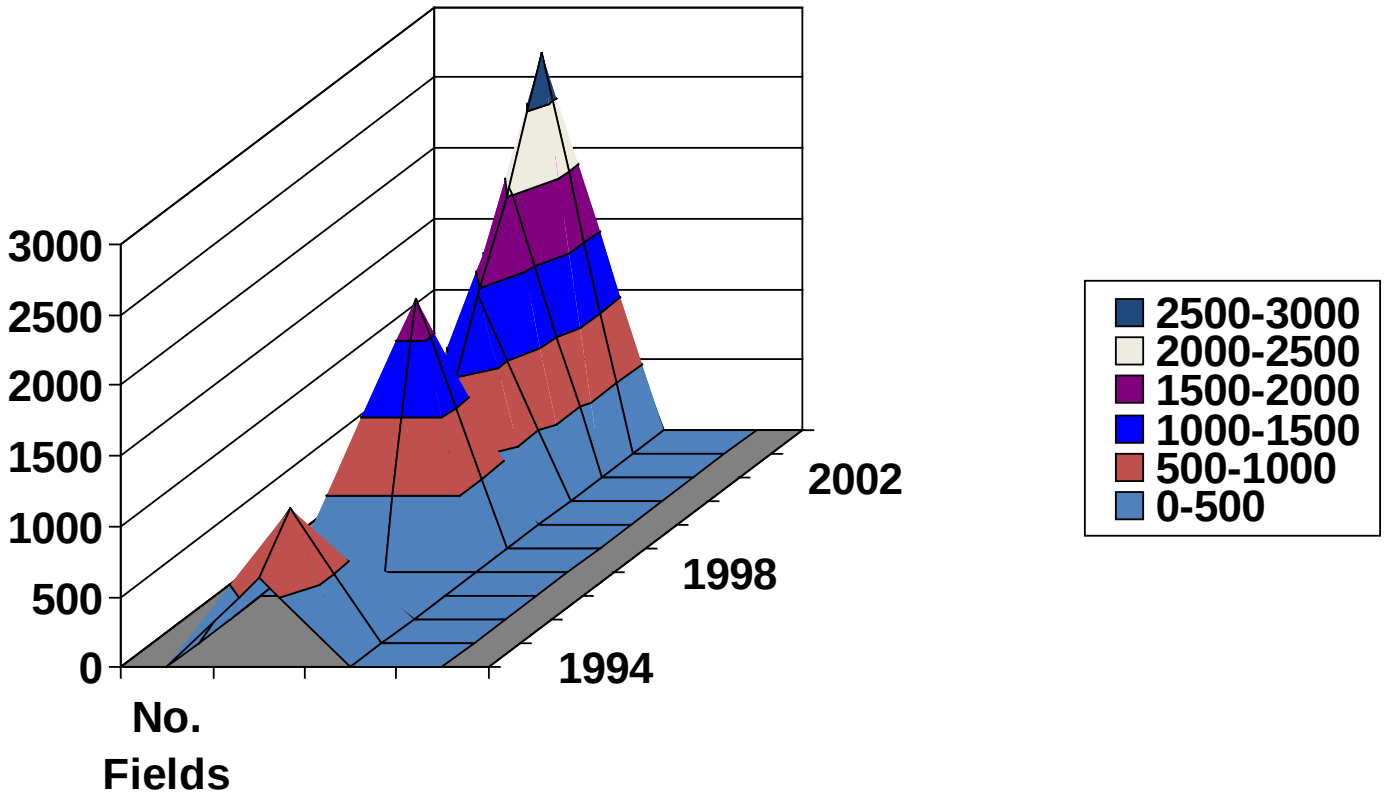
Research and Regulatory Update

Bob Ehn
CEO/Technical Manager
CA Garlic & Onion Research Advisory Board

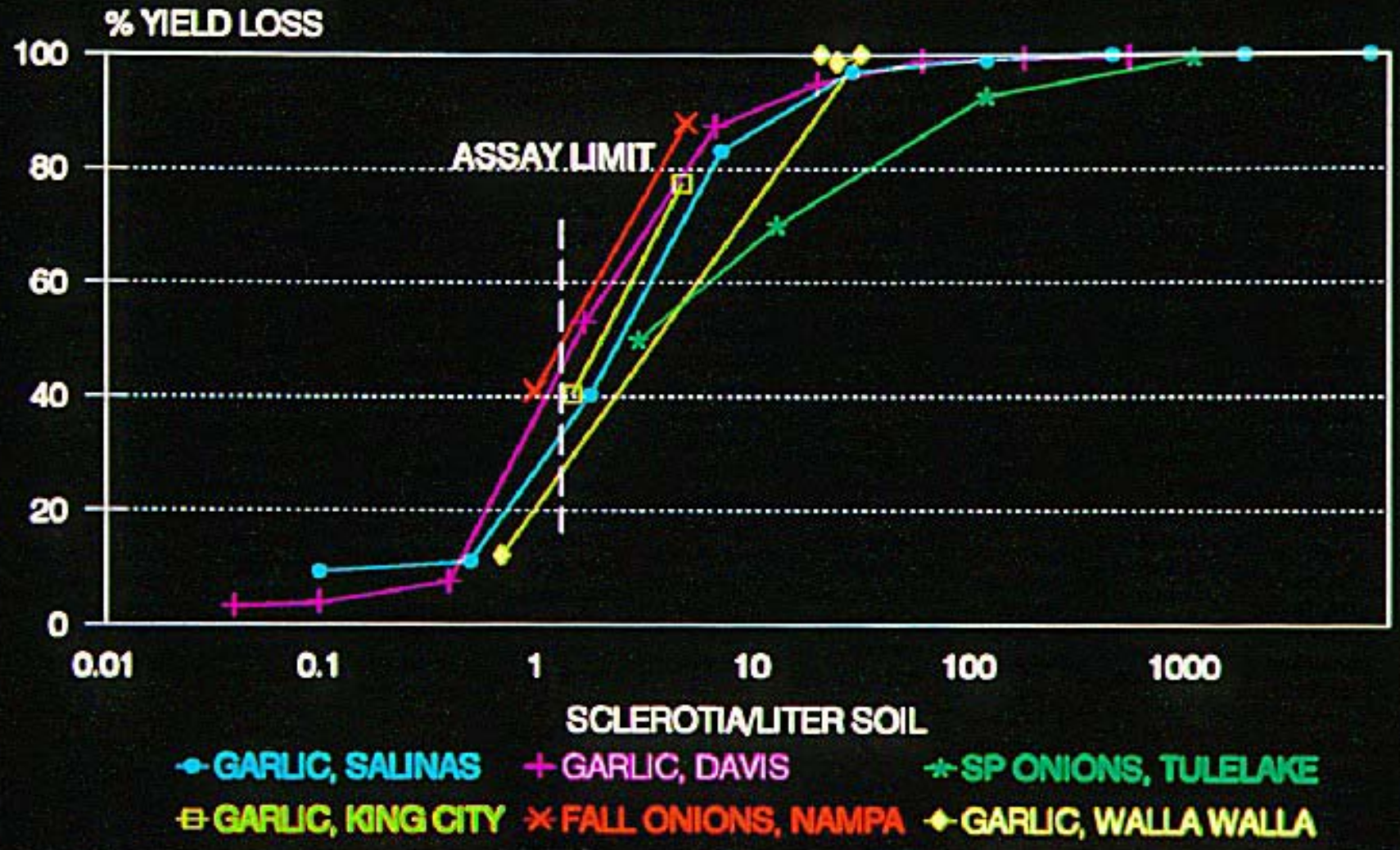
WHITE ROT UPDATE

- 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

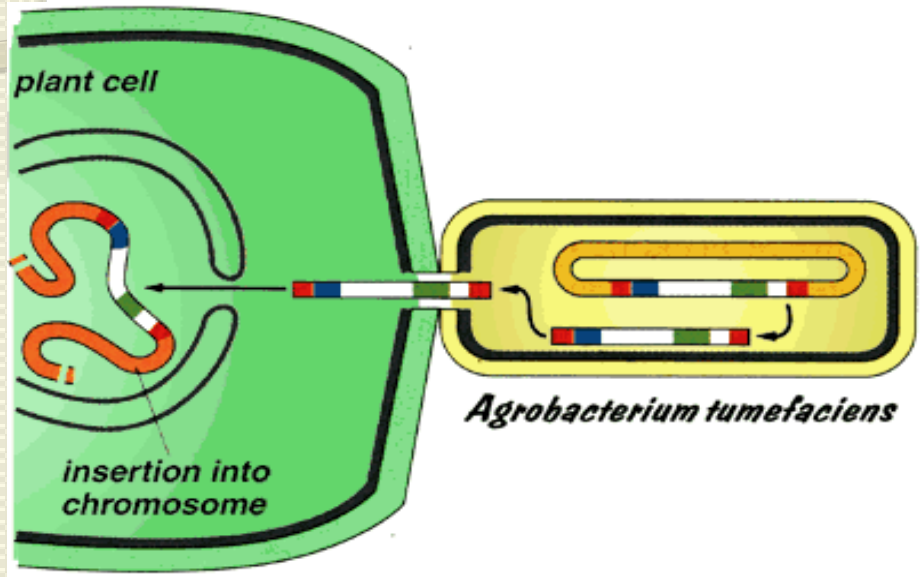
- Initial meetings in 2006 set research priorities
  - Short term projects
    - Pesticide testing
    - Product registration
    - Support of Westside white rot testing block - Diener Ranch
  - Intermediate term
    - IPM strategies for white rot
  - Long range
    - Increase research funding
    - Genetic control of white rot

Prepared by:

Colin Eady 05.02.09

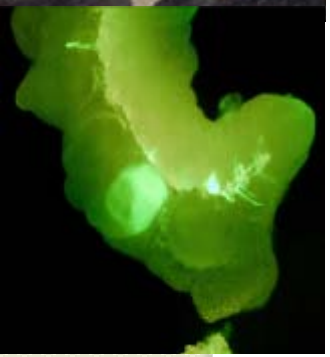
Assessment of a biotechnology approach for developing allium white rot resistant germplasm

What is transformation?
Agrobacterium-mediated DNA transfer



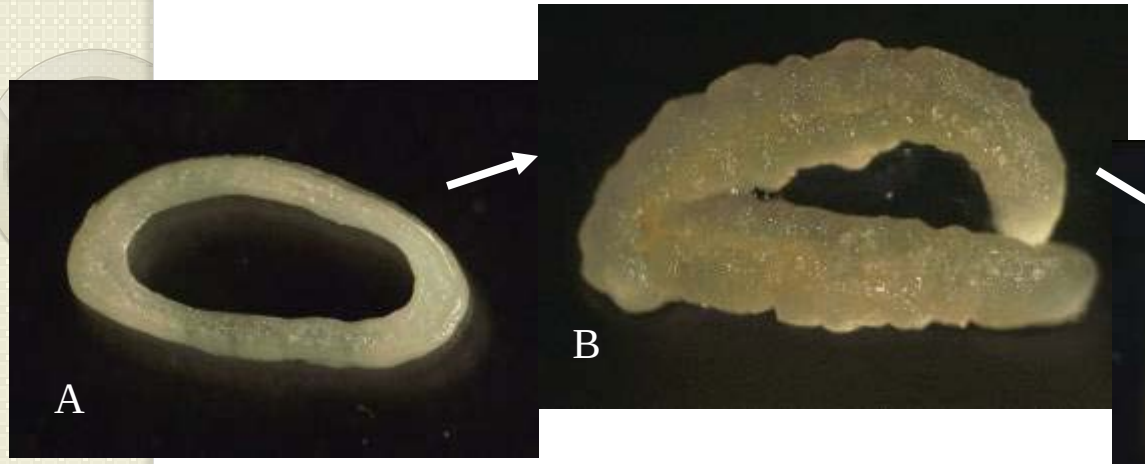
- In nature the bacteria transfers 2 genes to the plant
- In the lab the 2 genes are swapped with the genes conferring desirable traits

- 1983 first transgenic plant
- 1986 first field trial
- **1999 C&FR patent allium transformation**

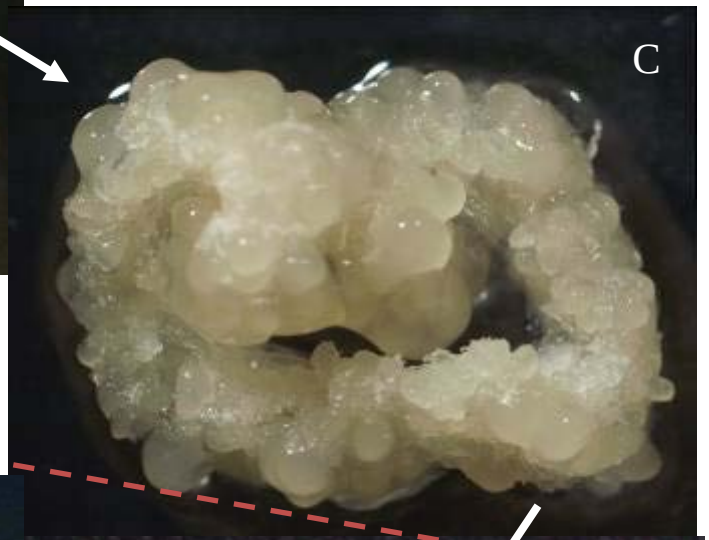


Progress towards an efficient transformation system for garlic

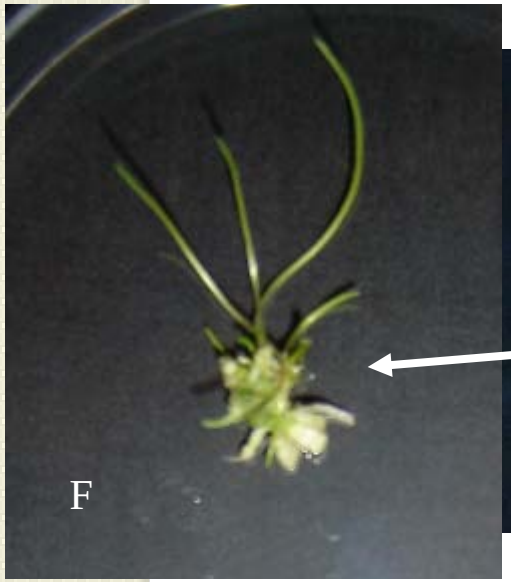
3 weeks

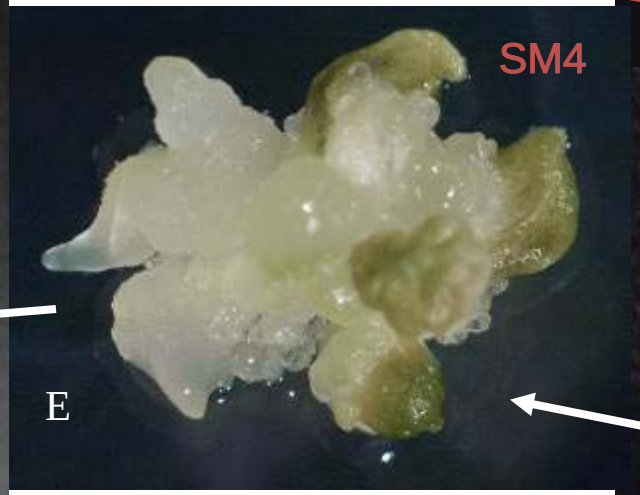


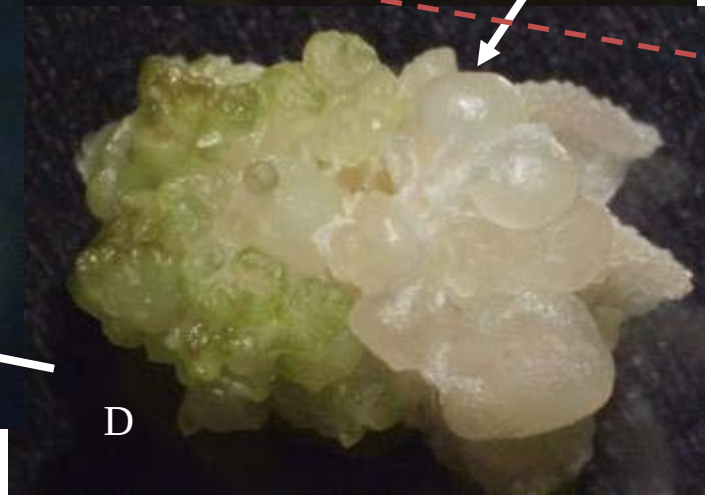
8 weeks (~50%)



P5-C







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

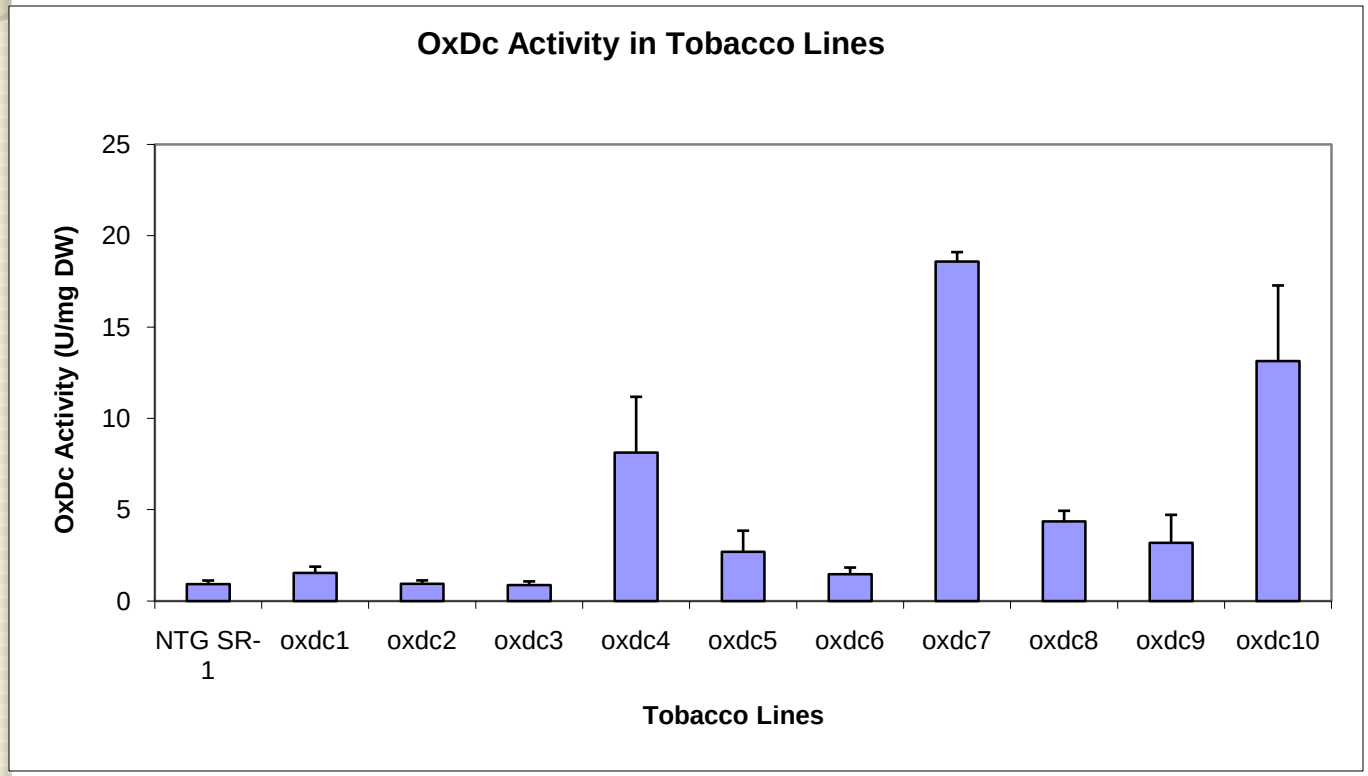
Woxo and *boxo* activity was observed in tobacco by adding oxalic acid and staining for the breakdown products. Plants which exhibited strong staining were used in infection studies with *S. sclerotiorum* a generalist white rot pathogen

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.

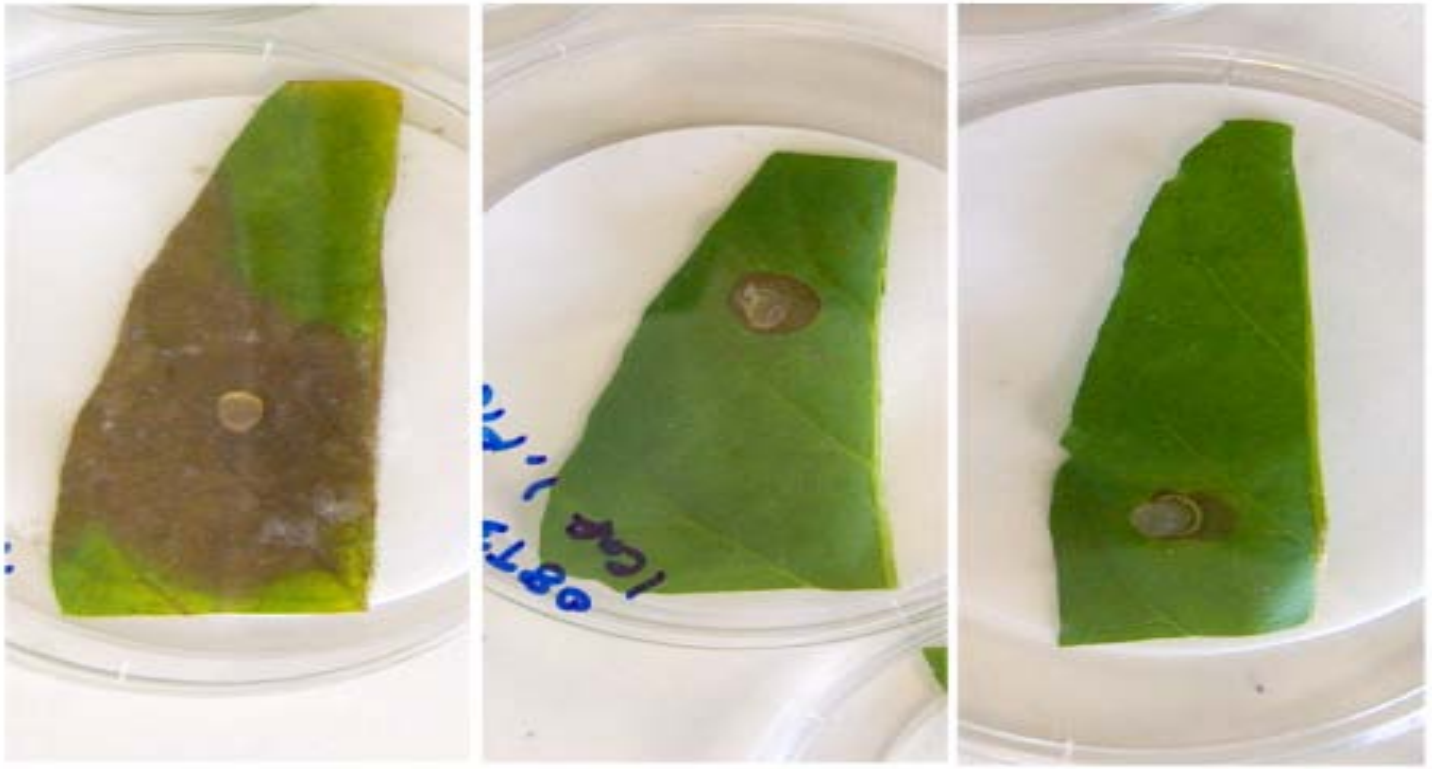
All showed some *OxDc* activity.



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**



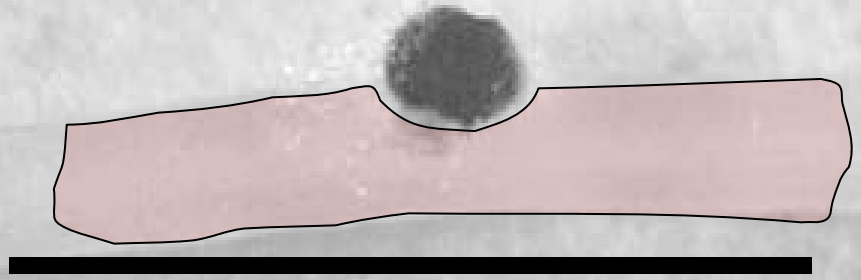
Summary

- *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

Bio-Protection



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

Plant & Food RESEARCH

RANGAHAU AHUMĀRA KAI

www.plantandfood.com

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

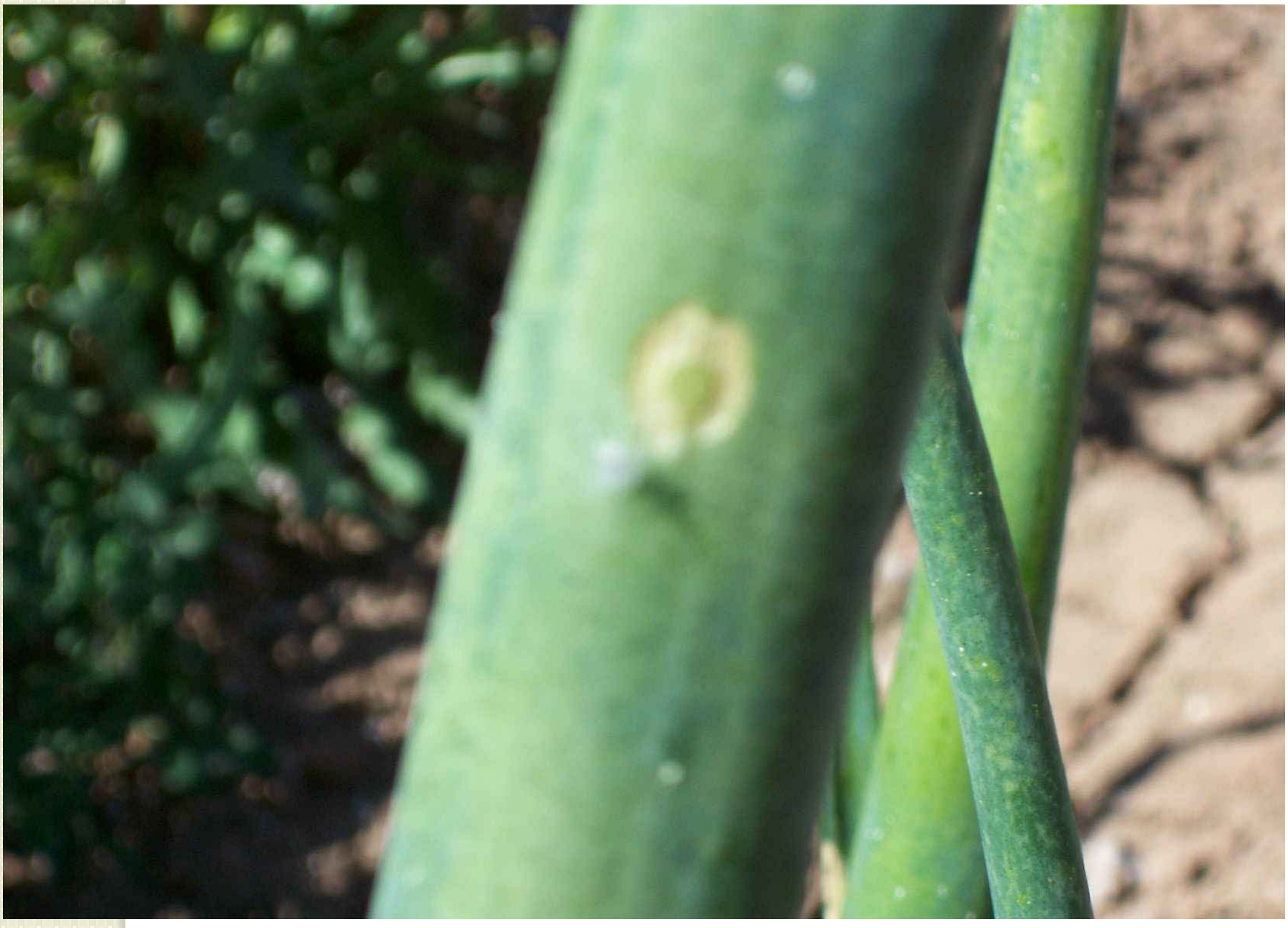
Registration

- Folicur (tebuconazole)
  - Registration work through IR-4/Bayer
  - Project started 1999 for garlic rust only

  USEPA PRIA Date was May 30, 2008
- Proposed Uses
  - Dry bulb onion, garlic, elephant garlic, shallot
- Disease
  - White rot (Sclerotium cepivorum)
  - Rust (Puccinia allii)
  - Pruple 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 Pathogist, 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)


NO FOLICUR

QUESTIONS???

THANKS FOR YOUR TIME