

# Fusarium wilt of lettuce in Arizona

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# Fusarium wilt of lettuce



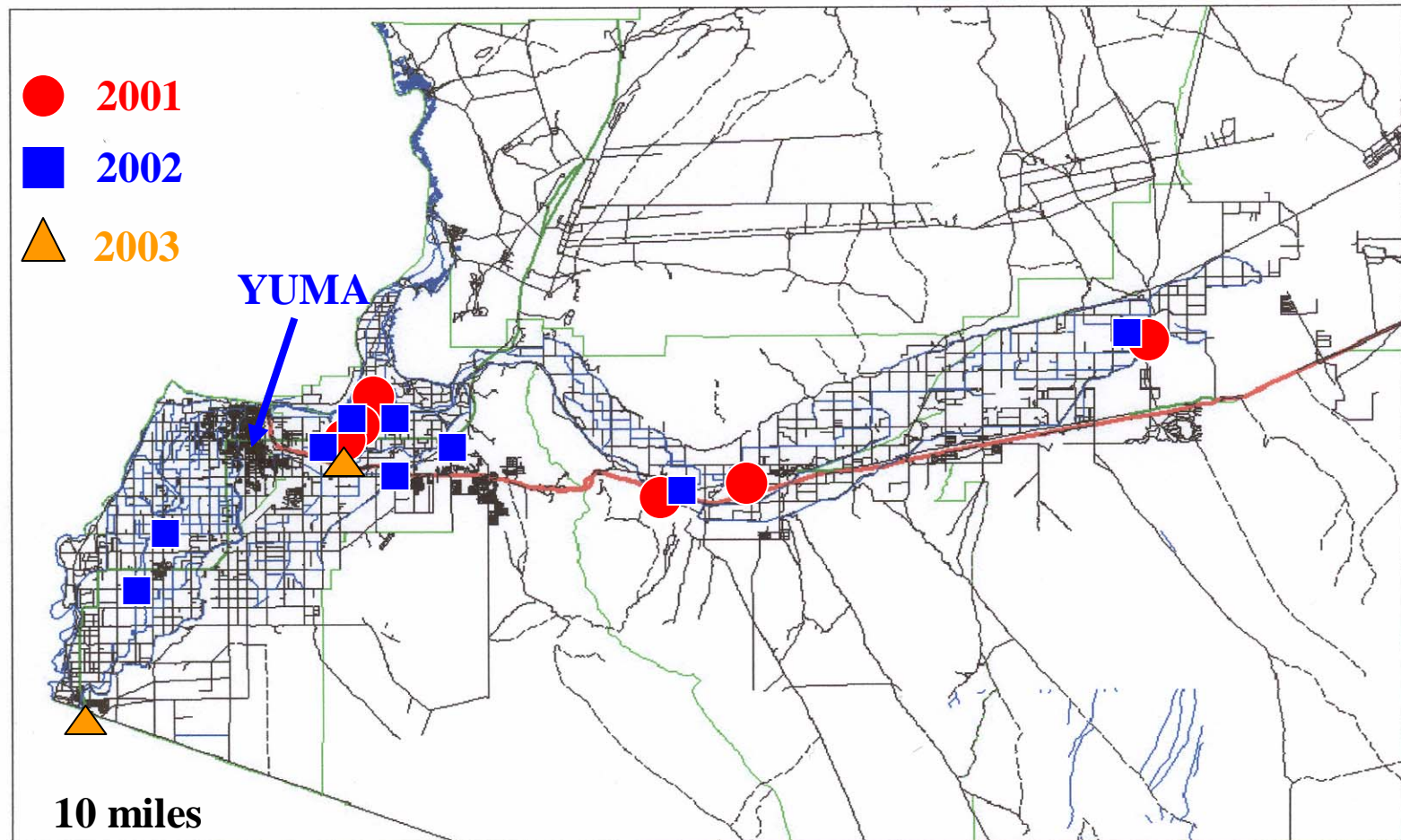
# **Fusarium wilt (root rot) of lettuce:**

- 1955 - First found on lettuce in Japan
- 1990 - USA; California; Fresno County (Huron)
- 1995 - Iran
- 1998 - Taiwan
- 2001 - USA; Arizona; 6 fields
- 2002 - Italy

# Fusarium wilt of lettuce in Yuma

- 2001 - *Fusarium oxysporum* was recovered from lettuce in 6 different fields
- 2002 - 11 new fields
- 2003 - 10 new fields (includes one site in Bard, CA)
- 2004 - ??

# Yuma County fields containing *Fusarium oxysporum* f. sp. *lactucae*



# *Fusarium oxysporum*

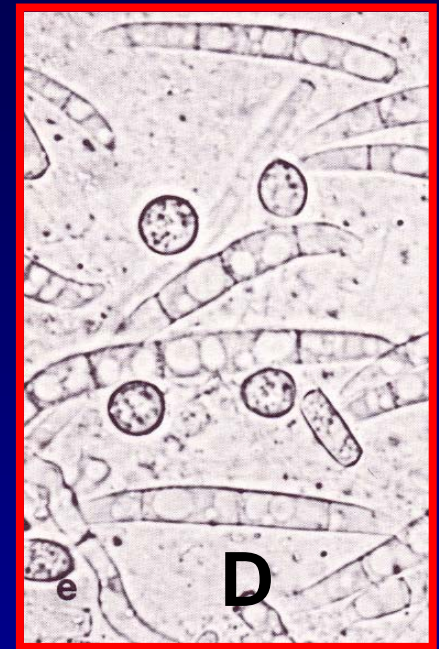
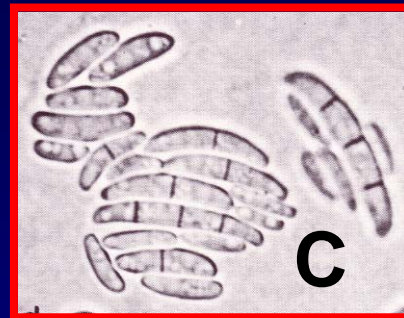
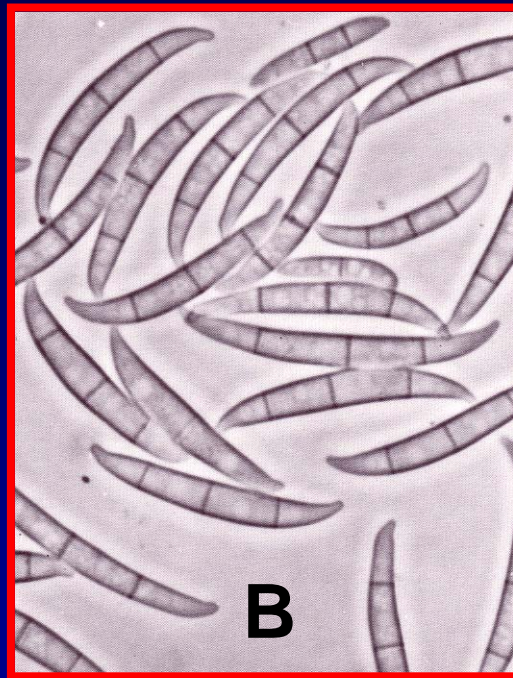
- Comprises 40 to 70% of the total *Fusarium* population in soil
- Very active saprophyte (nonpathogenic phase).
- When pathogenic, it primarily causes symptoms of wilt and sometimes root rot
- There are over 100 different formae speciales of *Fusarium oxysporum*

# What is a formae specialis?

- This is a sub-species categorization based on physiological or biochemical characteristics, particularly with respect to pathogenicity and host range
- The full name for the lettuce pathogen is *Fusarium oxysporum* f.sp. *lactucae*



# *Fusarium oxysporum*



**A = mycelium growing on agar**

**B = macroconidia**

**C = microconidia**

**D = chlamydospores + macroconidia**



**How do you know if you have  
*Fusarium oxysporum* f. sp. *lactucae*  
in your field?**

# Symptoms of Fusarium wilt on lettuce



# Symptoms of Fusarium wilt on lettuce

- Seedling stage

- Death of some plants
- Red streak through the cortex of the crown and upper root

- Older plants

- Brown streaks in the vascular system of the crown
- Reddish brown discoloration of the crown and upper root cortex



**In 1993, Hubbard and Gerik published the results of their work with the lettuce *Fusarium* pathogen in California**

- The pathogen grows between 46 and 89 F, with optimum growth at 82 F
- Lettuce is not susceptible to any of the *Fusarium* wilt pathogens from other crops, such as cotton, melon and tomato
- Seedling inoculation tests revealed that several lettuce cultivars were susceptible to the pathogen, with Salinas showing the most disease tolerance

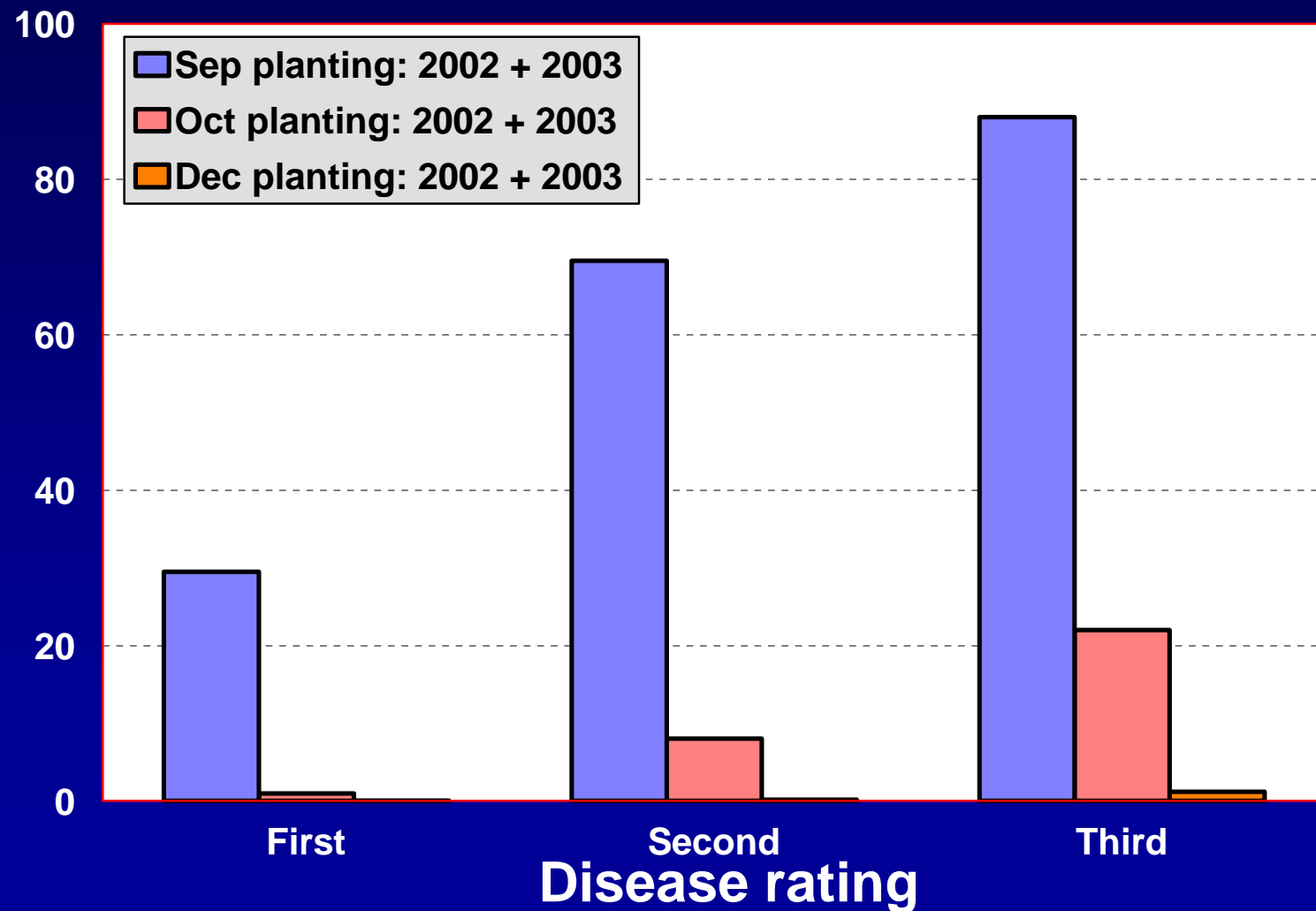
**On other crops,  
Plant resistance or genetic tolerance  
is most often used to manage wilt  
diseases caused by  
*Fusarium oxysporum***

# Lettuce cultivar evaluation trials

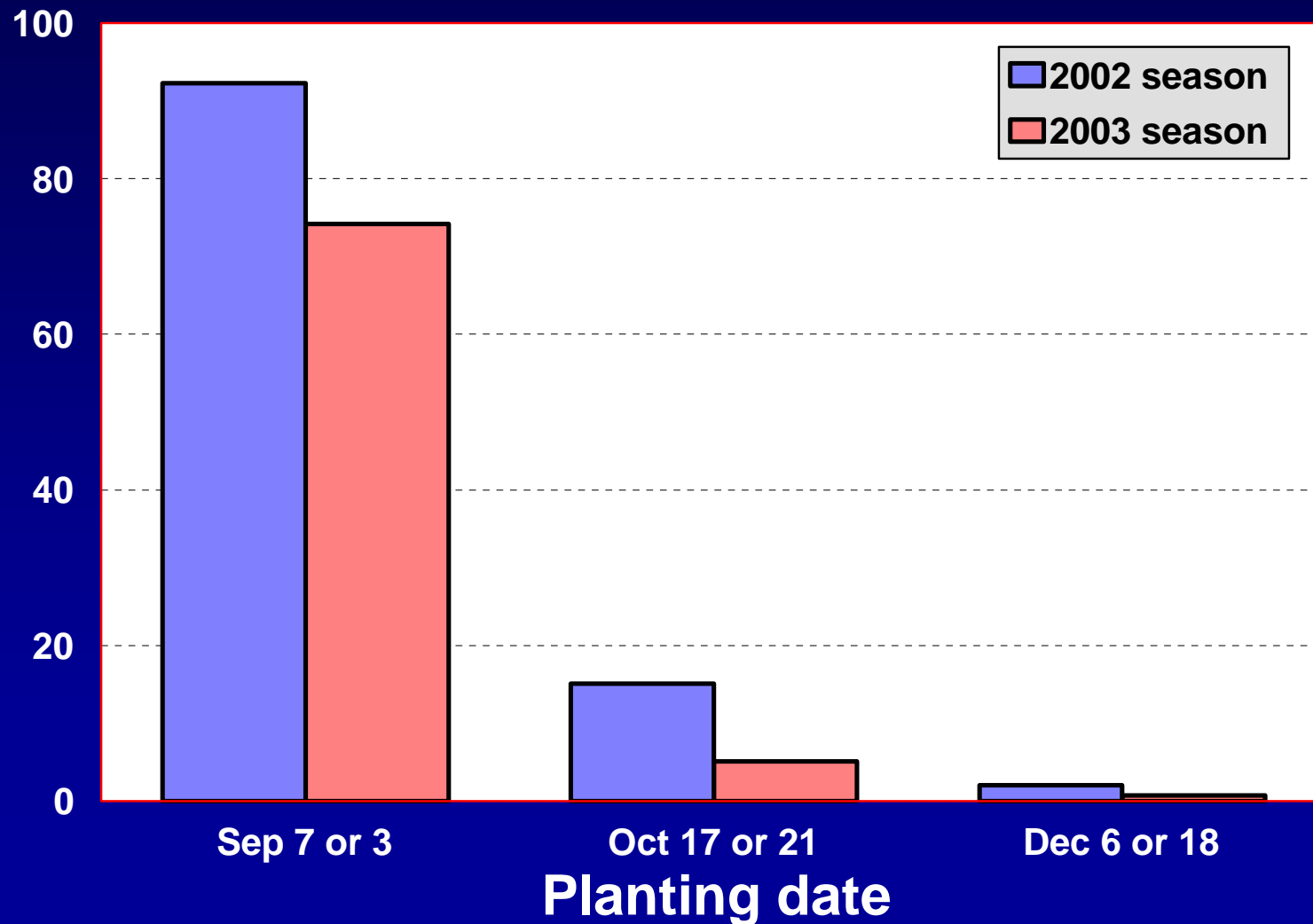
- Trials conducted in a field with a history of Fusarium wilt of lettuce
- Lettuce cultivars planted at three different planting dates
- The replicate plot size was two beds 150 ft. in length, with 4 replicate plots per cultivar arranged in a randomized complete block design
- Disease development was monitored from thinning until plant maturity



# Incidence of Fusarium wilt at first, second and third disease rating date



# Incidence of Fusarium wilt at crop maturity at different planting dates



# Soil temperature during time intervals between disease ratings

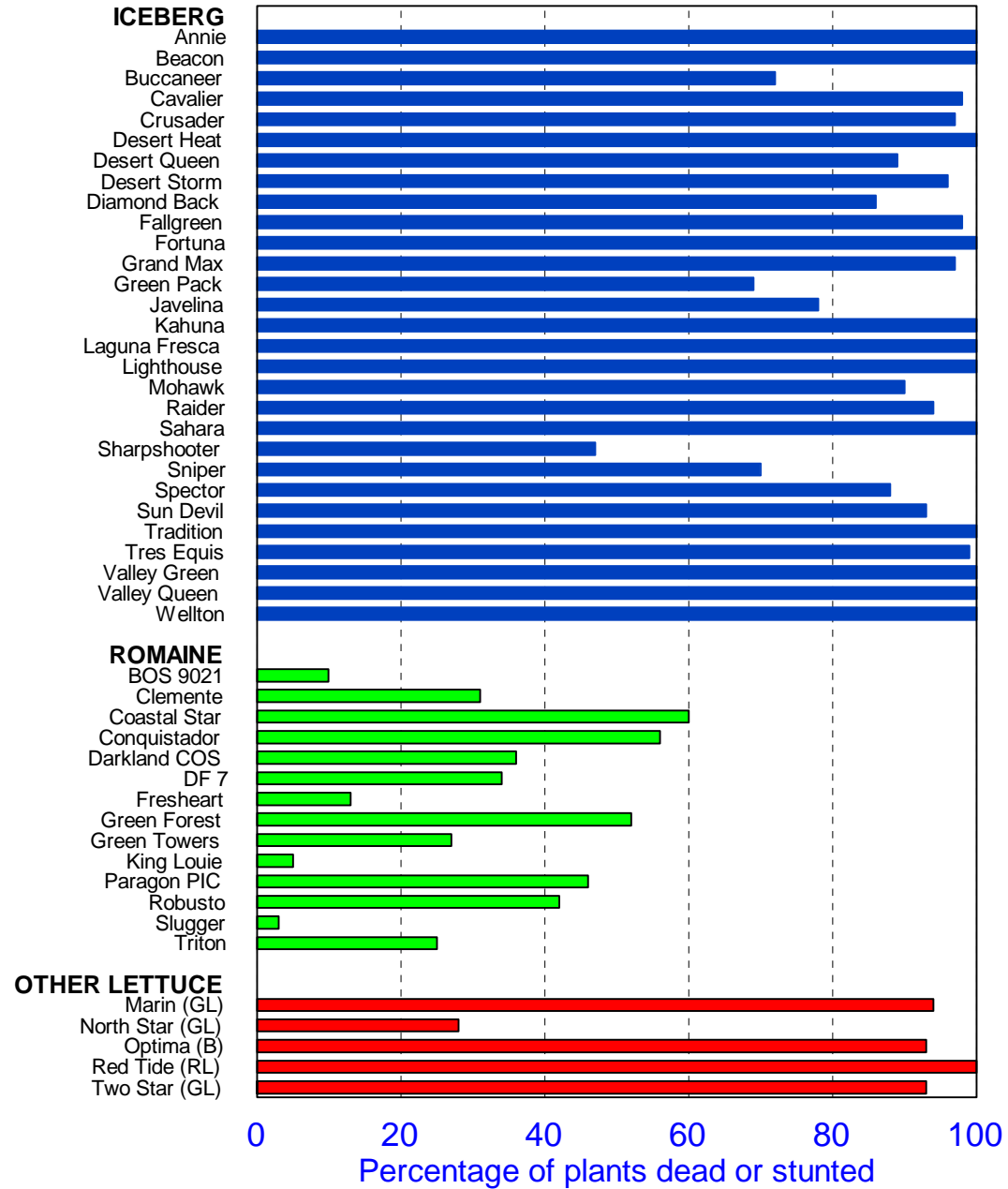
Planting date	Final disease incidence (%)	Soil temp (F): Seeding to first rating	Soil temp (F): First to second rating	Soil temp (F): Second to third rating
<b>2002-03</b>				
Sep 7	97	82	75	70
Oct 17	37	68	57	50
Dec 6	2	54	59	64
<b>2003-04</b>				
Sep 3	80	90	82	75
Oct 21	7	66	52	53
Dec 18	1	54	53	64

# Effect of planting date and lettuce type on incidence of Fusarium wilt (2 years)

Lettuce type	September planting	October planting	December planting
Crisphead	94	30	1.3
Romaine	34	8	0.2
Green leaf	74	2	0.1
Red leaf	67	1	5.2
Butterhead	88	1	0.3

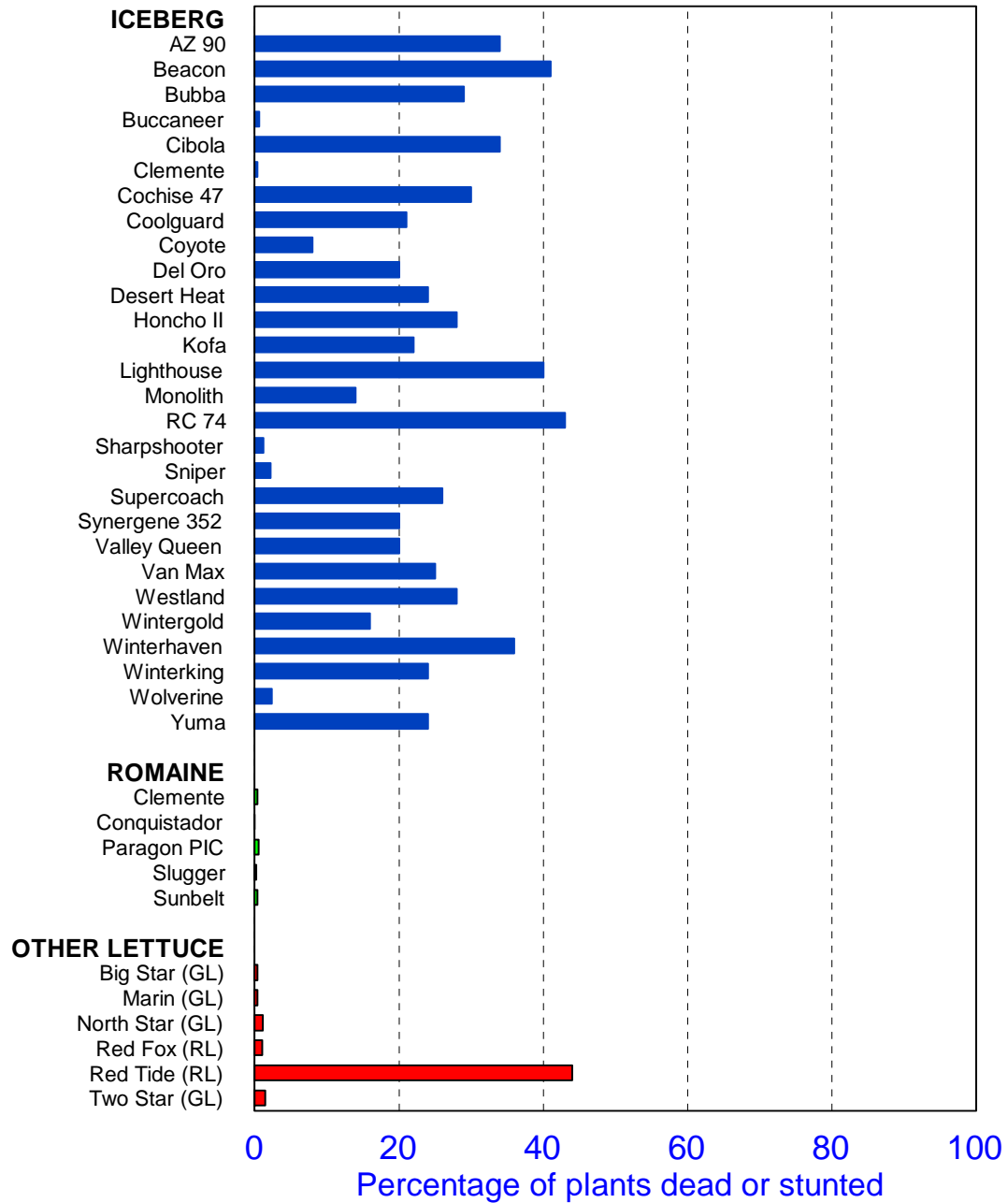
# Lettuce cultivar susceptibility to Fusarium wilt

2-year average - First planting



# Lettuce cultivar susceptibility to Fusarium wilt

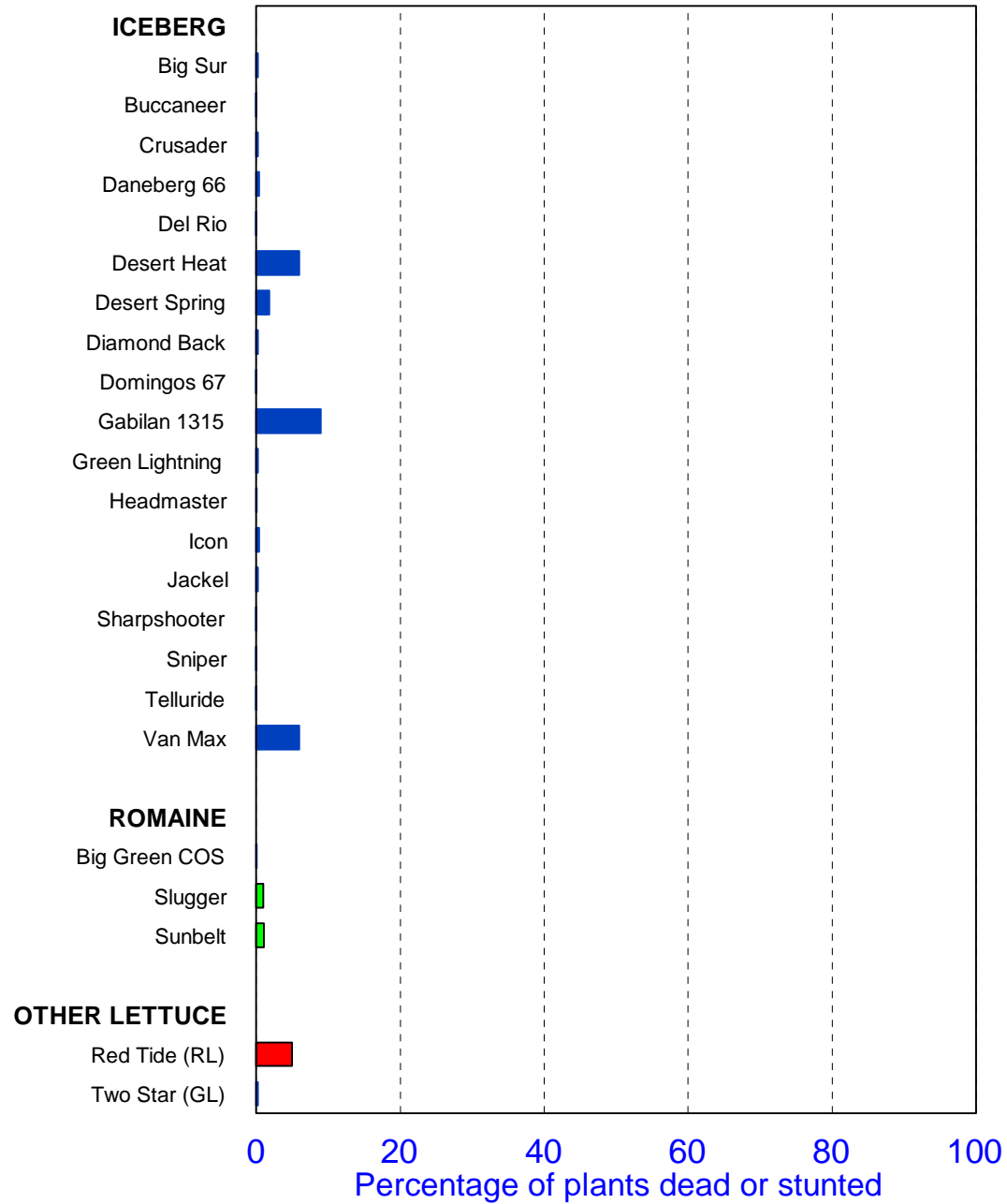
2-year average - Second planting





# Lettuce cultivar susceptibility to Fusarium wilt

2-year average - Third planting

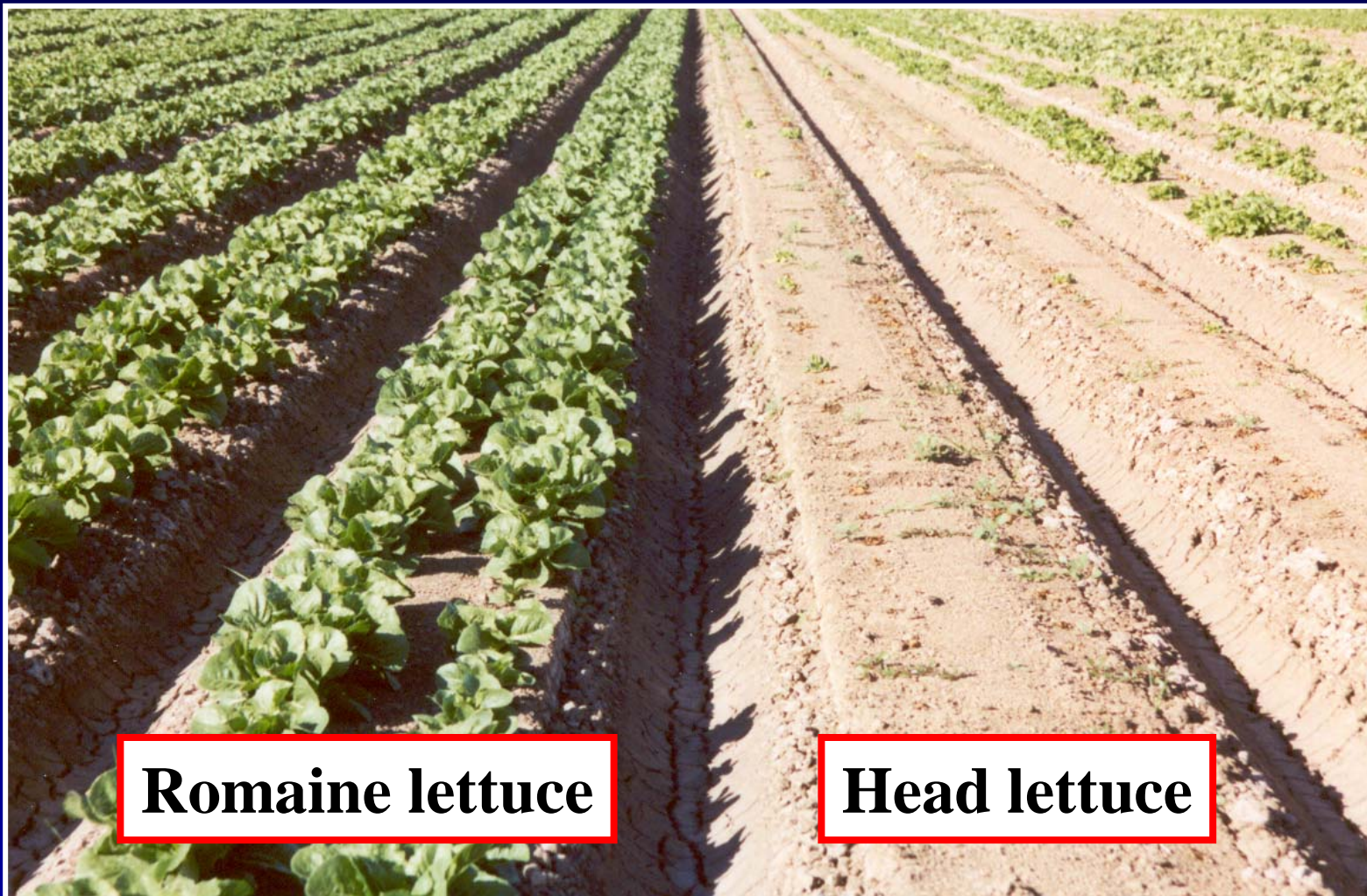


# Lettuce cultivar evaluation trial: Head lettuce: first planting





# Lettuce cultivar evaluation trial: Romaine vs. head lettuce







**Green leaf**

**Red leaf**

**Head**



# Second planting – Head lettuce



Susceptible  
cultivar



Tolerant  
cultivar



**Second planting – romaine, leaf lettuce**





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Plant resistance or genetic tolerance  
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**What else can be done to combat  
Fusarium wilt of lettuce?**

# Evaluation of selected fungicides against *Fusarium* wilt of lettuce

Three products

- Pristine (boscalid + pyraclostrobin)
- Scholar (fludioxonil)
- Topsin M (thiophanate methyl)

were applied to beds after seeding Lighthouse and before first irrigation, then again 4 wk later.

This experiment was conducted at each of the three planting dates during the 2003-04 season.

# Evaluation of selected fungicides against Fusarium wilt of lettuce

The three products

Pristine (boscalid + pyraclostrobin)

Scholar (fludioxonil)

Topsin M (thiophanate methyl)

had no effect on disease development in the  
September, October or December lettuce  
plantings

**Soil flooding and soil solarization  
have reduced the population of  
some fungal plant pathogens in  
earlier studies**

## Soil flooding and soil solarization trials

Soil infested with *Fusarium oxysporum* f. sp. *lactucae* was placed in 5-gallon buckets and treated as described below.

- No treatment of soil (the control)
- Soil flooded for 15, 30, 45 or 60 days
- Soil thoroughly irrigated, then covered with a clear plastic film for 15, 30, 45 or 60 days.

Lettuce seedlings then were transplanted into soil from each treatment and observed for symptoms of Fusarium wilt.



# Fusarium soil flooding trial





# Fusarium soil solarization trial



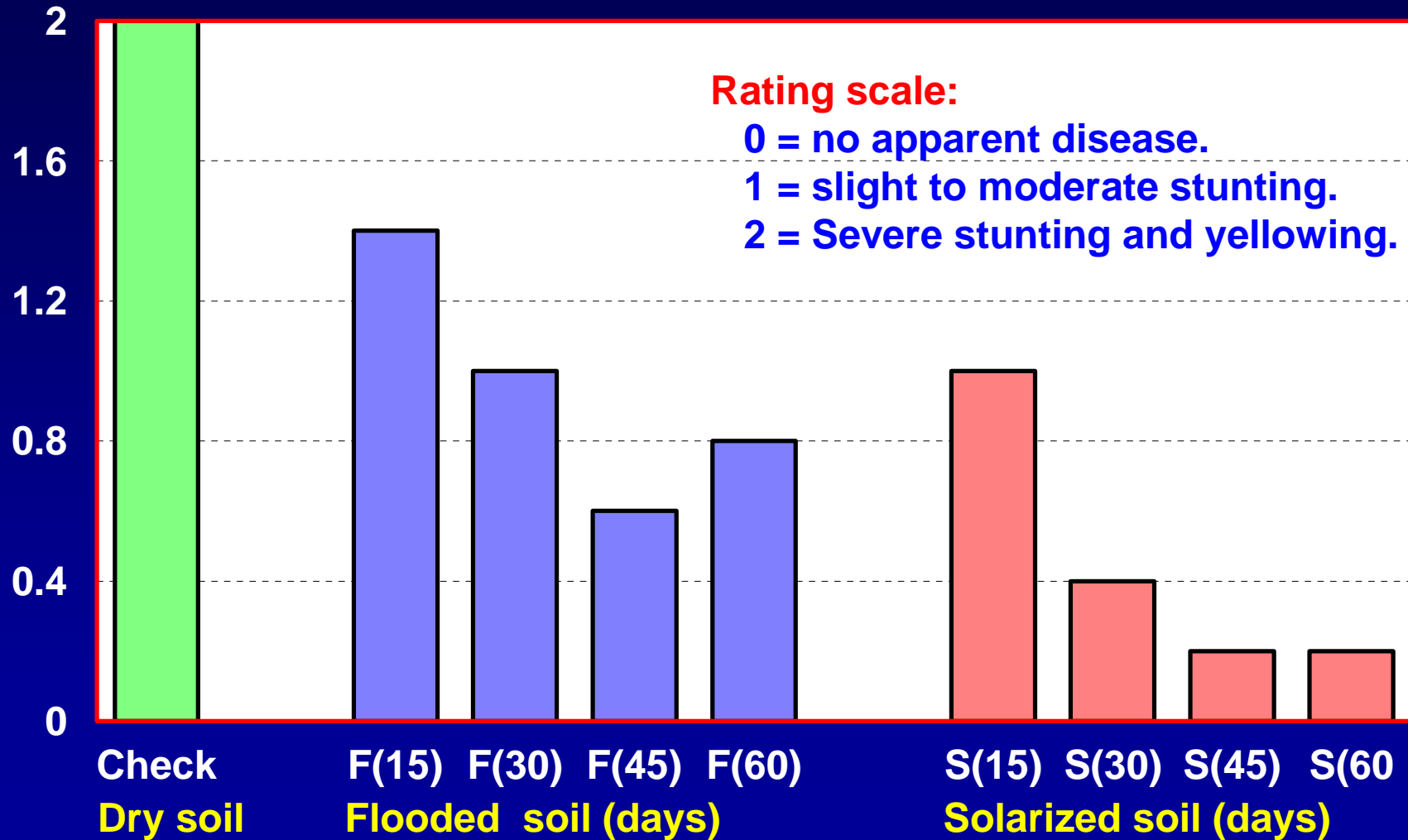


# Soil temperatures for treatments of Fusarium infested soil in 2003

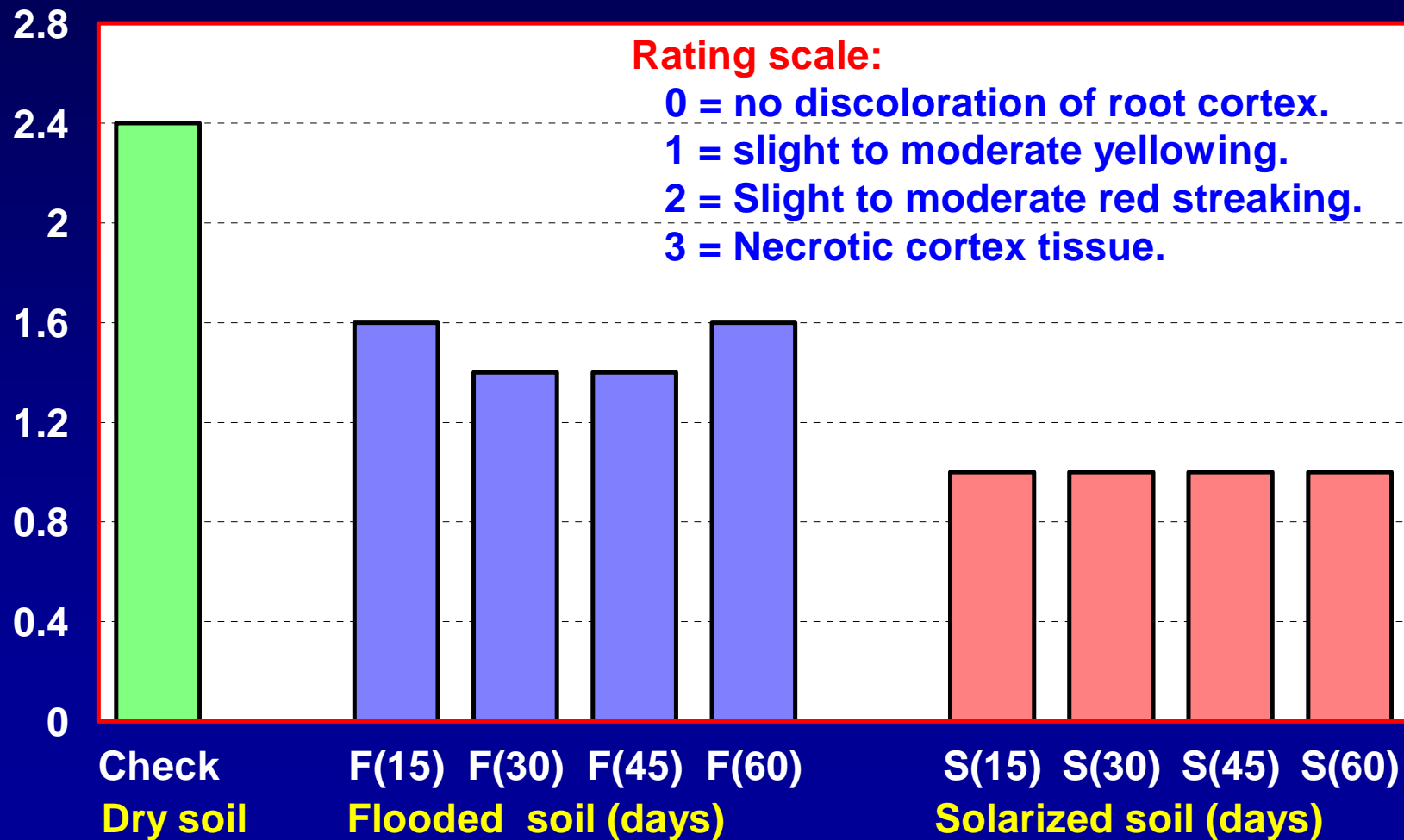
From Jul 22 to Sep 22, 2003

Soil treatment	Mean temp (F)	Temperature range (F)
<b>At the 2-inch depth</b>		
Dry soil	98	68-132
Flooded soil	88	68-106
Solarized soil	109	77-142
<b>At the 9-inch depth</b>		
Dry soil	95	86-108
Flooded soil	90	80-100
Solarized soil	102	86-118

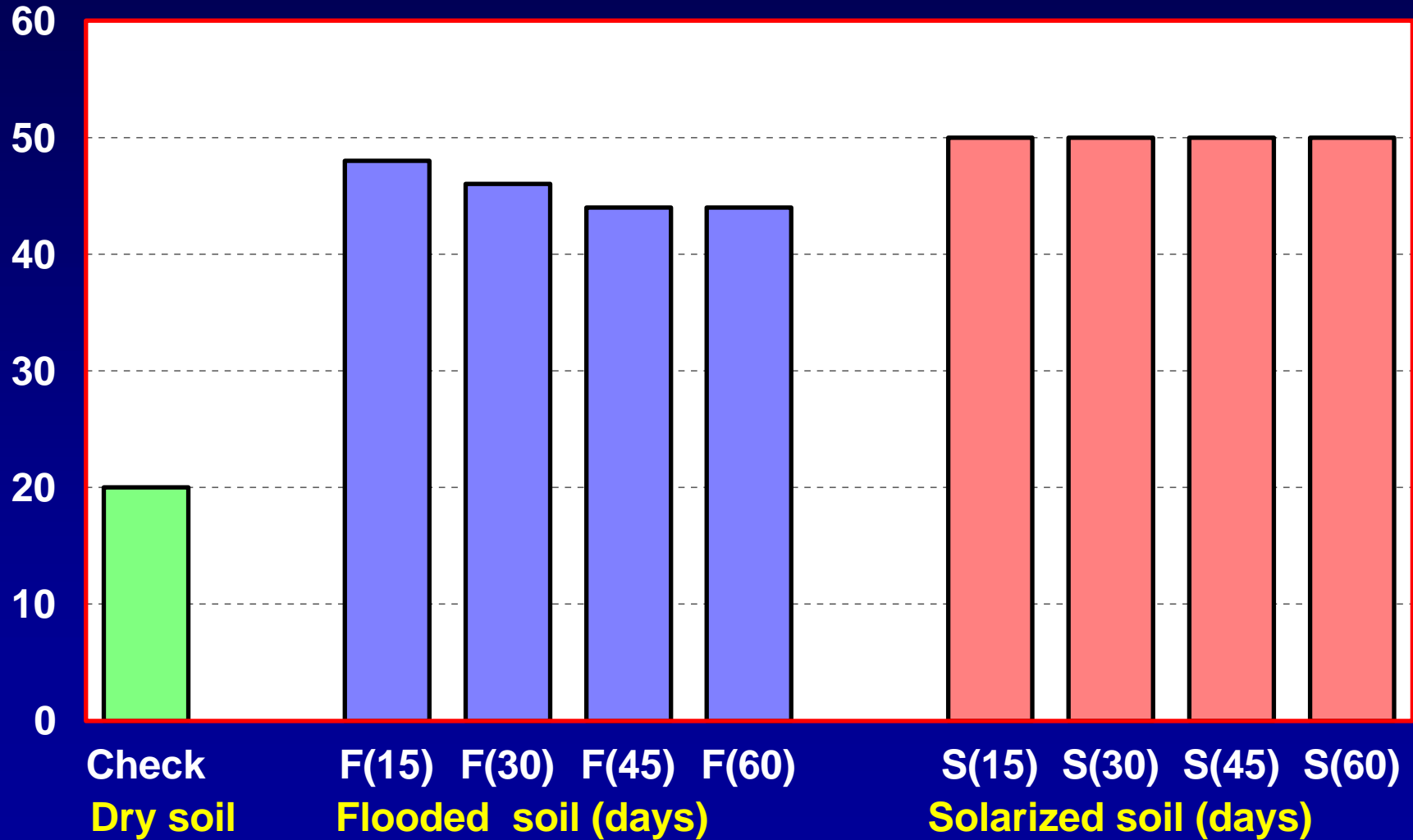
# Foliar symptom rating after treatment of soil infested with *Fusarium oxysporum* f. sp. *lactucae*



# Root symptom rating after treatment of soil infested with *Fusarium oxysporum* f. sp. *lactucae*



# Plant fresh weight (g) after treatment of soil infested with *Fusarium oxysporum* f. sp. *lactucae*



# Plants from soil flooding and solarization trial



**Disease rating of 3**



**Disease rating of 2**



**Disease rating of 1**



**Disease rating of 0**

# Management considerations for fields infested with *Fusarium oxysporum* f. sp. *lactucae*

- Prevent the spread of soil from contaminated to “clean” fields by workers and equipment
  - This may be especially difficult when crops other than lettuce are grown
- Selection of appropriate planting time and lettuce cultivar

# Management considerations for fields **not** infested with *Fusarium*

- The vast majority of lettuce production fields (99%) in Yuma County are not yet known to contain the lettuce *Fusarium* pathogen
  - In these fields, take every precaution to prevent the introduction of the pathogen
  - Use normal criteria for selection of planting time and lettuce cultivar

