

The Impact of Mustard Cover Crop Rotations with Lettuce on the Incidence of Lettuce Drop Caused by *Sclerotinia minor*

**Richard Smith, Tiffany Bensen, Krishna Subbarao,
Steve Koike and Steve Fennimore
University of California, Salinas, CA, USA**

Background on the Salinas Valley:

Agricultural production is worth \$3.3 billion. Lettuce is worth \$900 million. Produces 90% of US lettuce from spring to fall.



Background on the Salinas Valley

- Lettuce is the main economically viable vegetable crop in the Salinas Valley
- Two crops/year are typical
- Broccoli is the main rotational crop and it has been shown to be effective in reducing some soilborne diseases of lettuce (biofumigation???)
- Broccoli is not susceptible to *S. minor**

* after 5 weeks of age

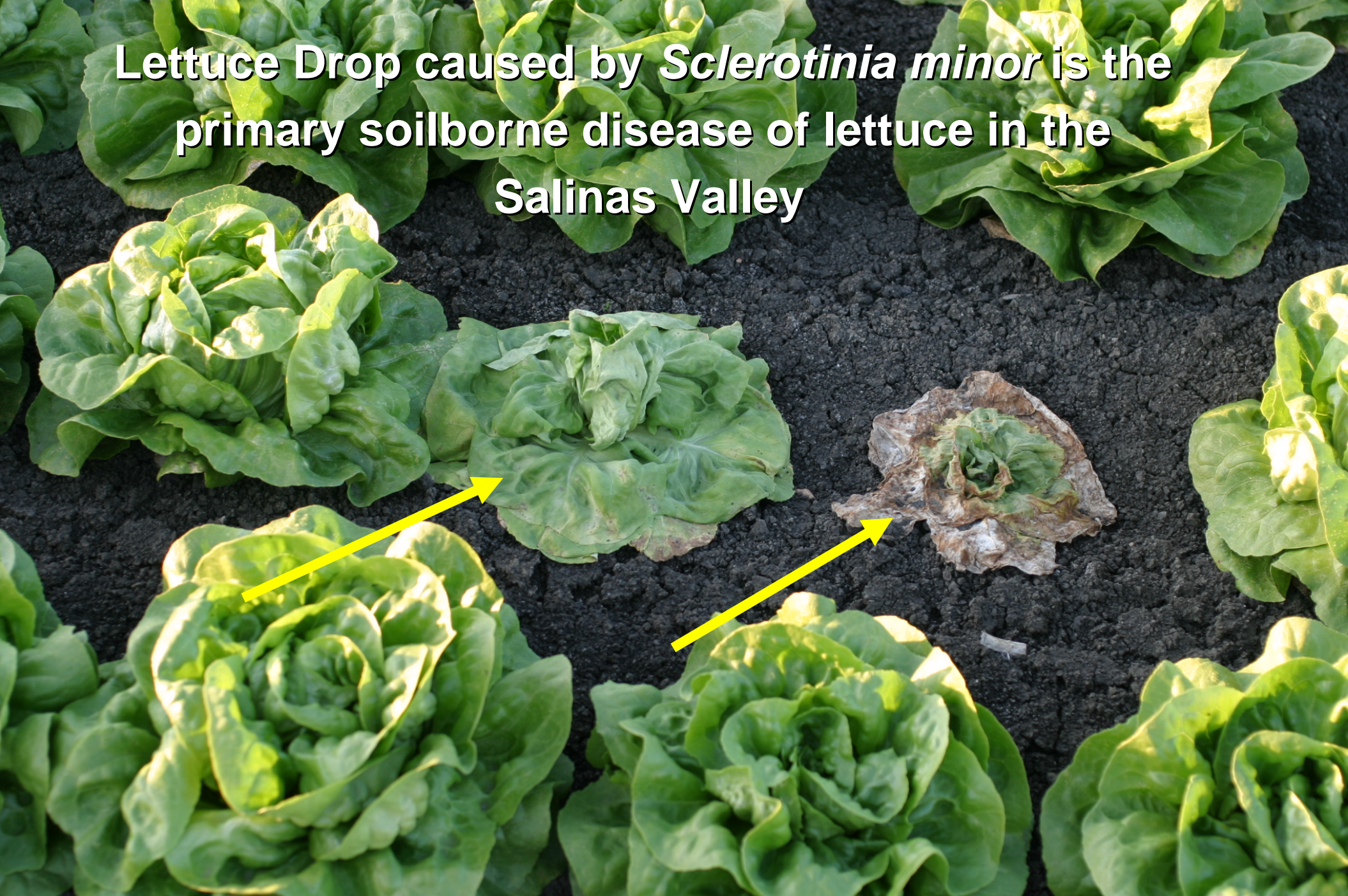
**Given the limited acres of broccoli relative to lettuce
there are many lettuce-lettuce rotations**

149,000 Acres of Lettuce

39,000 Acres of Broccoli



Lettuce Drop caused by *Sclerotinia minor* is the primary soilborne disease of lettuce in the Salinas Valley



Background on the Salinas Valley

- Mustard cover crops were enthusiastically welcomed to the Salinas Valley
- They have primarily been used in the fall following two crops of lettuce (grown for 60 days – August to September) and incorporated prior to the onset of winter (quick rotation)
- The hope was that this would provide control of *Sclerotinia minor* similar to broccoli



Primary cover crops utilized by growers include:

- ***Brassica juncea***
(‘Pacific Gold’ and ‘Caliente’ varieties)
- ***Sinapis alba***
(‘IdaGold’)

Our Research Project

Determine the effectiveness of Brassica cover crops to reduce the incidence of lettuce drop caused by *Sclerotinia minor* in lettuce production.

Sclerotinia Evaluations

1. Evaluated the susceptibility of the commonly used cover crop species to *S. minor*
2. Initiated a two-year rotational plot
3. Conducted seven short-term trials

Variety	Species	30 days	60 days	80 days
PacificGold	B. Juncea	D	D	H
IdaGold	S. alba	D	D	D
Martigena	S. alba	D	D	D
Nematrap	S. alba	D	D	H
Caliente 105	S. alba and B. juncea	D	D	D
<u>Humus</u>	B. napus	H	H	H

***Brassica juncea* Susceptibility
to *Sclerotinia minor* in the Field**



Sclerotia

Mycelia

Sclerotia



Notable Sclerotia production



Mustard Cover Crop Susceptibility to *Sclerotinia minor*

- **Sclerotinia infections on mustards appear to vary in severity depending upon weather conditions**
- **Cover crop infection by *Sclerotinia* is a highly undesirable characteristic of mustard cover crops**
- **It raises the question: does the build up of *Sclerotinia* on the cover crop over shadow potential reductions by biofumigation?**

Two Year Cover Crop Rotational Plot

Broccoli Bare White Mustard Indian Mustard Rye

- Each plot was 0.25 ha
- The cover crops were grown for two years in the fall on the same location
- They were incorporated in early winter
- Two head lettuce crops were grown in the subsequent growing seasons and evaluated for infection by *S. minor*

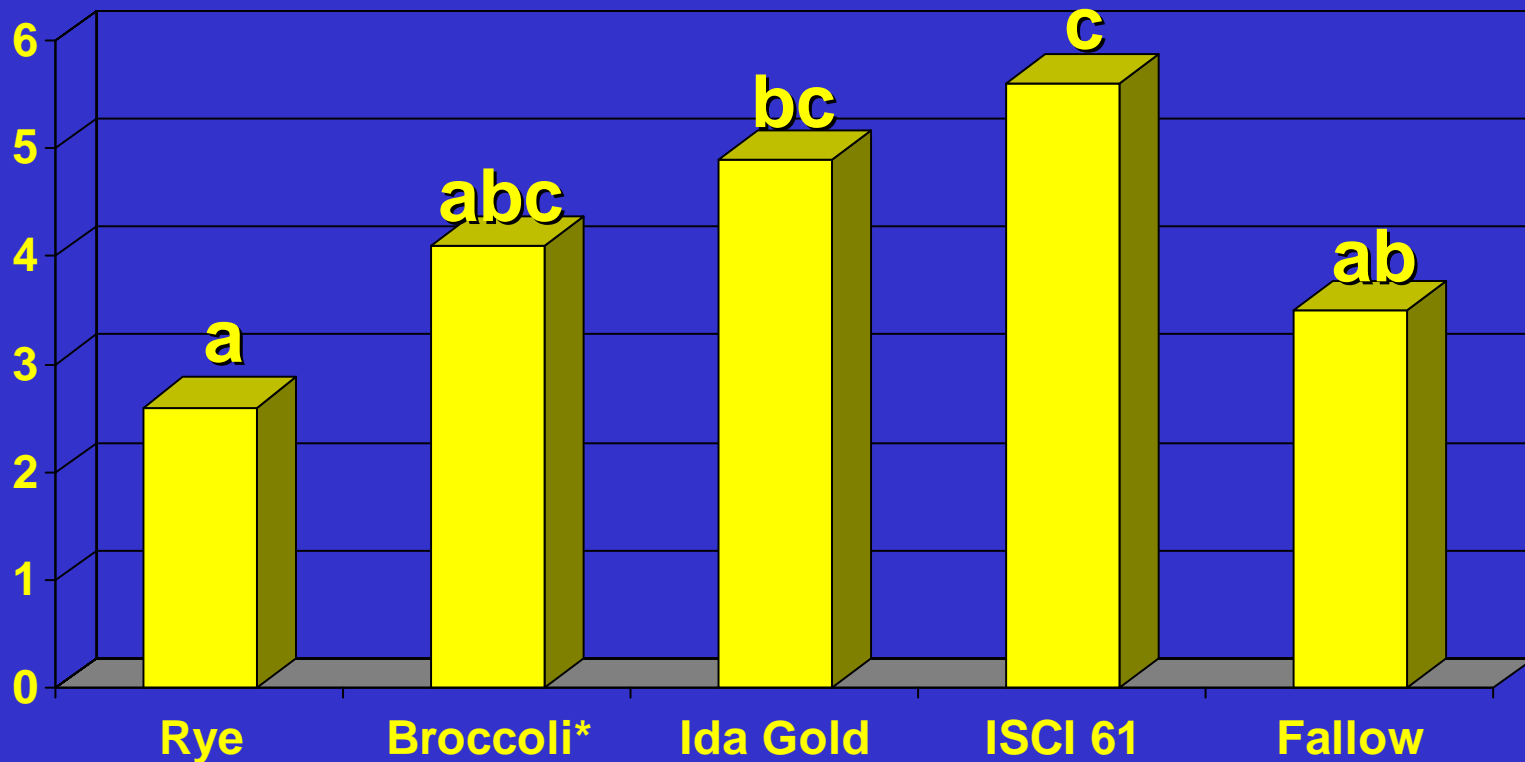
Sclerotinia Evaluations

- **Soil Sclerotia**
 - **No differences were observed in soil sclerotia counts among treatments**

Infection by *S. minor* on Subsequent Lettuce

Treatment	Spring 2004	Summer 2004	Spring 2005	Summer 2005
Rye	1.8	0.8	1.0	2.6
Broccoli	2.7	1.0	2.2	4.1
Ida Gold	2.7	1.0	1.5	4.9
ISCI 61	2.3	1.0	1.5	5.6
Fallow	2.6	0.7	1.9	3.5
LSD (0.05)	NS	NS	NS	1.5

Percent Infection by *S. minor* on Summer Lettuce Crop, 2005



* Did not grow well

Short-term Cover Crop Trials



**Conducted with cooperating growers
That were growing mustard cover crops
and that allowed us to put uncover cropped areas for
comparison**

Typical flail chopping of mustard (potential for volatilization)



Subsequent lettuce planting



Soil Sclerotia and Lettuce Infection

Summary of Seven Trials

Treatment	Soil Sclerotia		Infected heads (percent)
	Pre cover crop	Post cover crop	
Mustard	27.7	9.2	2.8
Bare	17.7	9.6	4.9
<i>LSD (0.05)</i>	<i>NS</i>	<i>NS</i>	<i>0.4</i>

Mustard Cover Crop Impacts on Infection of *Sclerotinia minor* on Lettuce

- These studies indicate that mustard cover crops can slightly reduce infection of *S. minor* on lettuce, but can also increase *S. minor* infection.

Mustard Cover Crop Impacts on Infection of *Sclerotinia minor* on Lettuce

- The increased infection by *S. minor* on lettuce could be due to increased production of *S. minor* on the mustards themselves
- However, we only measured marginally higher soil sclerotia in one trial

Cover Crop Treatments	Nov. 6, 03
Cereal Rye 'Merced'	1.2
Broccoli 'DiCicco'	3.0
White Mustard 'Ida Gold'	1.5
Indian Mustard 'ISCI 61'	7.3
Bare Fallow	2.2

Mustard Cover Crop Rotational Plot

Biofumigant Content in Tops

Cover Crop Treatment	Glucosinolate μmoles/g dry tissue	Vapam Equivalent Liters/ha
Merced Rye	----	----
White Mustard	15.8	21.5
Indian Mustard	15.7	16.0

Vapam Equivalency of Mustard Cover Crops

- **Label rates for Vapam are in the range of 351 to 701 liters/ha**
- **The equivalent quantity of methy isothiocyanates (biofumigant constituent) in mustard cover crops that we measured in the rotation plot was a fraction of what is commercially applied: 19 – 47 liters/ha**

Summary

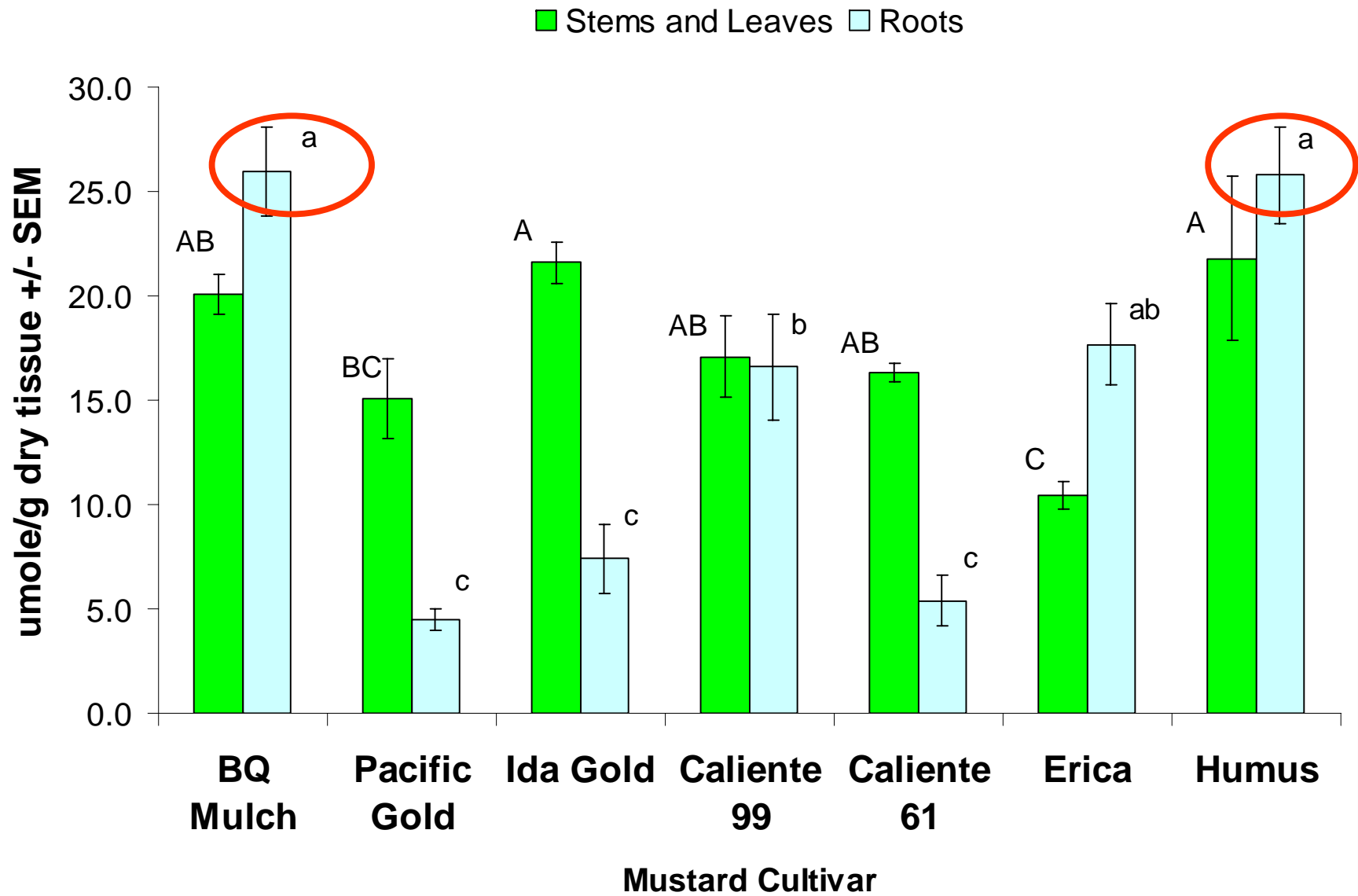
- Mustard cover crops did not reduce *S. minor* like broccoli
- Why is not entirely certain, but their susceptibility to *S. minor* could be a factor
- In addition, the levels of isothiocyanates that we measured in these cover crop trials were modest in comparison to labeled applications of methyl isothiocyanate

Summary

- **We observed reduced infection with 'Merced' rye.**
- **This may provide evidence that the suppression of soilborne diseases may partially be a soil microbiological**

Current Work

- In the studies just reported, we measured glucosinolate content of the cover crop tops only
- In current studies:
 - Screening various varieties
 - Measuring glucosinolate content of the tops and roots (do the roots significantly contribute to biofumigation and more efficiently deliver the biofumigant to the soil?)



Conclusions

- Mustard cover crops did not dramatically reduce the incidence of *S. minor* in these studies
- The susceptibility of the mustards to *S. minor* is problematic
- The continued development of higher glucosinolate content varieties may improve the level of control of soilborne diseases in the future
- Cultural practices may also have a role in increasing the impact of mustards

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