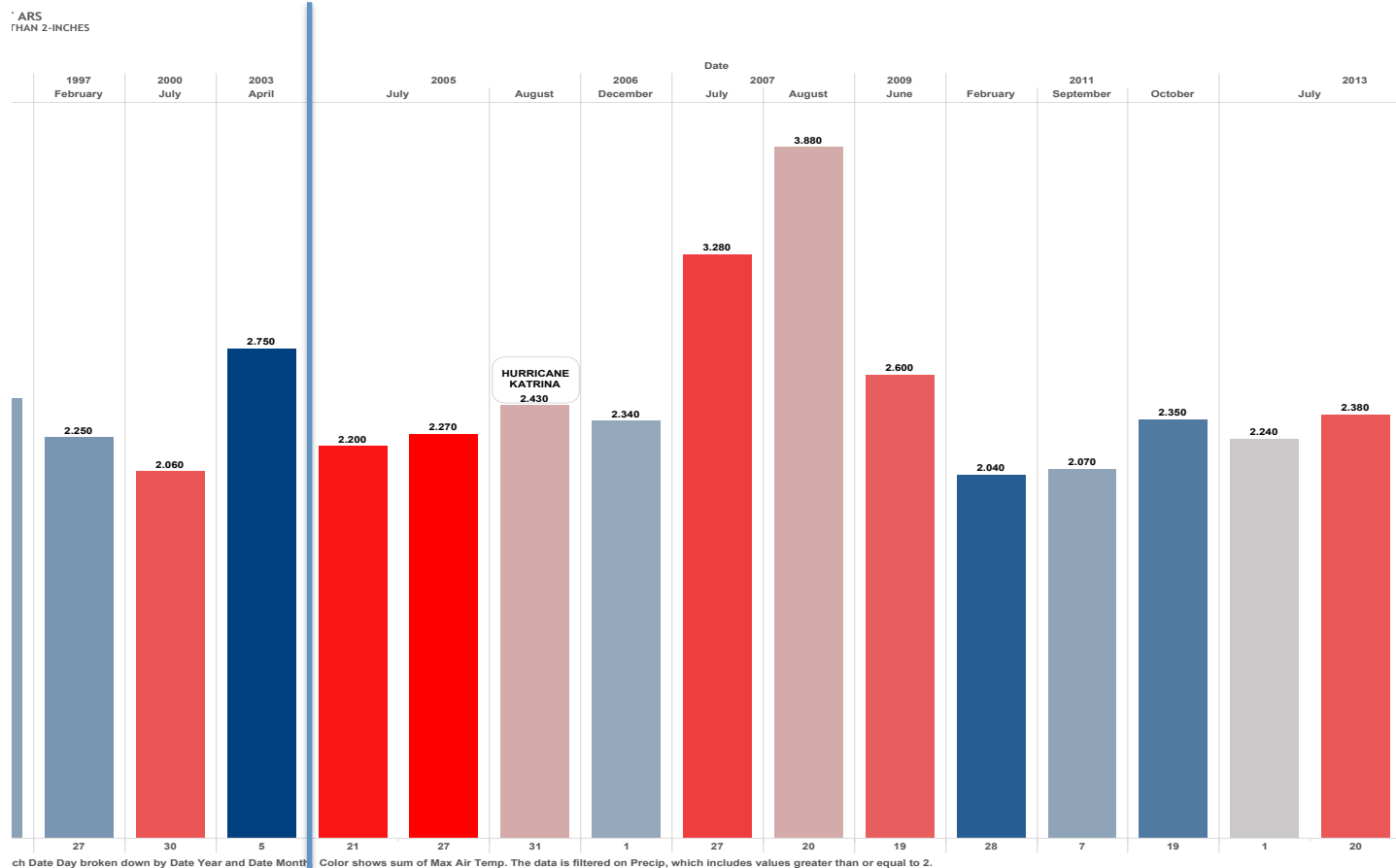
Why Are There So Many Diseases in Vegetable Crops Lately?



- Globalization – pathogens move on seeds
- Climate change – more extreme weather events
- Infested seed and plant movement
- Evolution and adaptation of pathogens



Rain Events $>2.0''$ in a Day – Fremont



1994-2004

2005 - 2014



Moisture Favors Major Pumpkin Diseases

- Bacterial diseases
 - Bacterial spot
 - Angular leaf spot
 - (Bacterial wilt)
- Phytophthora blight
- Downy mildew
- Various fungal diseases
- Exception: powdery mildew



Sporangia and zoospores of *Phytophthora* carved into a jack-o-lantern



Bacterial Diseases of Pumpkins



Bacterial spot of pumpkin

- More severe in rainy years than dry years
 - Rain, flooding and overhead irrigation spread disease
 - Long-distance spread of bacteria in aerosols may occur
 - Some bacteria survive in surface water
- Diseases have different temperature optima



Bacterial Spot - *Xanthomonas*

- Scabby and/or watersoaked lesions on fruit
- Necrotic spots, yellow haloes on leaves, defoliation
- Seedborne
- Favored by warm, rainy conditions





Angular Leaf Spot – *Pseudomonas*



- Cucumber most susceptible but all cucurbits may be affected
- Favored by moderate temperatures and high moisture
- Seedborne + survives several years in soil assoc. with plant debris
- 2014 outbreak in summer squash attributed to contaminated seed



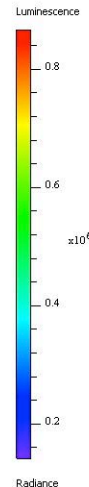
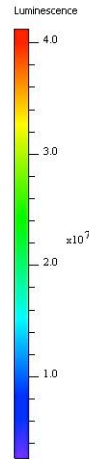
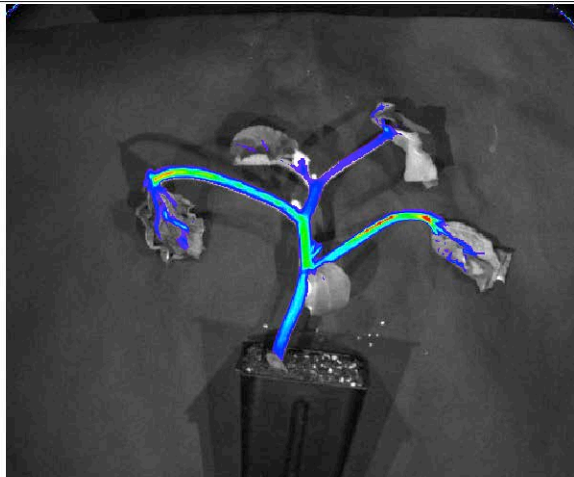
Bacterial Wilt - *Erwinia*



- Transmitted by cucumber beetles
- Not seedborne
- Cucumbers most susceptible but other cucurbits affected
- Plants infected early likely to wilt and die



Bacterial Wilt in Melons



- Bacteria (*Erwinia*) clog the plant's water-conducting vessels
- Bacteria likely overwinter in beetles and transmit during feeding
 - Snow cover in winter protects overwintering beetles from cold temps

“Glow in the dark” engineered bacteria
in melon seedling and beetle (C. Vrisman, OSU)



Phytophthora Blight



- Serious and persistent in all vine crops
- No resistant varieties
- Once introduced can survive many years in soil
- Surface water may be contaminated with *Phytophthora*



Powdery Mildew



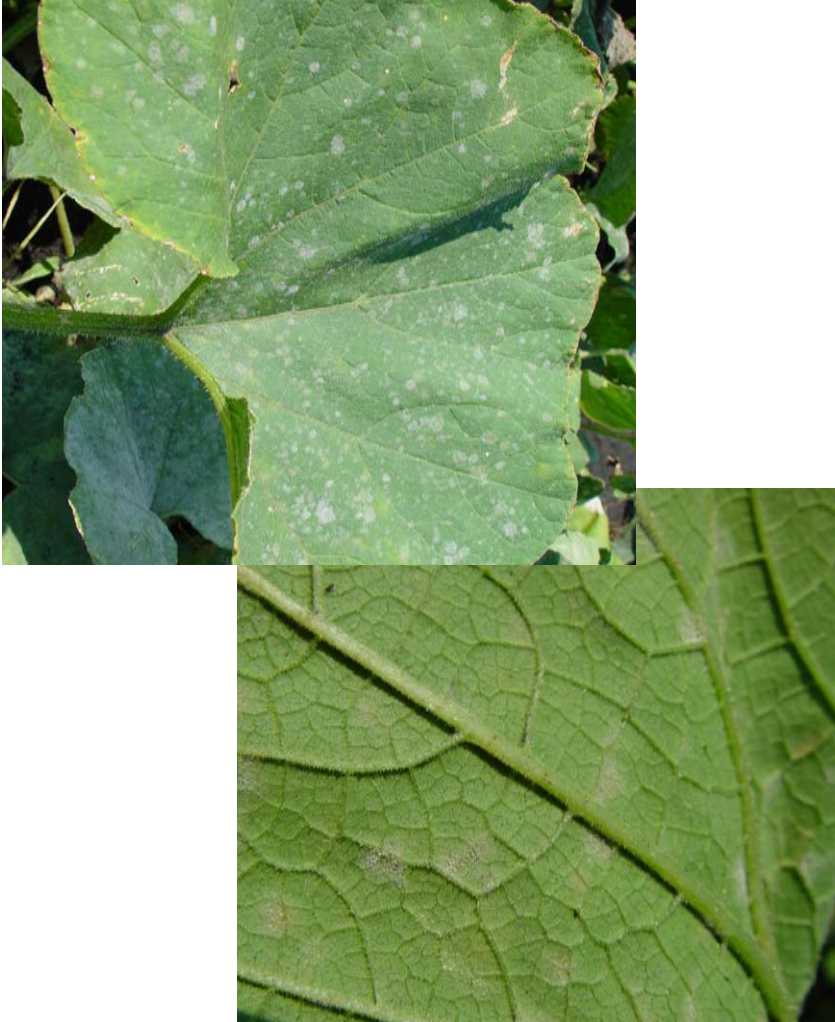
- The pathogen has a broad host range and can infect many different plants
- Spores blow into the Midwest and Northeast from the South
 - Usually mid-July



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Powdery Mildew





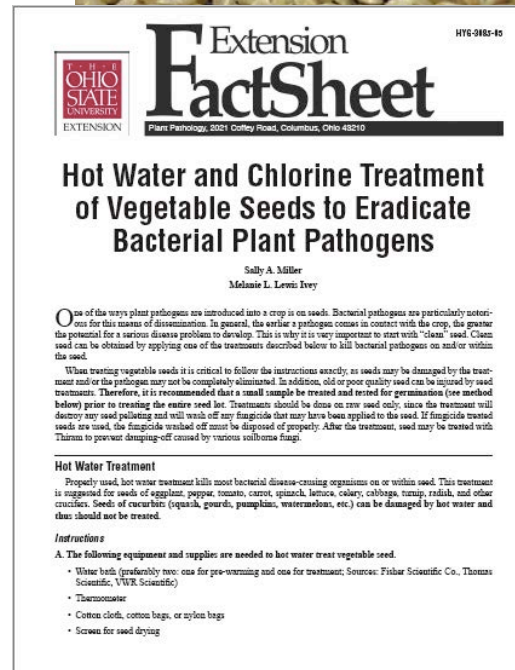
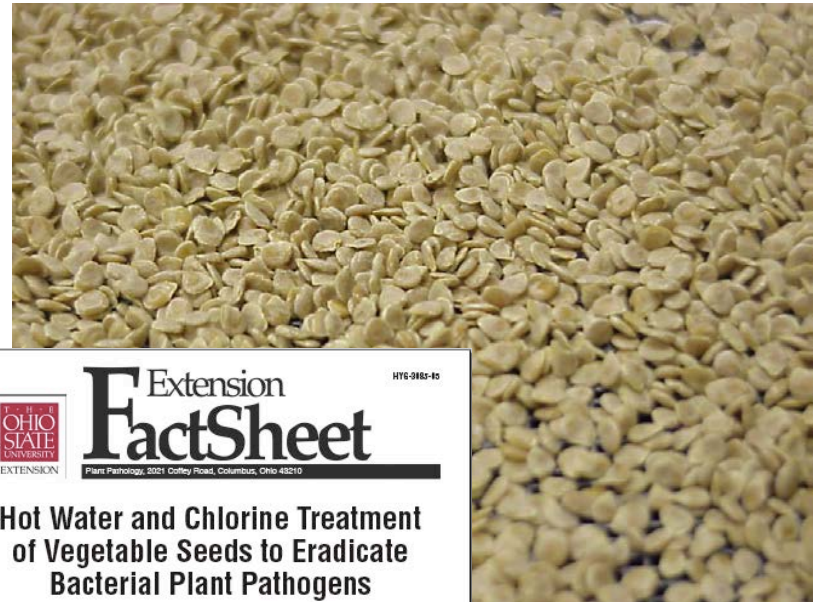
6-Step Integrated Disease Management Program

1. Use clean seed
2. Choose a resistant variety
3. ~~Use pathogen-free transplants~~
4. Choose the best site and rotate
5. Use appropriate cultural practices
6. Use crop protectants as needed



1. Use Clean Seed

- Check with seed provider – have seed lots been tested for seedborne diseases?
- Are you saving your own seed, e.g. heirloom varieties?
- If not tested and shown to be negative, or are saved seed:
 - Treat seed with dilute Clorox or hot water
 - <http://ohioline.osu.edu/hyg-fact/3000/3085.html>





Sanitizing Seed Treatments

Treatment	Infestation rate %	<i>Cmm</i> infestation level in seed (log cfu/100 seed)	Seed vigor index (SVIS)
Control	11.8 b	5.3 a	801 ab
H ₂ O ₂	15.3 a	4.3 bc	803 ab
Kasugamycin	10.1 bc	5.0 a	603 c
Streptomycin	6.3 d	3.9 b	766 b
Thymol	2.3 ef	3.9 b	747 c
Dry heat	7.6 cd	3.7 b	536 d
Hot water	0 f	- *	785 b
HCl	0 f	0 c	833 a
NaClO/hot water	0 f	0 c	778 b
KleenGrow	0 f	0 c	797 ab
Virkon	0 f	0 c	789 b



Effect of Sanitizing Seed Treatments on Pumpkin Seed

Treatment	Application Rate	Fresh Weight (g)	Height (cm)	Germination Rate (%) Day 7	Germination Rate (%) Day 14
<u>KleenGrow</u>	0.6 %	4.6 <u>ab</u>	6.9 a	81.5 a	84.0 a
<u>Bleach</u>	1:5 <u>v:v</u>	4.2 c	6.4 <u>bc</u>	73.5 a	77.0 a
<u>Virkon</u>	2 %	4.8 a	6.8 a	78.0 a	81.5 a
<u>Hydrochloric acid</u>	0.6 M	4.6 <u>ab</u>	5.8 d	65.5 a	67.0 a
Hot Water	50°C	4.6 <u>ab</u>	6.7 <u>ab</u>	74.0 a	80.0 a
Dry Heat	75°C	4.3 <u>bc</u>	6.2 cd	54.5 a	60.0 a
Non-treated		4.6 <u>ab</u>	5.9 d	58.0 a	64.5 a
<u>p value</u>		0.001	≤ 0.001	0.535	0.583

****We recommend dilute chlorine bleach treatment of pumpkin seeds to manage bacterial spot****

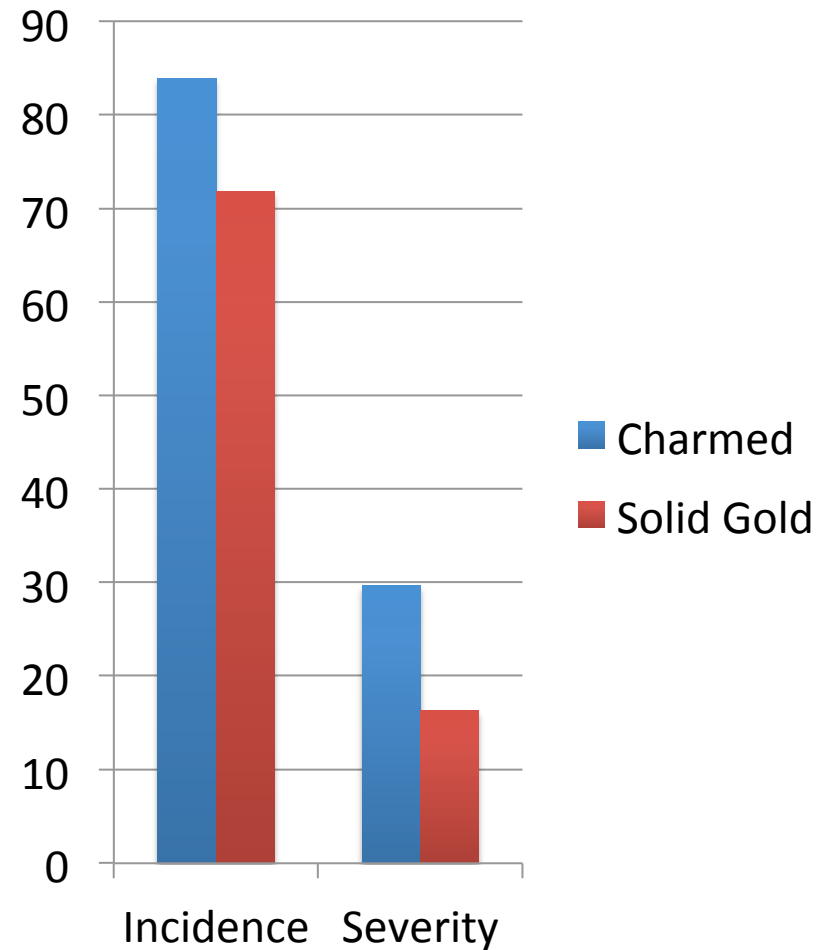


2. Choose Resistant Varieties

Disease	Cucumber	Squash	Pumpkin	Water-melon	Melon
Angular leaf spot	++++	x	x	x	x
Bacterial leaf spot	NL	NL	NL	NL	NL
Bacterial wilt	+	x	x	-	x
Phytophthora blight	x	x	x	x	x
Phytophthora fruit rot	x	x	+ hard-rind types eg 'Lil' Ironsides'	x	x
Powdery mildew	++++	+++	++++	x	++++



Resistance to Bacterial Spot-Pumpkin



Data: Jim Jasinski et al. OSU



4. Choose the Best Site and Rotate

- Site selection
 - Well-drained
 - Good air movement
 - Sunny
- Rotate rotate rotate
 - Bacterial spot – 1-2 years
 - Angular leaf spot, bacterial wilt, Phytophthora- ≥ 3 years
 - Rotate out of like families
 - Not helpful for powdery mildew, downy mildew



5. Use Best Cultural Practices

- Scout early and often
- Avoid handling plants when they are wet
- Sanitize hands, boots, tools, equipment between fields; remove diseased material from field
- Maintain reduced-stress growing conditions
 - Well-drained soil; plant on ridges if *Phytophthora* present
 - Appropriate fertilizer (adequate but not excessive N)
 - Regular irrigation if needed
 - Improved organic matter content – cover crops, compost



6. Use Crop Protectants – Bacterial Diseases

- Scout regularly for cucumber beetles; apply insecticides once thresholds have been exceeded.
 - Pumpkins: apply insecticides after seedling emergence if threshold of 0.5 beetles/plant (cotyledon stage) or 1 beetle/plant (1-2 leaf stage) is exceeded
- At-plant (e.g. Admire) or foliar insecticides as soon as plants emerge and on 5-day intervals until cucumber beetle infestations subside.
- Apply copper on a 5-7 day schedule beginning early after emergence if conditions are conducive to disease
- Apply Actigard preventatively on 7 day schedule (general disease suppression)



6. Use Crop Protectants – Phytophthora

- Fungicides will not cure this disease but slow its progression
- Cultural practices critical in managing this disease

Apron XL LS* at 6.4 fl. oz. per 100 lbs. seed. *Only for direct-seeded plants.*

Forum 4.18SC* at 6 fl. oz. per acre. 0-day PHI.

Presidio 4SC* at 3-4 fl. oz. per acre. 2-day PHI.

RR Ranman 400SC* at 2.75 fl. oz. per acre. May be applied in transplant water. 0-day PHI.

RR Revus 2.09SC* at 8 fl. oz. per acre. *Suppression only.* 0-day PHI.

Tanos 50WG* at 8-10 oz. per acre. *Suppression only.* 3-day PHI.

Zampro* at 14 fl. oz. per acre. 0-day PHI.



6. Use Crop Protectants – Downy Mildew

Fungicide	PHI	Efficacy
Presidio	2	++++++
Ranman	0	+++++++
Previcur Flex	2	+++++++
Curzate	3	++++++
Tanos	3	++++++
Gavel	5	++++++
Zing!	0	++++++
Zampro	0	++++++
Mancozeb	5	++++
Bravo	0	++++



6. Use Crop Protectants – Downy Mildew

- Before Disease (7-10 day intervals)
 - Gavel 75 WG/Zing!
 - Presidio 4FL
 - Previcur Flex 6SC
 - Ranman 3.6SC
 - Tanos 50WG
- Alternate products and mix each with either:
 - Dithane (mancozeb) 3 lb or
 - Bravo (chlorothalonil) 1.5 pt
- After Disease (7 - day intervals)
 - Previcur Flex 6SC
 - Presidio 4FL
 - Ranman 3.6SC
 - Tanos 50WG
- Alternate products and mix each with either:
 - Dithane (mancozeb) 3 lb or
 - Bravo (chlorothalonil) 2 pt



6. Use Crop Protectants – Powdery Mildew

- Some effective fungicides
 - Procure/Rally
 - Quintec
 - Torino
 - Fontelis
 - Luna Sensation
 - (Pristine)
 - Microthiol Disperss (sulfur) – don't apply if >85°F
 - Bravo (protectant)
- Tank mix with a protectant fungicide
- Alternate fungicides with different modes of action/FRAC numbers



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QUESTIONS?



Acknowledgments

- OSU Vegetable Pathology Lab
- OVSFRDP
- OARDC

