

## Fusarium wilt of lettuce in Arizona

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## Fusarium wilt of lettuce



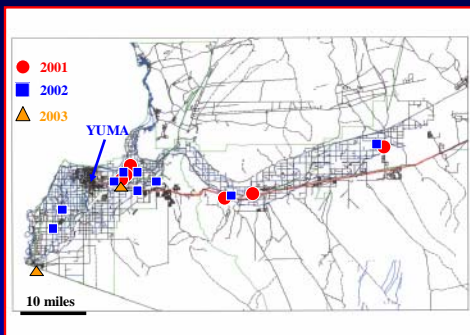
## Fusarium wilt (root rot) of lettuce:

- 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*



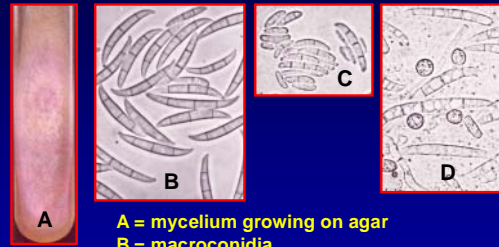
## *Fusarium oxysporum*

- 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

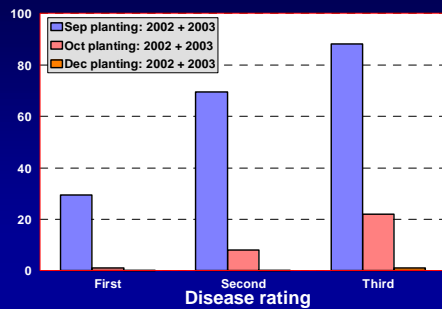
- The pathogen grows between 46 and 89 F, with optimum growth at 82 F
- Lettuce is not susceptible to any of the Fusarium wilt pathogens from other crops, such as cotton, melon and tomato
- Seedling inoculation tests revealed that several lettuce cultivars were susceptible to the pathogen, with Salinas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

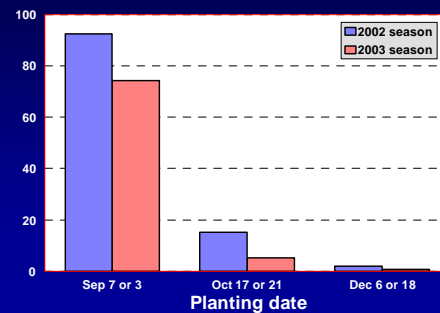
### Lettuce cultivar evaluation trials

- 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

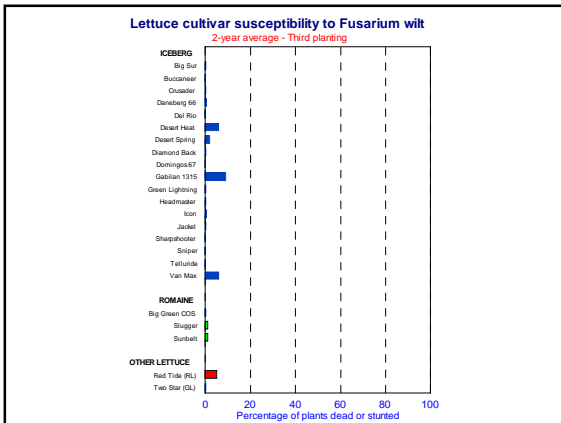
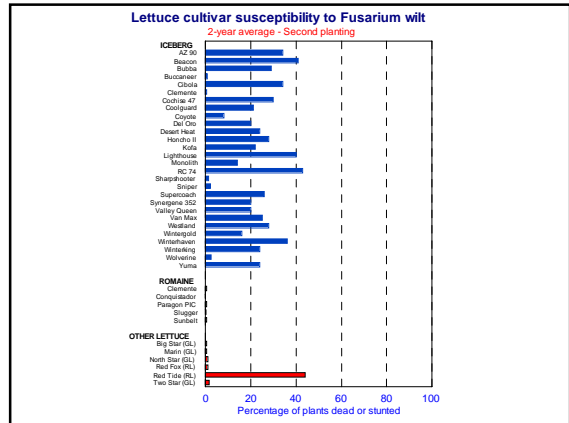
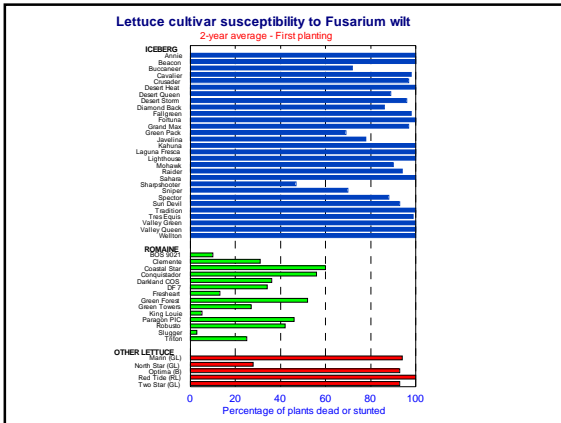


Soil temperature during time intervals between disease ratings

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
2002-03				
Sep 7	97	82	75	70
Oct 17	37	68	57	50
Dec 6	2	54	59	64
2003-04				
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



### Second planting – Head lettuce



Susceptible cultivar



Tolerant cultivar

### Second planting – romaine, leaf lettuce



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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**

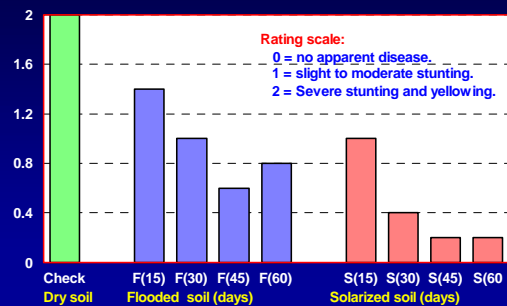


**Soil temperatures for treatments of Fusarium infested soil in 2003**

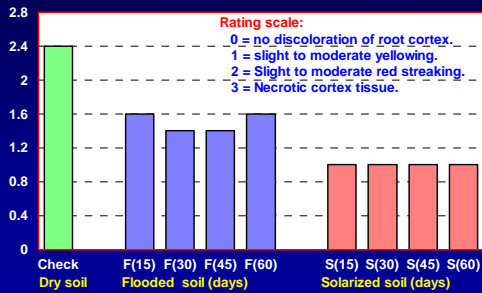
From Jul 22 to Sep 22, 2003

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

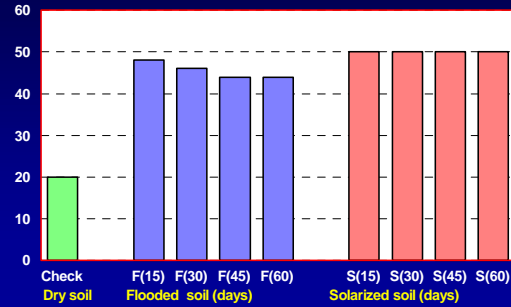
**Foliar symptom rating after treatment of soil infested with *Fusarium oxysporum* f. sp. *lactucae***



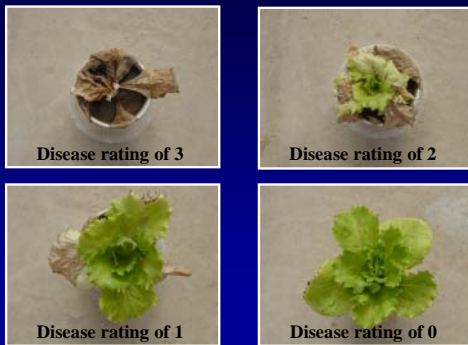
**Root symptom rating after treatment of soil infested with *Fusarium oxysporum* f. sp. *lactucae***



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



**Plants from soil flooding and solarization trial**



**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

