



Managing Early Blight and Fungicide Resistance Management




How do we increase the longevity of crop protection products?

- Eliminate sources of inoculum.
- Plant resistant varieties where possible.
- Maintain adequate crop fertility.
- Increase crop rotation intervals when possible.
- Apply fungicides before disease is established.
 - Avoid curative applications!
- Use fungicides appropriately
 - Effective tank mixtures
 - Rotation
 - Proper rates





Early Blight and Brown Spot











Early Blight on Western Russet

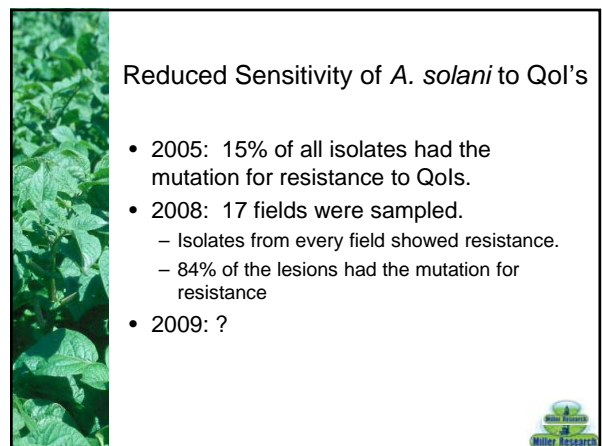
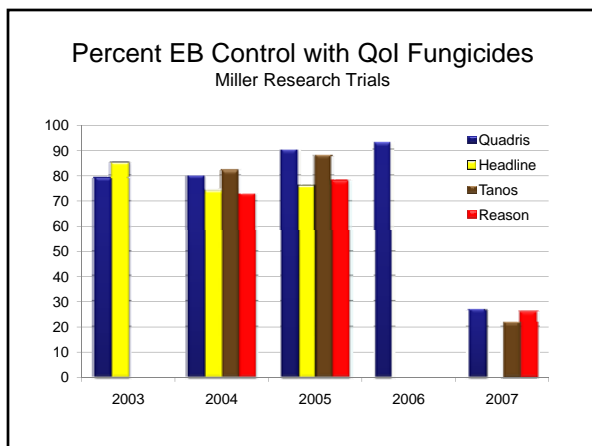
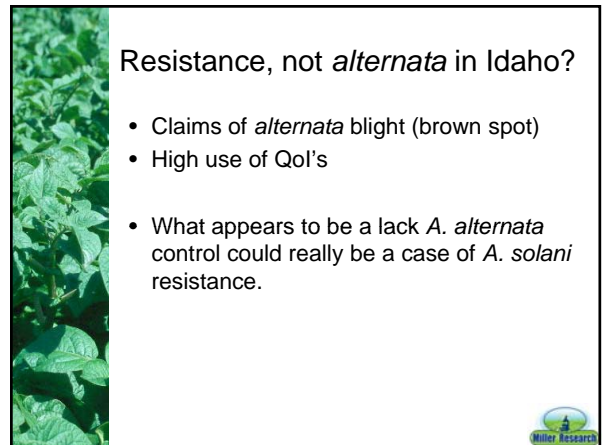
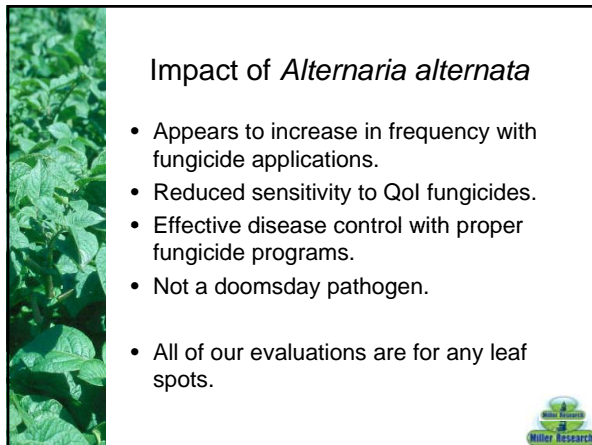
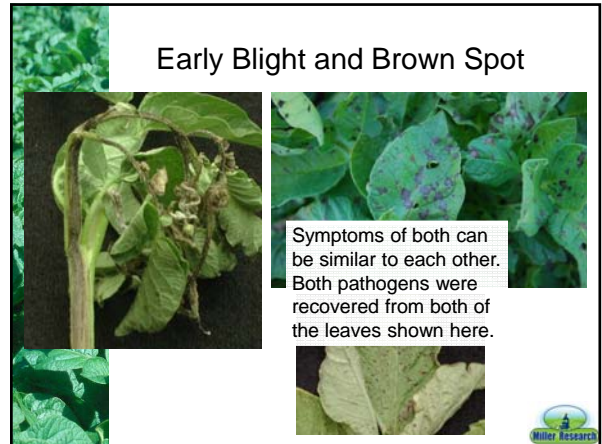
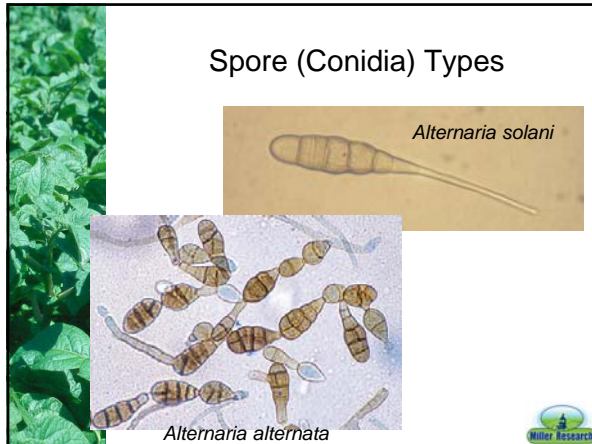




Early Blight Tuber Decay on Western Russet

Early Blight Tuber Decay on Western Russet Severe, coalescing lesions






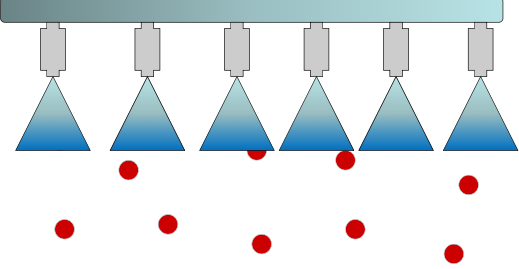
Early Blight Management

1. Use preventative fungicide programs.
2. Maintain adequate fertility
N and P important
3. Use less susceptible varieties.
4. Allow tubers to mature prior to harvest.



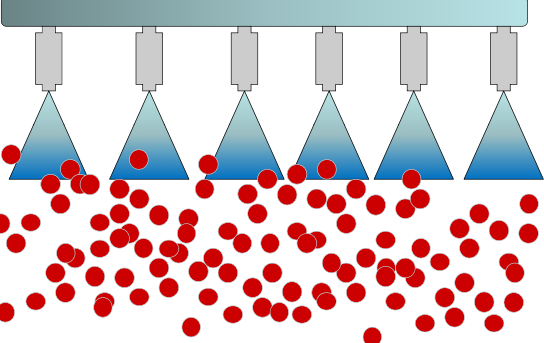

Fungicide Application

Proper Timing - 90% Efficacy





Fungicide Application

Late Timing - 90% Efficacy

Importance of Prevention

- Efficient reduction of initial inoculum.
- Reduces the likelihood of resistance development.
 - Resistance is a numbers game
 - Lower the number, better the odds for you





Effective Early Blight Fungicides

Standard Protectants

- Chlorothalonil – Group M5
 - Bravo
 - Echo
 - Equus
- EBDC/mancozeb – Group M3
 - Dithane
 - Penncozeb
 - Polyram
 - Manzate
 - Manex

Also provide late blight protection.



Effective Early Blight Fungicides

“Premium” Products

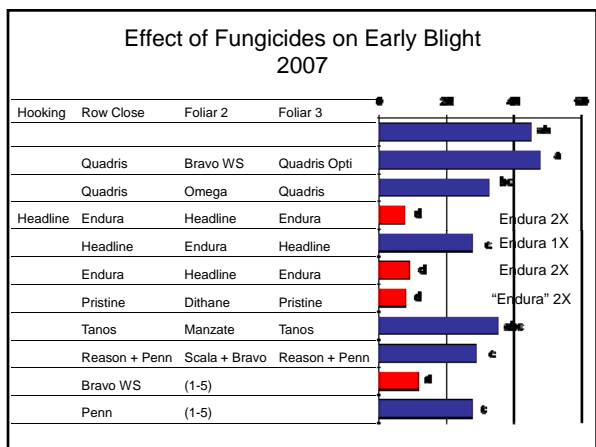
- Qol inhibitors – Group 11
 - Quadris
 - Headline
 - Evito
 - Gem
 - Tanos ★
 - Reason ★
 - Quadris Opti (also group M5)
 - Quadris Top (also group 3)
- Triazoles – Group 3
 - Revus Top (also group 40) ★
 - Quadris Top (also group 11)
 - Quash
- Carboxamides – Group 7
 - Endura ☆
 - Luna Tranquility (also group 9) ☆
- Organotin – Group 30
 - Super Tin
- Pyrimethanil – Group 9
 - Scala ★
 - Luna Tranquility (also group 7) ☆

★ Stronger on late blight ☆ Strong against white mold
★ Strong on gray mold



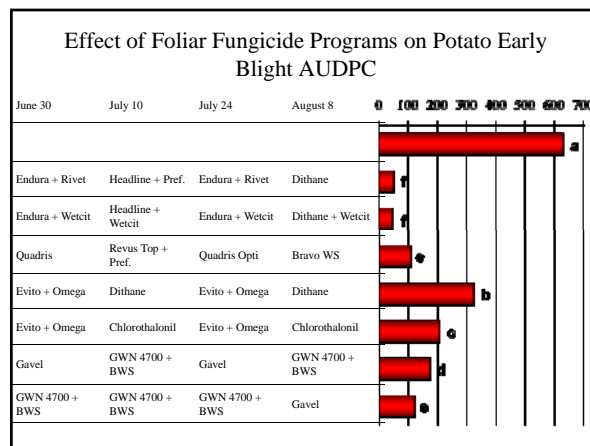
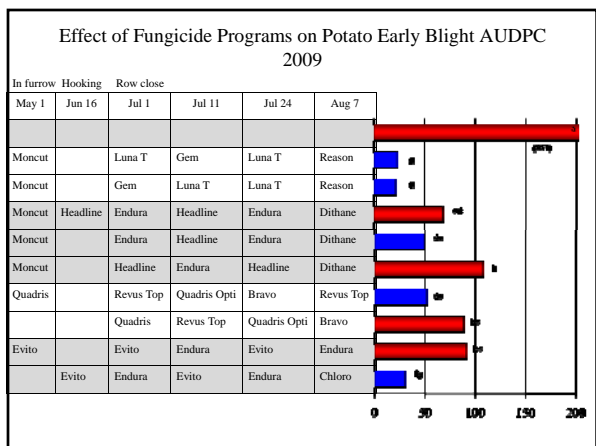
Miller Research Foliar Disease Trials

- Potatoes are evaluated visually for the percentage of leaf area with leaf spots
 - Early blight (*Alternaria solani*)
 - Brown spot (*Alternaria alternata*)
 - Black dot (*Colletotrichum coccodes*)
 - Gray mold (*Botrytis cinerea*)
- At the end of the season lesions are evaluated to determine which pathogen was prevalent.
- Disease severity is a measure of all four pathogens combined.




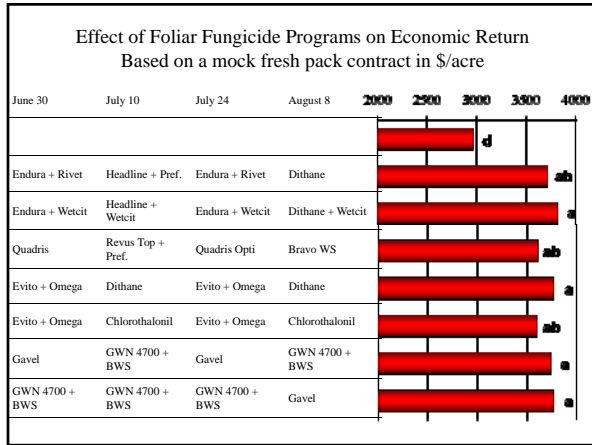
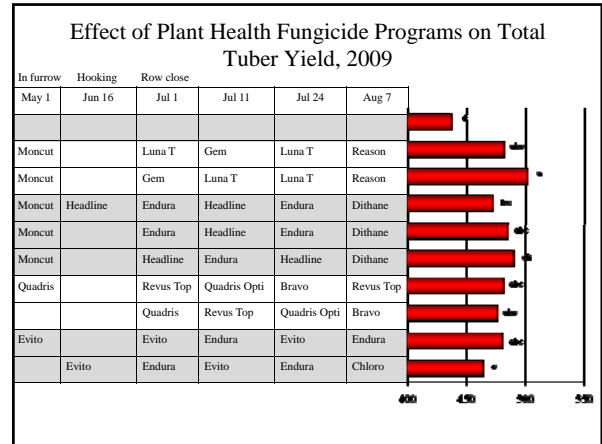
2007 Fungicide Summary

- Two carboxamide apps most effective.
 - Endura
- Programs relying on QoI's less effective.
 - Quadris
 - Headline
 - Tanos
 - Reason
- Bravo alone (additional apps) effective.




2009 Fungicide Summary

- Two apps of carboxamides most effective.
 - Luna Tranquility
 - Endura
- Programs relying on QoI's less effective.
 - Quadris
 - Headline
 - Evito
- Quadris Opti is effective (mixture)
- Revus Top was effective
 - Mandipropamid (LB) + difenoconazole (EB)
- Gavel and Bravo WS


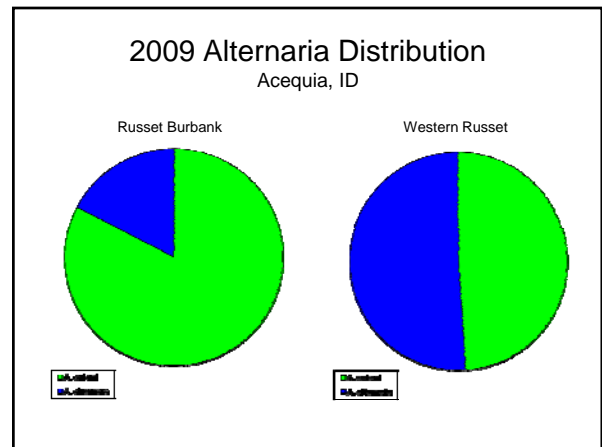
Yield and Economic Return


- All programs increased yield
 - Control of black dot with QoI's?
 - QoI's still providing value?
 - Powdery mildew control
- Most programs increased economic return



Secondary Fungicide Benefits


- Carboxamides effective against white mold.
 - Not effective against late blight!
- Revus Top effective against late blight.
- Scala effective against gray mold.
- QoI's effective against black dot and powdery mildew.



How do you avoid fungicide resistance?


1. Apply fungicides in a preventative, not curative manner.
2. Rotate products – use different chemistry groups. Do not apply products from the same chemistry group back to back.
 - Tank mixing may compensate
3. Tank mix two different active ingredients for the target pathogen.
4. Do not cut rates.




Using Mixtures and Rotation



- Tank mix
 - Protectant
 - Effective systemic
- Rotate with other fungicides
 - No two products back to back in same group







Mixtures that are not mixtures

- Revus Top
 - Mandipropamid effective against late blight
 - Difenconazole effective against early blight
- Quadris Top?
 - Resistance present to Quadris (azoxystrobin)
 - Difenconazole effective alone?
 - Synergy between the two products?


Avoid Resistance

- Do not spray single products from the same group back to back!
 - Endura followed by Endura is a bad idea unless you tank-mix.
 - Quadris followed by Headline
- Do not spray a QoI without a mix partner!
 - Fungicide resistance
- Something new is not going to come along!
 - We will probably lose Endura for EB.

Take Home Message

- Good fungicide options:
 - Endura and Revus Top
 - Gavel
 - Bravo, QoI group
 - Dithane, Scala
 - Super Tin?
- Practice resistance management




Summary of Reports

www.millerresearch.com



	WM only	EB only	WM + EB	WM + EB + LB
Early July		Endura/Revus Top		
Mid July	Endura/Omega	Protectant		
Late July	Endura/Omega	Endura/Revus Top		
Early August		Protectant		
Mid August		Protectant		