



Research and Regulatory Update

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CEO/Technical Manager

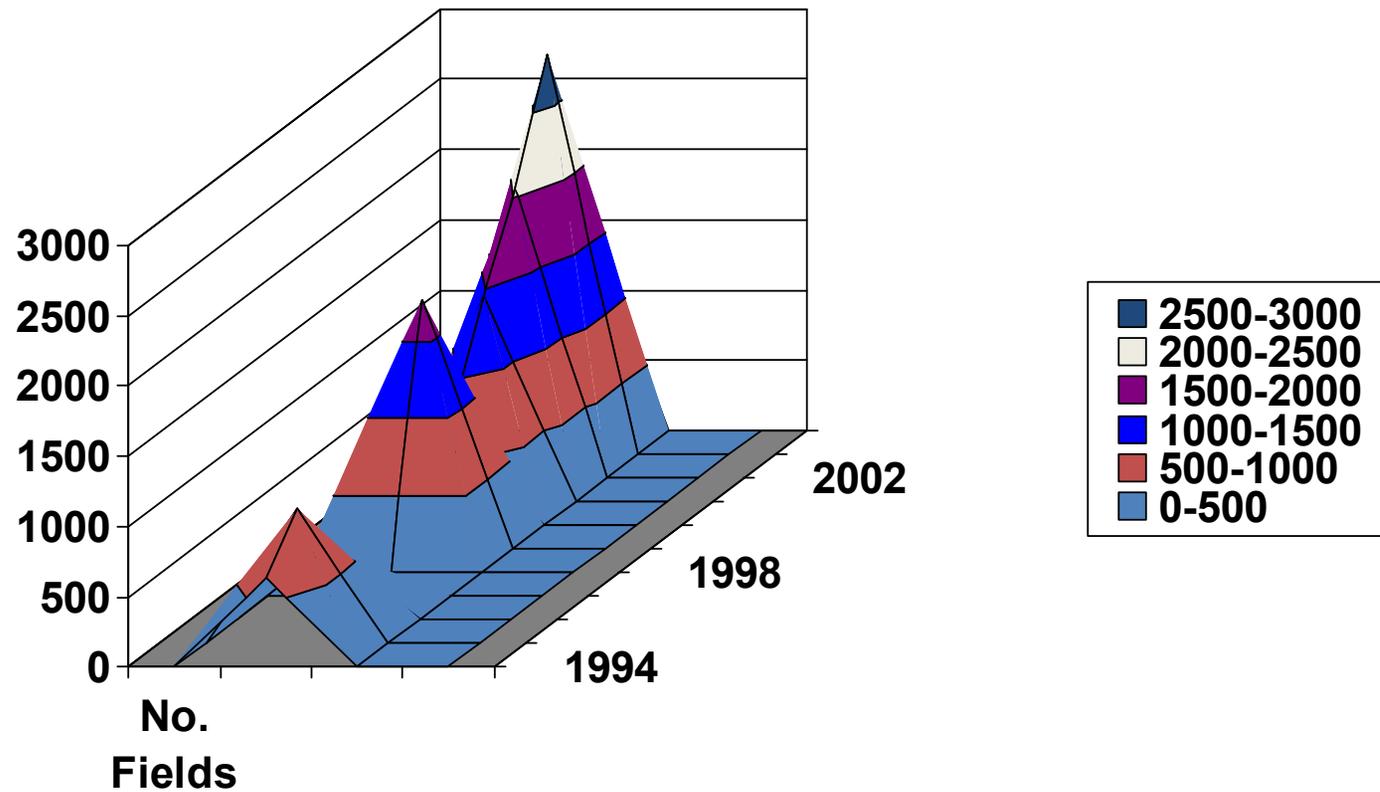
CA Garlic & Onion Research Advisory Board



WHITE ROT UPDATE

- Level of infection San Joaquin Valley
- Research Efforts
- Registration Status
- Grant-In-Aid Programs
 - CAGORAB
 - CADPR
 - USDA ARS

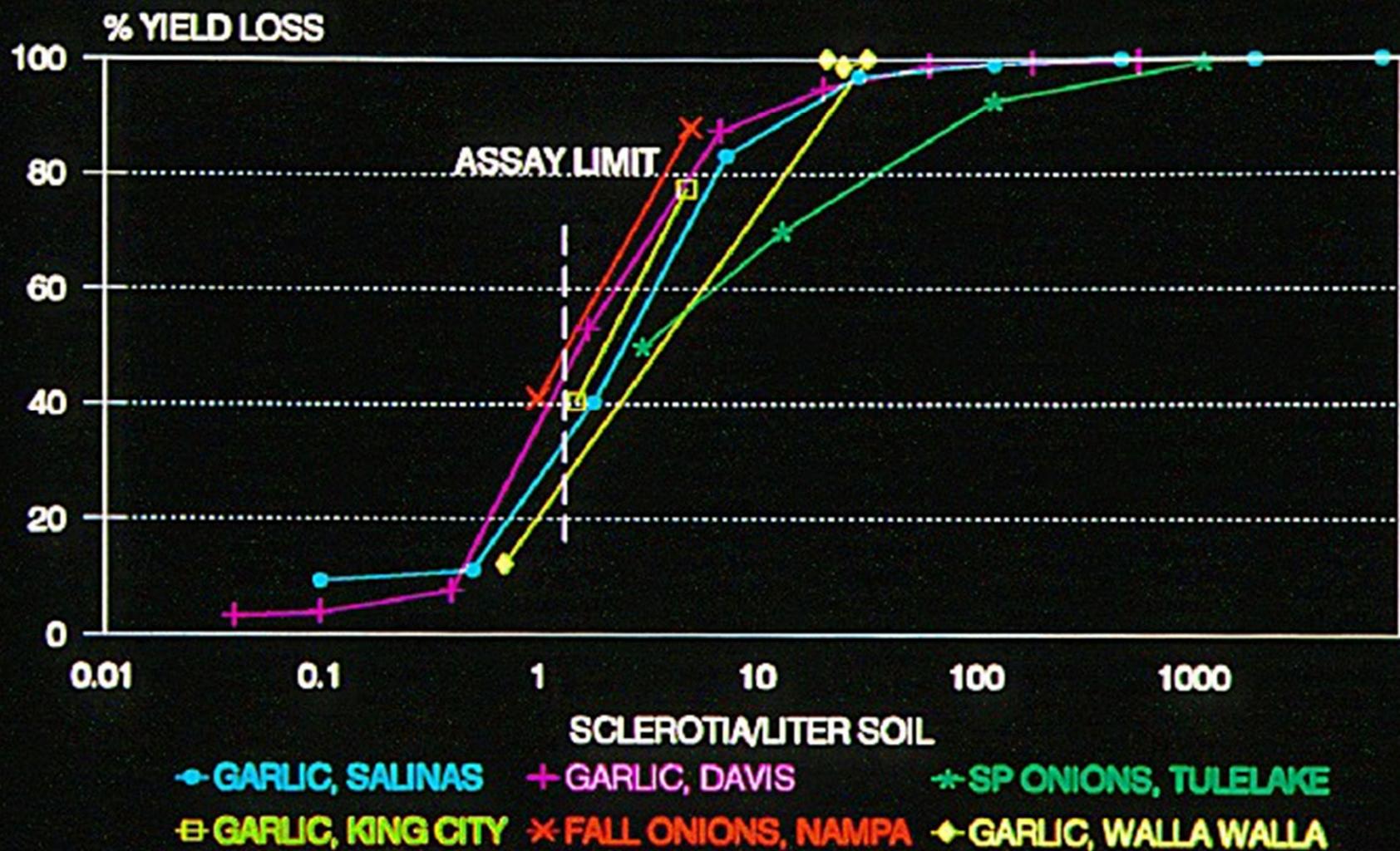
Summary of White Rot Strikes 1994-2009





WHITE ROT OF ONIONS & GARLIC

Inoculum Density Vs. Disease Loss



Data from F. Crowe, 1976-1992





Research Efforts White Rot

- **Breeding for resistance**
 - No significant gains through traditional breeding programs
- **Biotechnology**
 - NZ Partnership genome modification
 - In third year of cooperative program with Dr. Colin Eady, New Zealand Crop and Food Research Institute

GORAB Research Subcommittee

• Initial meetings in 2006 set research priorities

◦ Short term projects

- Pesticide testing
- Product registration
- Support of Westside white rot testing block - Diener Ranch

◦ Intermediate term

- IPM strategies for white rot

◦ Long range

- Increase research funding
- Genetic control of white rot



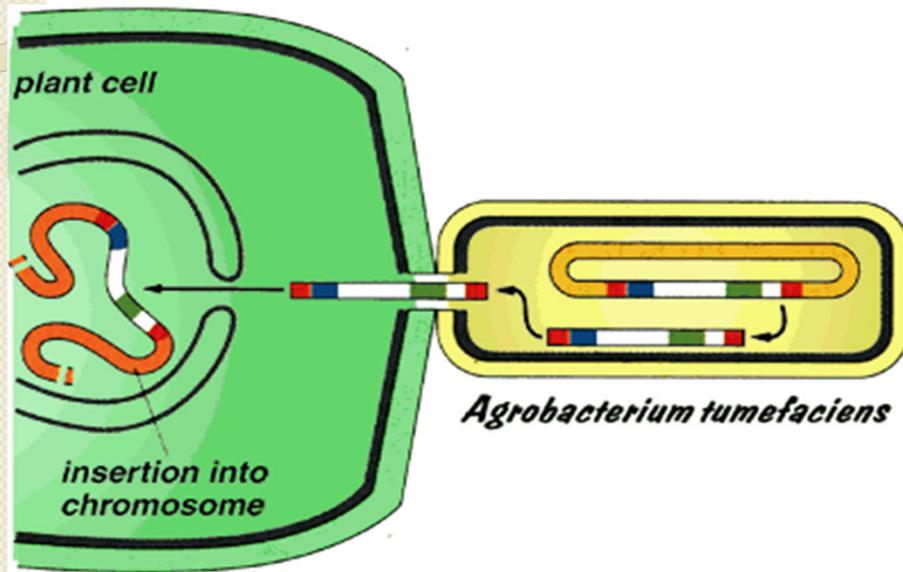
Prepared by:

Colin Eady 05.02.09

Assessment of a biotechnology approach for developing allium white rot resistant germplasm

What is transformation?

Agrobacterium-mediated DNA transfer

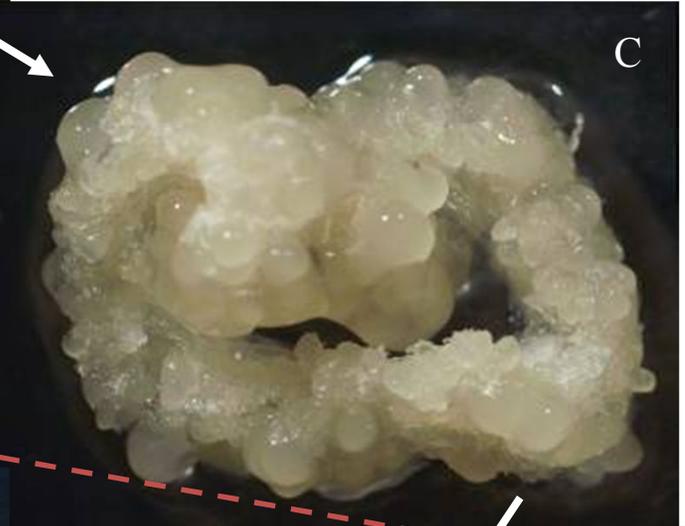


- In nature the bacteria transfers 2 genes to the plant
- In the lab the 2 genes are swapped with the genes conferring desirable traits
- 1983 first transgenic plant
- 1986 first field trial
- **1999 C&FR patent allium transformation**

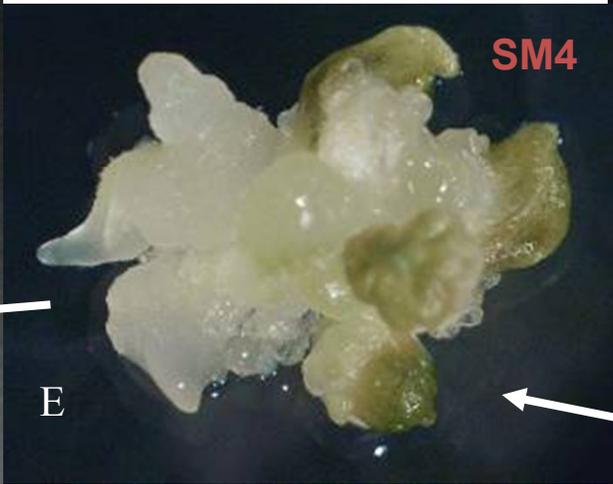
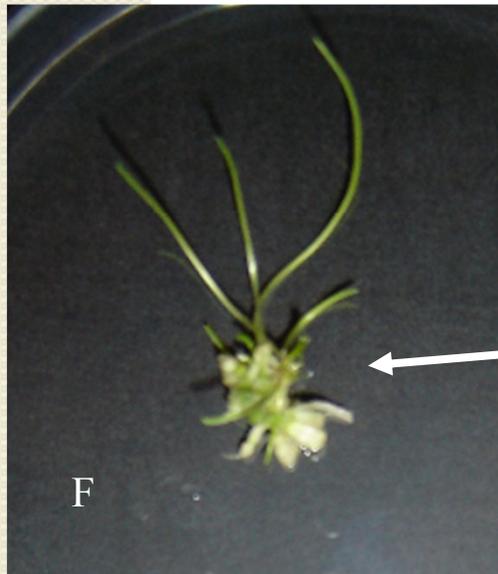


3 weeks

8 weeks (~50%)



P5-C



SM4



15 weeks (~15%)

12 weeks

10 weeks

Background



- Allium white rot (AWR) attacks by producing oxalic acid to kill the plant cells.
- If the plant could produce enzymes that degrade oxalic acid, this should in theory prevent host cell death and so prevent the fungus from invading.
- Three enzymes with the potential to do this have been investigated by inserting the genes for the enzymes into a model system, tobacco.
- The genes:
 - Wheat oxalate oxidase (*woxo*)
 - Barley oxalate oxidase (*boxo*)
 - Oxalate decarboxylase from *Flammulina* sp. (*OxDc*)



Results – Wheat (*woxo*) and Barley (*boxo*) oxalate oxidase constructs

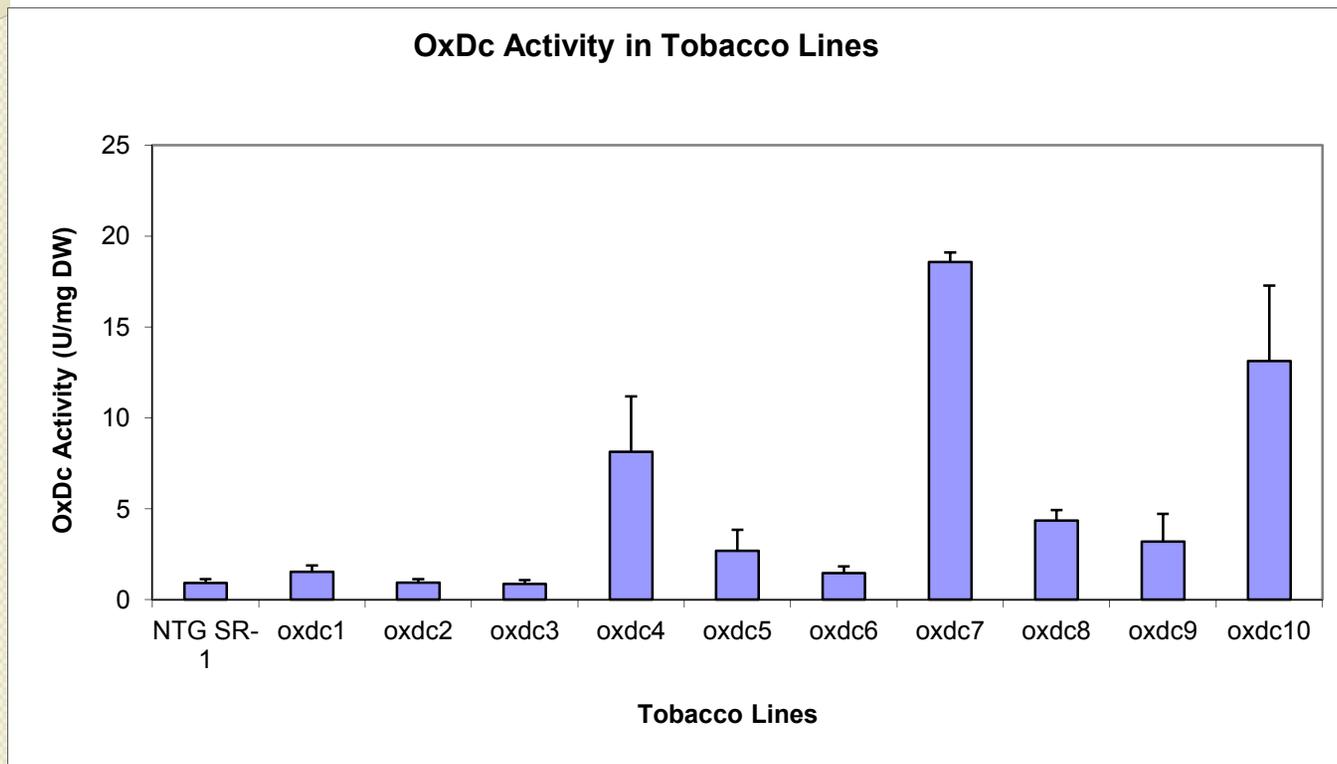
Woxo and *boxo* activity was observed in tobacco by adding oxalic acid and staining for the breakdown products. Plants which exhibited strong staining were used in infection studies with *S. sclerotiorum* a generalist white rot pathogen

S. sclerotiorum infection assays against oxalate oxidase tobacco.
– 4 days post infection – No resistance



Results - Oxalate decarboxylase (*OxDc*) constructs

Ten transgenic tobacco lines were evaluated.
All showed some *OxDc* activity.

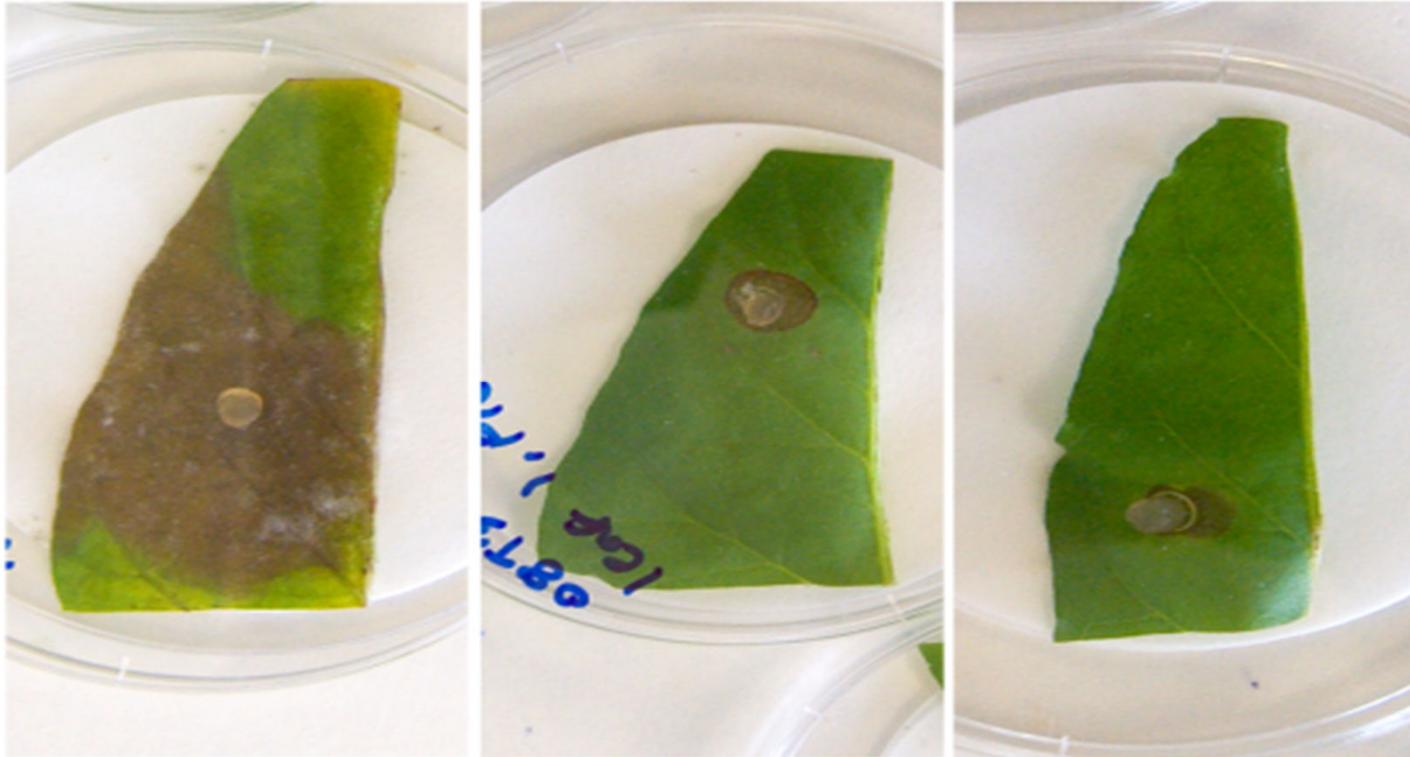


High expressing lines were evaluated in infection assays

S. sclerotiorum infection assays against oxalate decarboxylase tobacco

- 4 days post infection – Excellent resistance

Control tobacco OxDc tobacco #5 OxDc tobacco #10



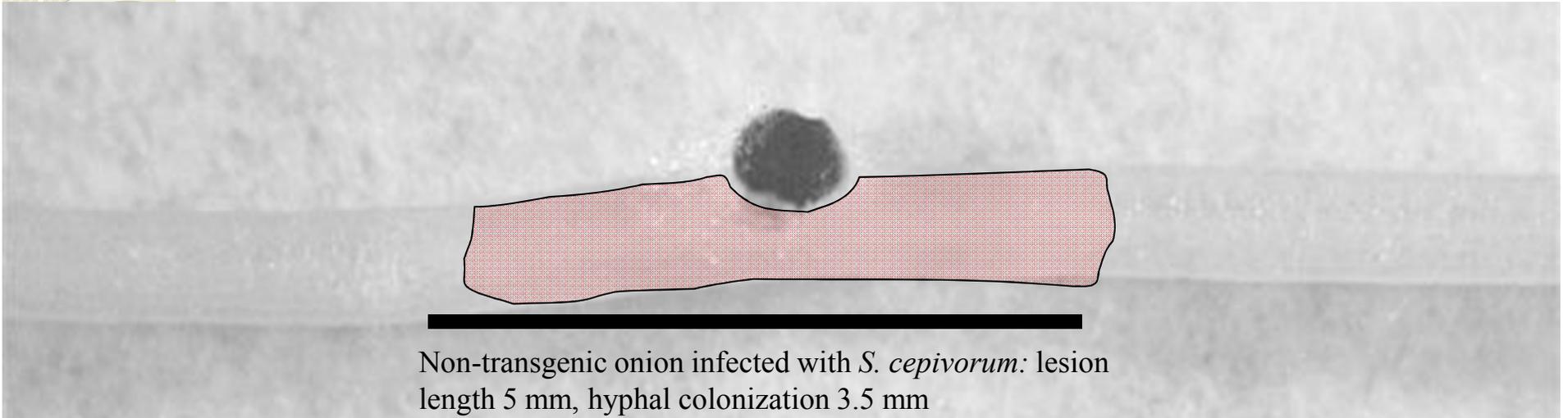
Summary



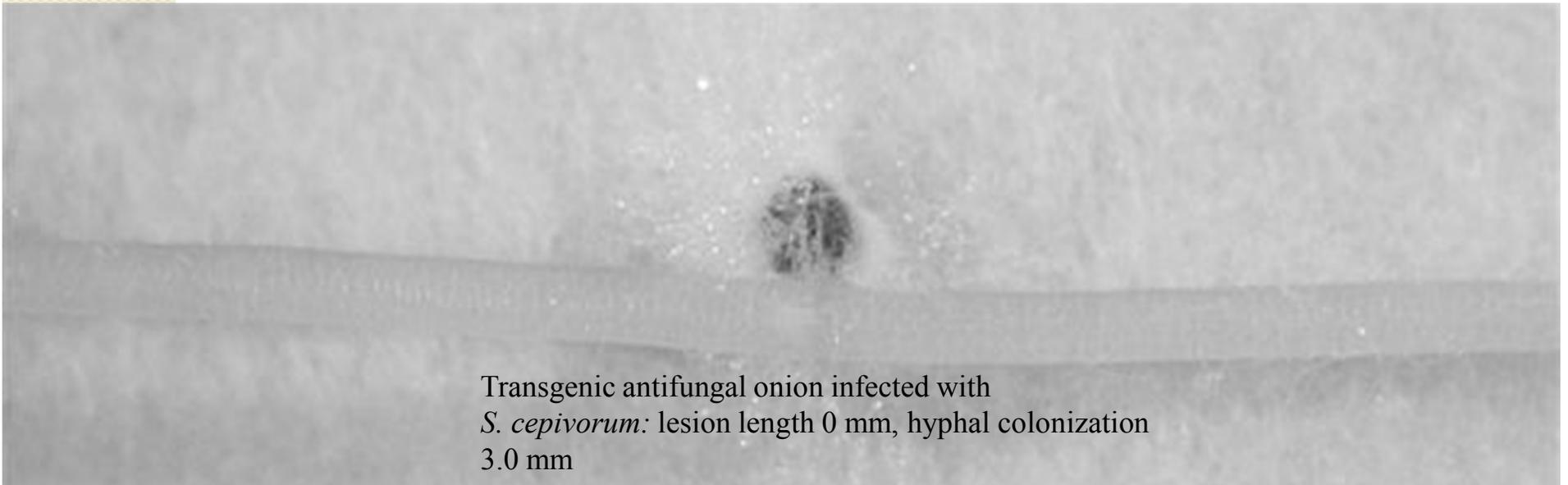
- *OxDc* expressing tobacco gave almost complete resistance to *S.sclerotiorum*.
- This indicates it is a good gene to test in *Alliums*
- The first garlic plants containing this gene are currently in our containment glasshouse and will soon be ready for infection assays with AWR.



24hr after white rot infection



Non-transgenic onion infected with *S. cepivorum*: lesion length 5 mm, hyphal colonization 3.5 mm



Transgenic antifungal onion infected with *S. cepivorum*: lesion length 0 mm, hyphal colonization 3.0 mm

The New Zealand Institute for Plant & Food Research Limited

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WHITE ROT2009/10 RESEARCH

- COOPERATORS
 - Chemical and Biostimulant Control
 - Mike Davis (UCDavis)
 - Harry Carlson (Tulelake UCCE)
 - Tom Turini (Fresno County)
 - Kurt Hembree (Fresno County)
 - Application Engineering
 - Ken Giles (UCDavis Ag Engineering Dept)
 - Biotechnology
 - Colin Eady, New Zealand Crop and Food Research Inst.
- ANNUAL GIA BUDGET: \$80K
- CADPR Grant: DADS implementation \$40K (in second year)
- NV Garlic & Onion Research Board \$10K





Registration

- Folicur (tebuconazole)
 - Registration work through IR-4/Bayer
 - Project started 1999 for garlic rust onlyUSEPA PRA Date was May 30, 2008
- Proposed Uses
 - Dry bulb onion, garlic, elephant garlic, shallot
- Disease
 - White rot (*Sclerotium cepivorum*)
 - Rust (*Puccinia allii*)
 - Purple blotch (*Alternaria porii*)
- Rates:
 - 20.5 fl oz/A in 4-6 inch band (white rot)
 - 4-6 fl oz/acre for rust and purple blotch
 - Max 32.5 oz/A if in-furrow treatment made
- PHI: 7 days





Garlic Rust Management

- First observed CA 1934
- Severe outbreak spring 1998
- Obtained Section 18 for Folicur 1999 and have continued that 18 for 7 years (except 2003)
- Azoxystrobin (Quadris) is only registered compound for use on garlic rust. It is preventative
- Only Folicur (tebuconazole) can reach back and control infection once observed
- CA DPR Registration pending (in posting for March 3, 2009 issuance)







IYSP Cooperative Project

- Researchers:
 - Hanu Pappu (WA State Univ. Virology)
 - Eric Natwick (UCCE Imperial Valley)
 - Joe Nunez (UCCE Kern County)
 - Tom Turini (UCCE Fresno County)
 - Mike Davis (UC Extension Pathologist, Davis)
 - Howard Schwartz (Colorado State Univ.)



Seed Corn Maggot

- Submitted Section 18 for use of Poncho as a seed treatment (No. CA & Klamath Basin)
- Issued December 19, 2008
- Valid until March 15, 2009
- Rate: 50 gms ai/kg seed (1 gal/100 lbs)
- Processors working with seed treaters
- Researchers: Joe Nunez (Kern County) & Harry Carlson (UCCE Tulelake)





QUESTIONS???

THANKS FOR YOUR TIME