Update on White Rot Control with Fungicides in the San Joaquin Valley

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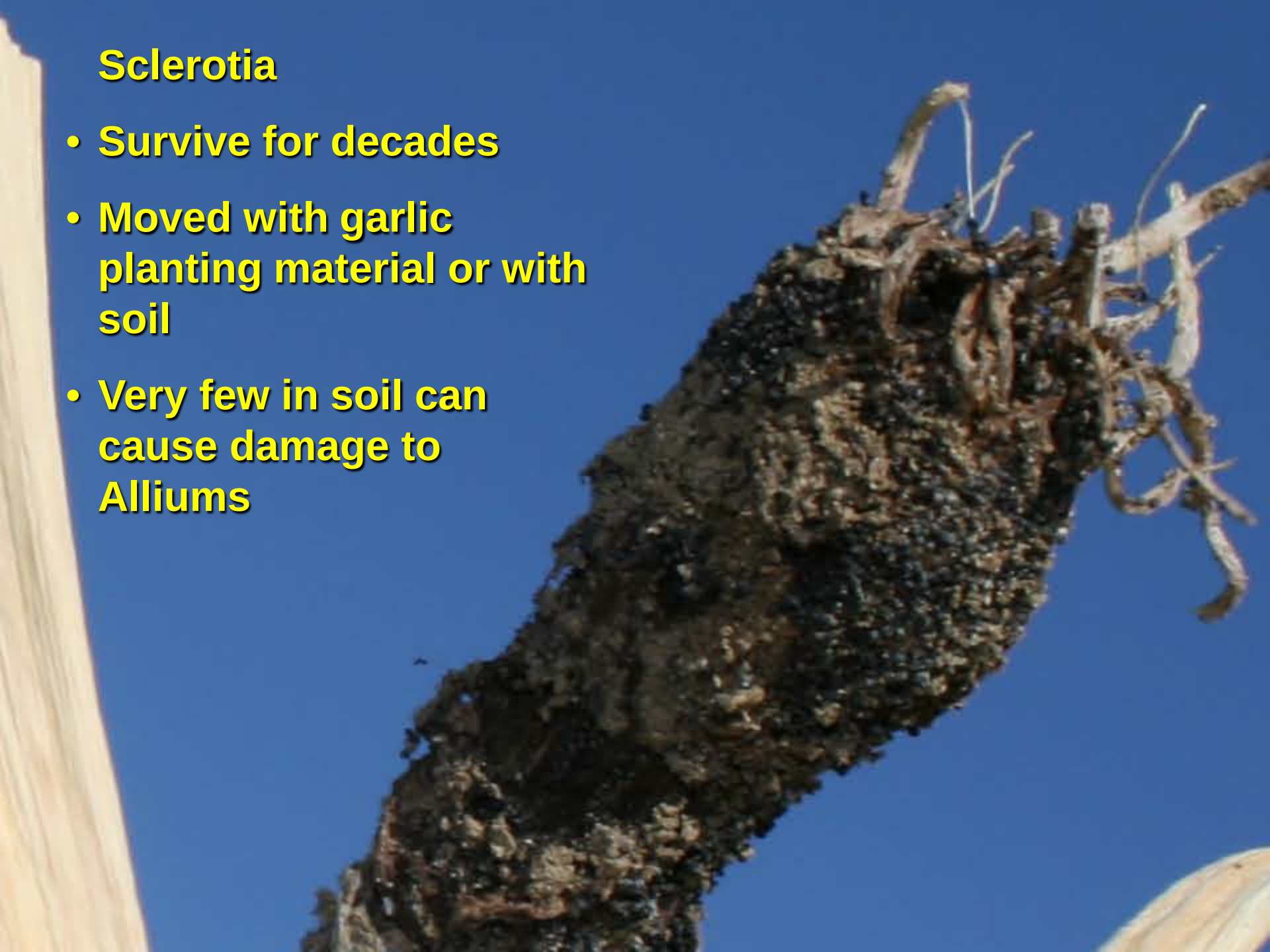
White Rot of Garlic (and other Alliums)
Sclerotium cepivorum

Photo by Shannon Mueller

Sclerotia



Sclerotia

- Survive for decades
- Moved with garlic planting material or with soil
- Very few in soil can cause damage to Alliums

Central San Joaquin Valley

13,000 acres with *Sclerotium cepivorum*

Control

- Sanitation
- Sclerotia-germinating stimulant 90-99% effective.
- Some fungicides applied at planting reduce disease severity.

Many of the treatments to be discussed are not currently labeled uses

- Carefully read the current product label before writing any pesticide recommendation.

Fungicide Comparison 2003-04
Shannon Mueller

Treatment	Yield (T/A)	Disease from 5/6/04
Planted, Untreated Control	4.5 e	4.0 a
Botran (foliar)	5.1 de	4.5 a
Pristine (foliar)	5.3 de	4.0 a
Switch (foliar)	5.4 de	3.8 ab
Rovral (in furrow)	5.9 cd	3.6 ab
Pristine (foliar – HIGH RATE)	6.8 bc	2.9 bc
Botran (in furrow)	7.2 ab	2.1 cd
Switch (in furrow)	7.7 ab	2.4 cd
Folicur (seed treatment)	8.4 a	2.0 cd

Foliar treatments were applied on 3/5/04, 3/17/04, 3/25/04, 4/7/04, and 4/16/04.

Fungicide Comparison 2004-05 Shannon Mueller

Material	Rate	Ap	Yield	Disease
Elevate (fenhexamid)	1.5 lb/A	Foliar	5.4 f	7.2 a
Botran (dicloran)	1 pint/A	Drip	5.5 f	6.7 ab
Rovral (iprodione)	4 pints/A	Drip	5.6 f	6.1 abcde
Elevate (fenhexamid)	1.5 lb/A	Foliar	5.8 f	6.9 ab
Untreated Control -- --			6.0 ef	6.9 ab
Pristine	18.5 oz/A	Drip	6.0 ef	6.5 abc
Endura (boscalid)	6.8 oz/A	Drip	6.1 def	6.3 abcd
Folicur (tebuconazole)	20.5 fl oz/A	Drip	6.4 cdef	6.2 abcd
Omega (fluazinam)	0.6 pints/A	In furrow	6.9 bcdef	5.9 bcde
Botran (dicloran)	2 pints/A	Drip	7.0 bcdef	6.1 abcde
	1 pint/A			
Thiophanate methyl	13 lbs/A	Drip	7.7 abcde	5.9 bcde
Switch (fludioxinil + cyprodinil)	14 oz/A	In furrow	7.8 abcde	4.9 ef
Scholar (fludioxinil)	8 oz/A	In furrow	7.9 abcd	5.1 def
Botran (dicloran)	102 oz/A	In furrow	8.2 abc	5.7 bcde
Folicur (tebuconazole)	20.5 oz/A	In furrow	8.7 ab	4.1 f
Pristine	18.5 oz/A	In furrow	8.9 a	5.4 cde
Folicur (tebuconazole)	20.5 fl oz/A	In furrow	9.2 a	3.9 f
	5.8 fl oz/A	2 Foliar		
Endura (boscalid)	6.8 oz/A	In furrow	9.4 a	5.1 def

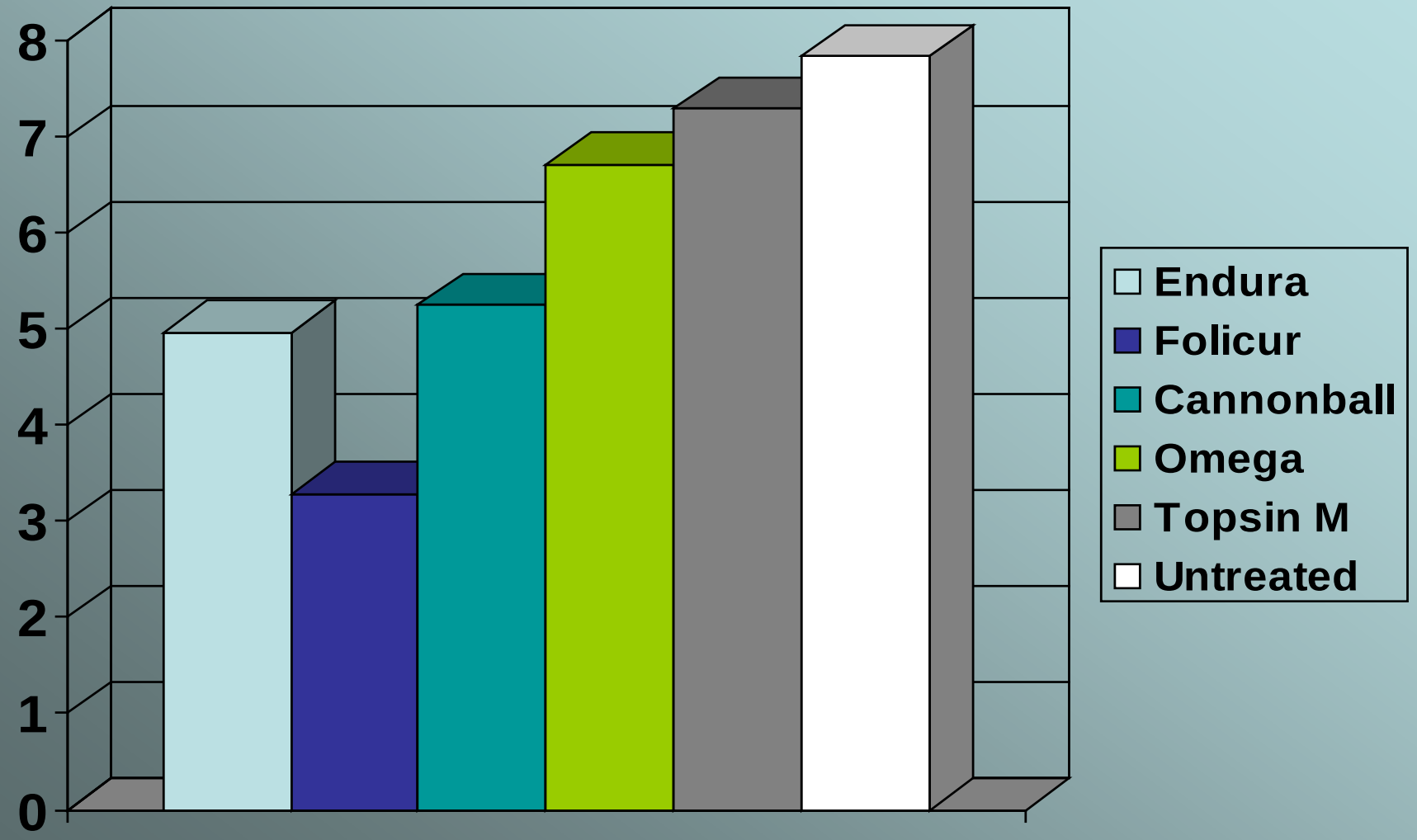
Foliar: 3/11/05 and 3/31/05. 50 gpa and 20 psi.

Drip injected: 3/11/05: repeated for Botran on 4/8, 4/25, 5/3, and 5/18/05.

Fungicide In furrow Comparison, 2005-06

Shannon Mueller

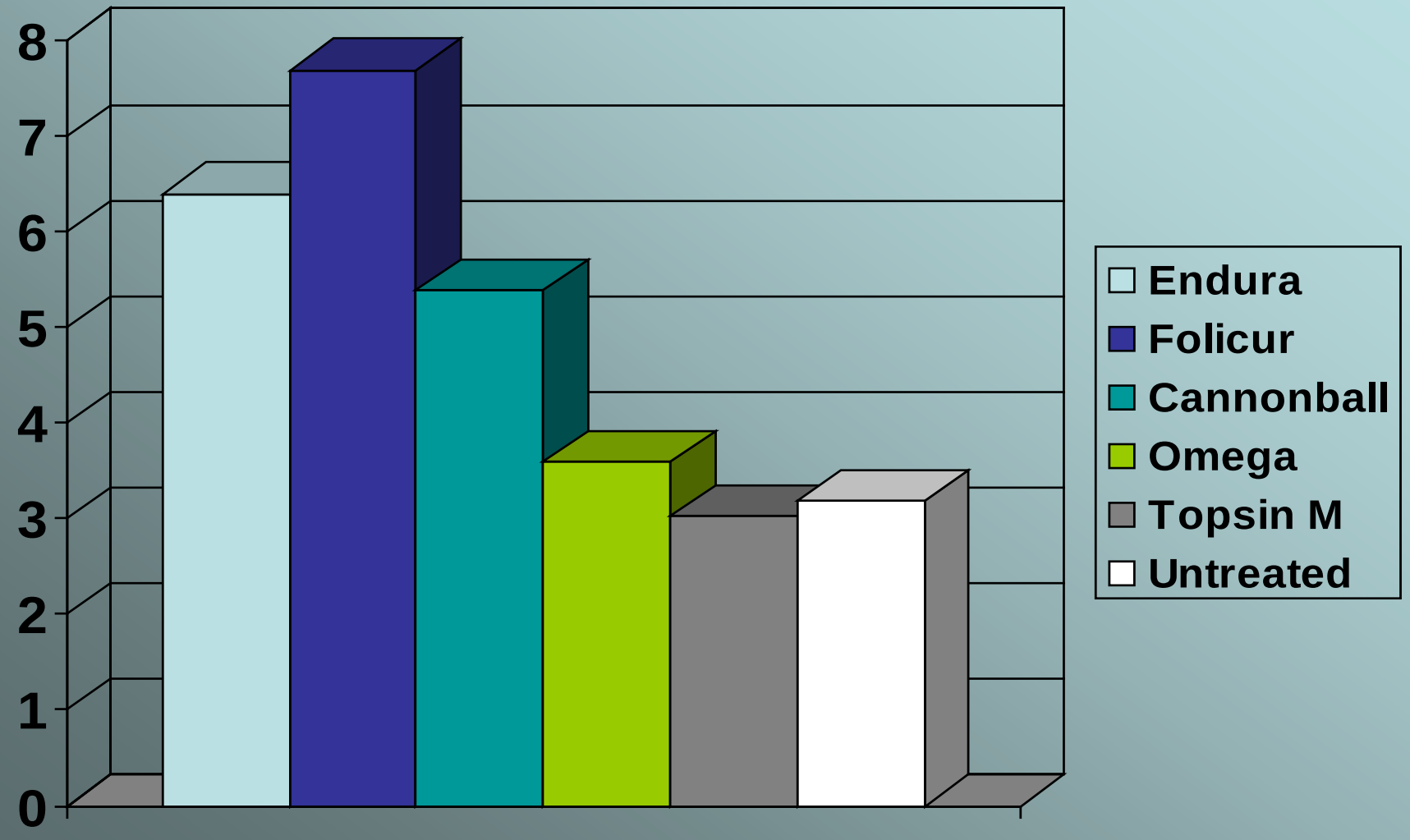
above ground disease severity



Fungicide In furrow Comparison, 2005-06

Shannon Mueller

yield (tons/a)



Drip: Fungicide Comparison, 2005-06
Shannon Mueller

Treatment	Fresh Wt (t/A)	Disease rating
Botran 2 pts/A	4.42	6.00
Endura 6.8 oz/A	4.97	5.77
Untreated	5.24	5.90
LSD	NS	NS

Drip injected on 4/28/06 and 5/11/06.

2007-2008 Objectives

- To evaluate white rot management programs (combining furrow/multiple drip applications)
- To compare performance of fungicides
- To assess activity of biological control agents against white rot
- To assess the effect of a soil surfactant soil adjuvant (Watermaxx II) on fungicide performance.

Fresno County Research 2003-2007 (Shannon Mueller: UCCE, Fresno)

- At Planting Fungicide Applications
  - At planting, Folicur, Endura, Scholar, Switch and Botran reduced disease severity and increased yield
- Drip applications (2005-06) not effective

Fresno Co., CA White Rot Trials, 2007-2008

- Evaluation of at-planting applications combined with drip applications
- Chemical/biological control agent efficacy comparison

Cultural Details

Location: *S. cepivorum* infested field in Fresno Co. *(114 sclerotia/kg soil sampled 27 Sep 2007).*

California Late garlic was planted in 2 seed lines per 40” beds on 20 Nov 2007.

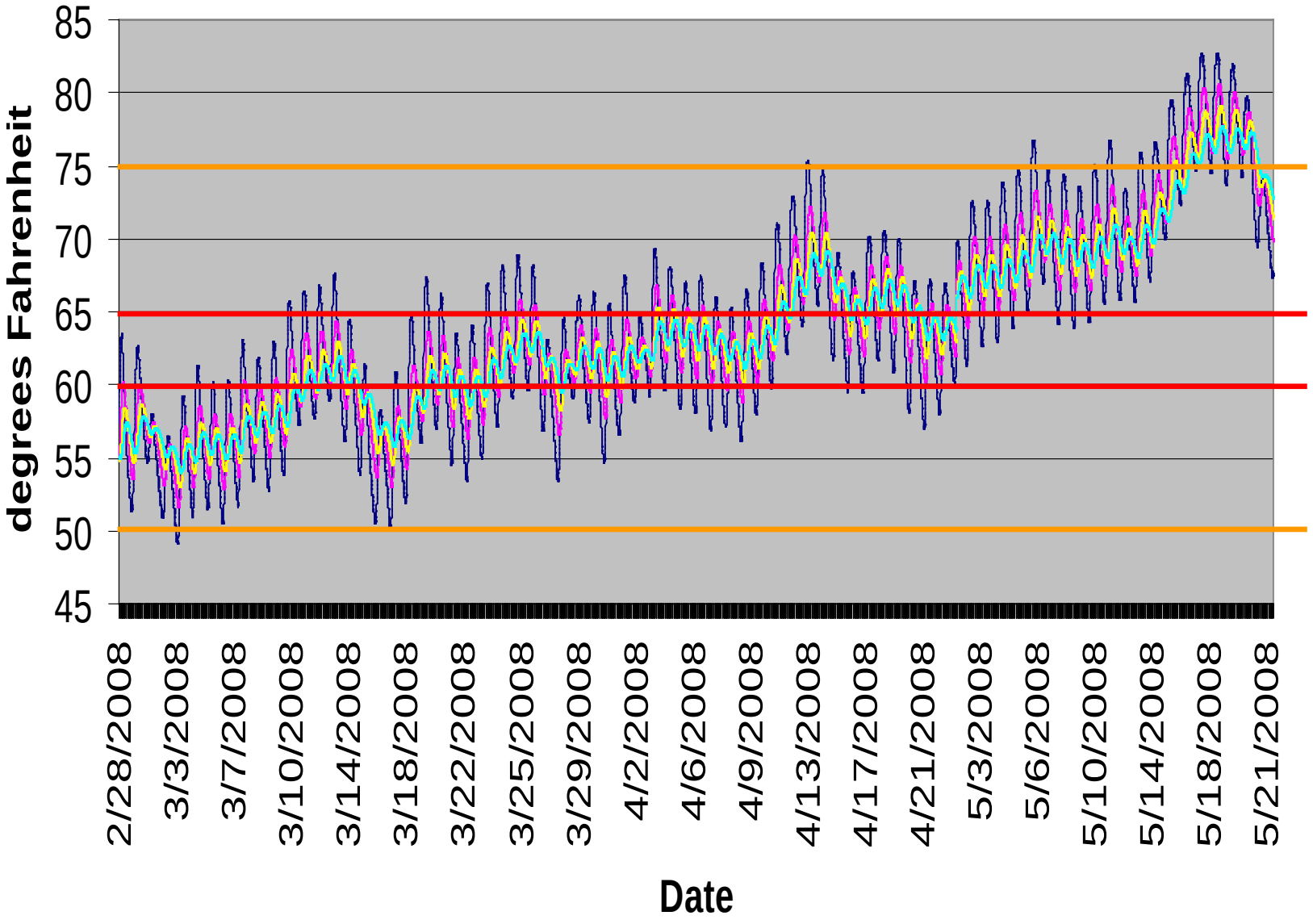
Application Details

- At planting application
  - CO_2-pressurized backpack sprayer
  - 25 gallons of water per acre
  - 30 psi.
- All drip applied materials were pumped into the 1-2 inch deep drip line over 45 minutes.

Monitoring

- OnSet temperature recorder was placed in field with sensors buried to depths of 2.5, 5, 7.5 and 10 inches

Soil Temperatures at Fresno Co. White Rot Trial



Optimum temperature for infection:
60-65°F
Temp range:
50-75°F

Monitoring

- OnSet temperature recorder was placed in field with sensors buried to depths of 2.5, 5, 7.5 and 10 inches
- Fifty garlic cloves were collected from buffers (untreated) on 7 and 14 Feb and surface sterilized and incubated in moist chambers at 72^{o}F

Garlic Clove Collection and Incubation

- 7 Feb collection: *S. cepivorum* grew from 2/50 cloves
- 14 Feb collection: *S. cepivorum* grew from 1/50 cloves

Monitoring

- OnSet temperature recorder was placed in field with sensors buried to depths of 2.5, 5, 7.5 and 10 inches
- Fifty garlic cloves were collected from buffers (untreated) on 7 and 14 Feb and surface sterilized and incubated in moist chambers at 72^{o}F
- Above ground symptoms were rated (0-10 scale) on 23 Apr and 14 May.

Monitoring

- OnSet temperature recorder was placed in field with sensors buried to depths of 2.5, 5, 7.5 and 10 inches
- Fifty garlic cloves were collected from buffers (untreated) on 7 and 14 Feb and surface sterilized and incubated in moist chambers at 72^{o}F
- Above ground symptoms were rated (0-10 scale) on 23 Apr and 14 May.
- Twenty-five ft of each plot was harvested on 22 - 23 Aug, weighed and re-weighed on 3 Sep

At Planting Treatments

1 Folicur 20.5 oz
2 Cannonball 8.0 oz
3 Contans 4 lbs/a
4 Cannonball 8.0 oz + Botran 5F 102 oz
5 Untreated control

Drip Applied Treatments

	Application dates		
	15 Feb	**7 Mar**	**27 Mar**
1	Cannonball 8.0oz	Folicur 20.5 oz	
2	Cannonball 8.0oz	Folicur 20.5 oz	Endura 6.8 oz
3	Folicur 20.5 oz	Cannonball 8.0oz	Endura 6.8 oz
4	Untreated control		

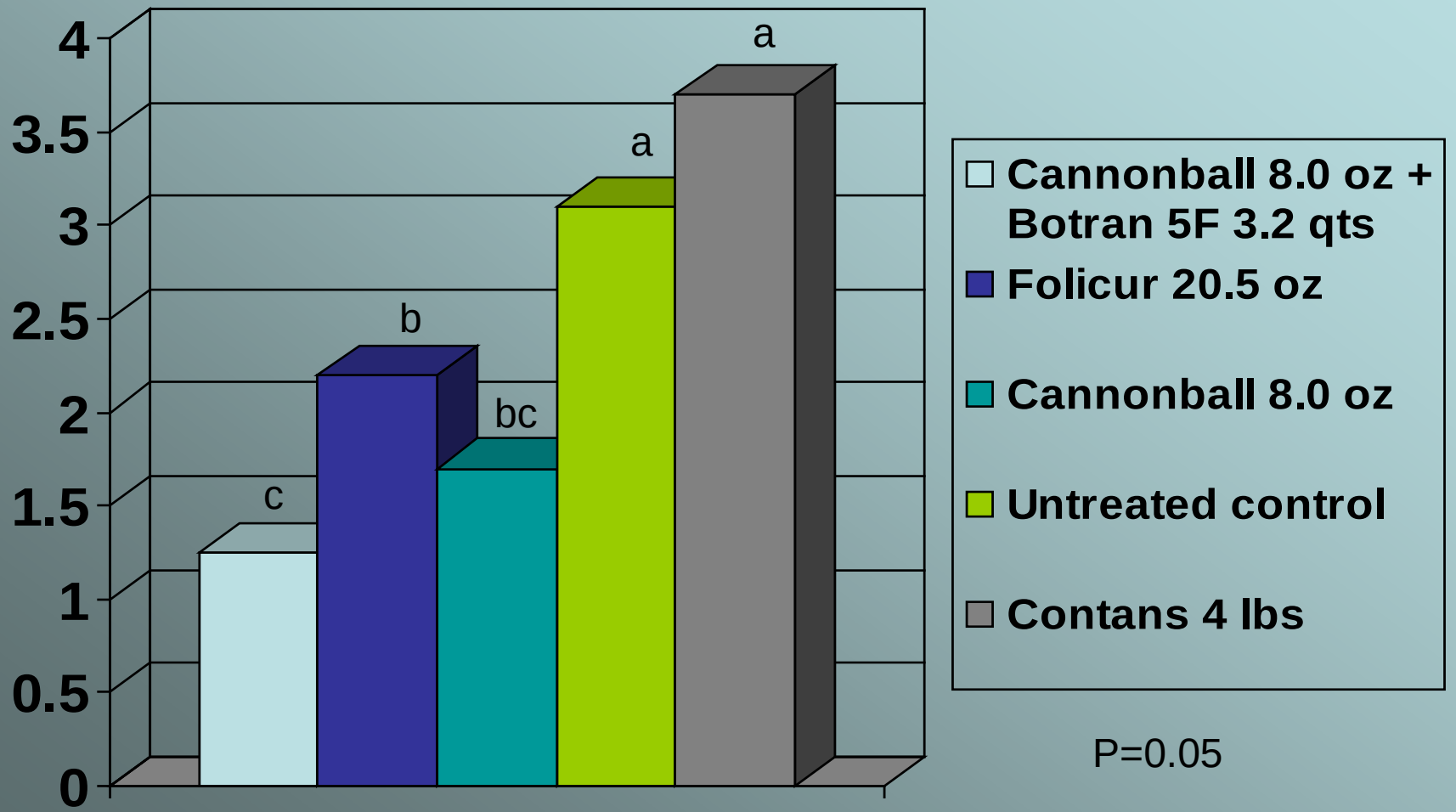
Five Replication Split-Plot Experimental Design

	REP 1				REP 2				REP 3				REP 5				REP 5			
-10’	Drip 4	Drip 2	Drip 1	Drip 3	Drip 4	Drip 1	Drip 3	Drip 2	Drip 3	Drip 2	Drip 1	Drip 4	Drip 1	Drip 3	Drip 4	Drip 2	Drip 4	Drip 1	Drip 3	Drip 2
	IF 5	IF 3	IF 2	IF 3	IF 5	IF 4	IF 2	IF 3	IF 5	IF 1	IF 4	IF 5	IF 2	IF 5	IF 4	IF 1	IF 2	IF 3	IF 1	IF 4
	IF 2	IF 5	IF 4	IF 2	IF 3	IF 1	IF 5	IF 1	IF 3	IF 4	IF 2	IF 4	IF 5	IF 2	IF 3	IF 5	IF 4	IF 4	IF 2	IF 5
	IF 4	IF 2	IF 1	IF 5	IF 2	IF 2	IF 3	IF 5	IF 1	IF 3	IF .3	IF 2	IF 3	IF 4	IF 5	IF 3	IF 1	IF 5	IF 4	IF 1
	IF 1	IF 4	IF 3	IF 4	IF 4	IF 3	IF 1	IF 4	IF 2	IF 2	IF 1	IF 1	IF 4	IF 3	IF 1	IF 4	IF 5	IF 1	IF 3	IF 2
	IF 3	IF 1	IF 5	IF 1	IF 1	IF 5	IF 4	IF 2	IF 4	IF 5	IF 5	IF 3	IF 1	IF 1	IF 2	IF 2	IF 3	IF 2	IF 5	IF 3
-10’	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23

20 Apr 2008

Programs Trial: In furrow

Above-ground symptom severity, 23 Apr



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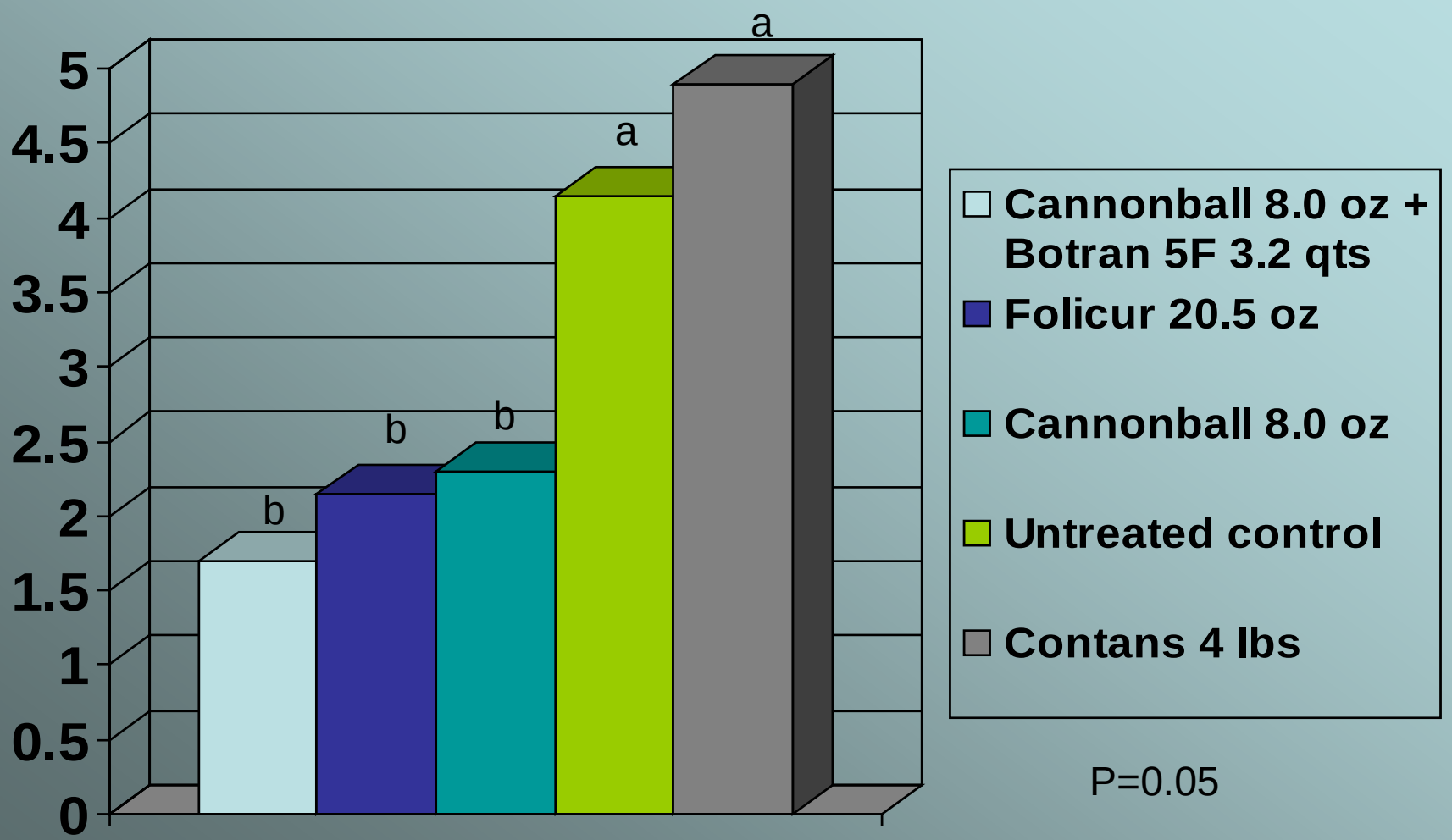
Programs Trial: In furrow

Above-ground symptom severity, 14 May



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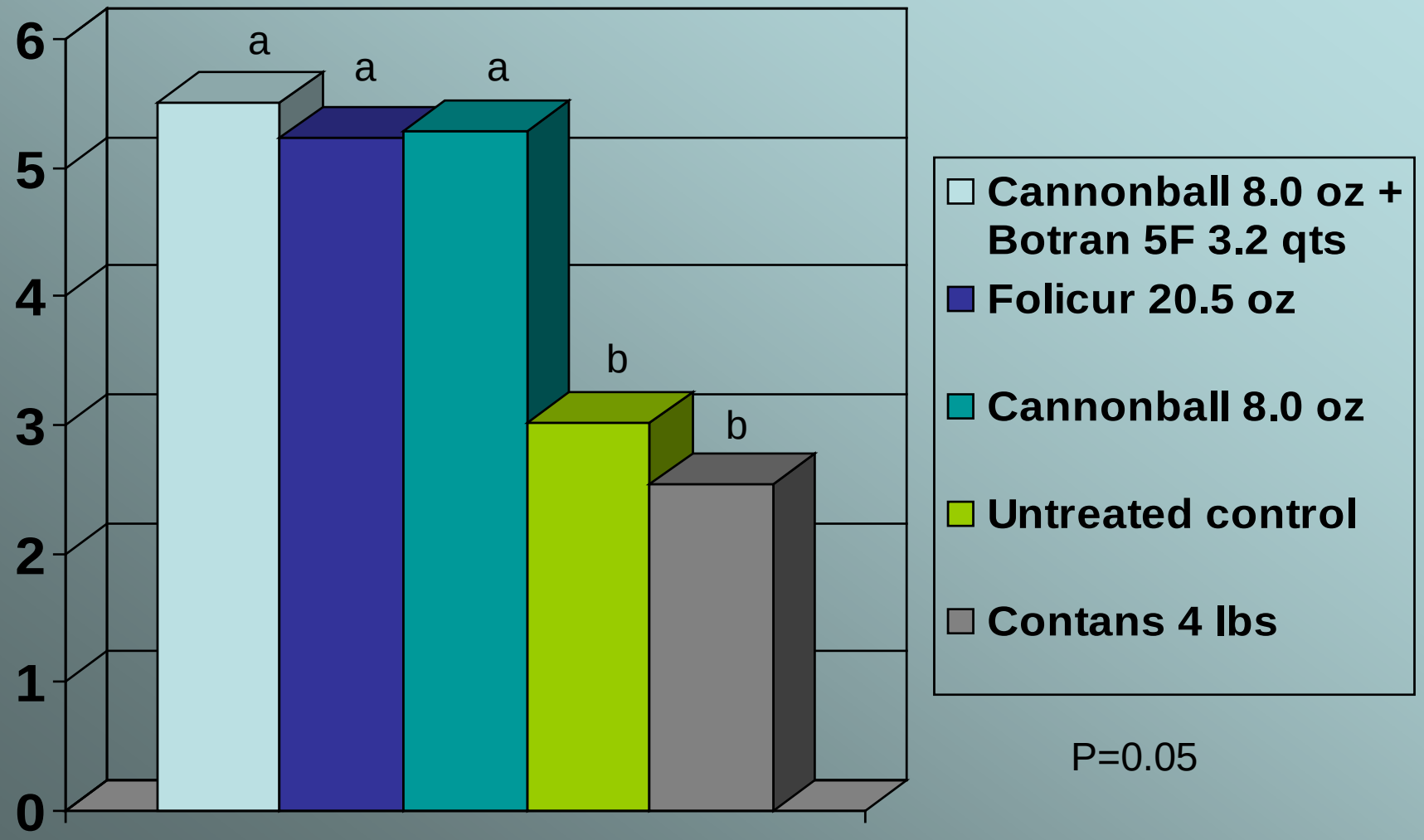
Programs Trial: In furrow

fresh weights (tons/acre)



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Programs Trial: drip applied treatments

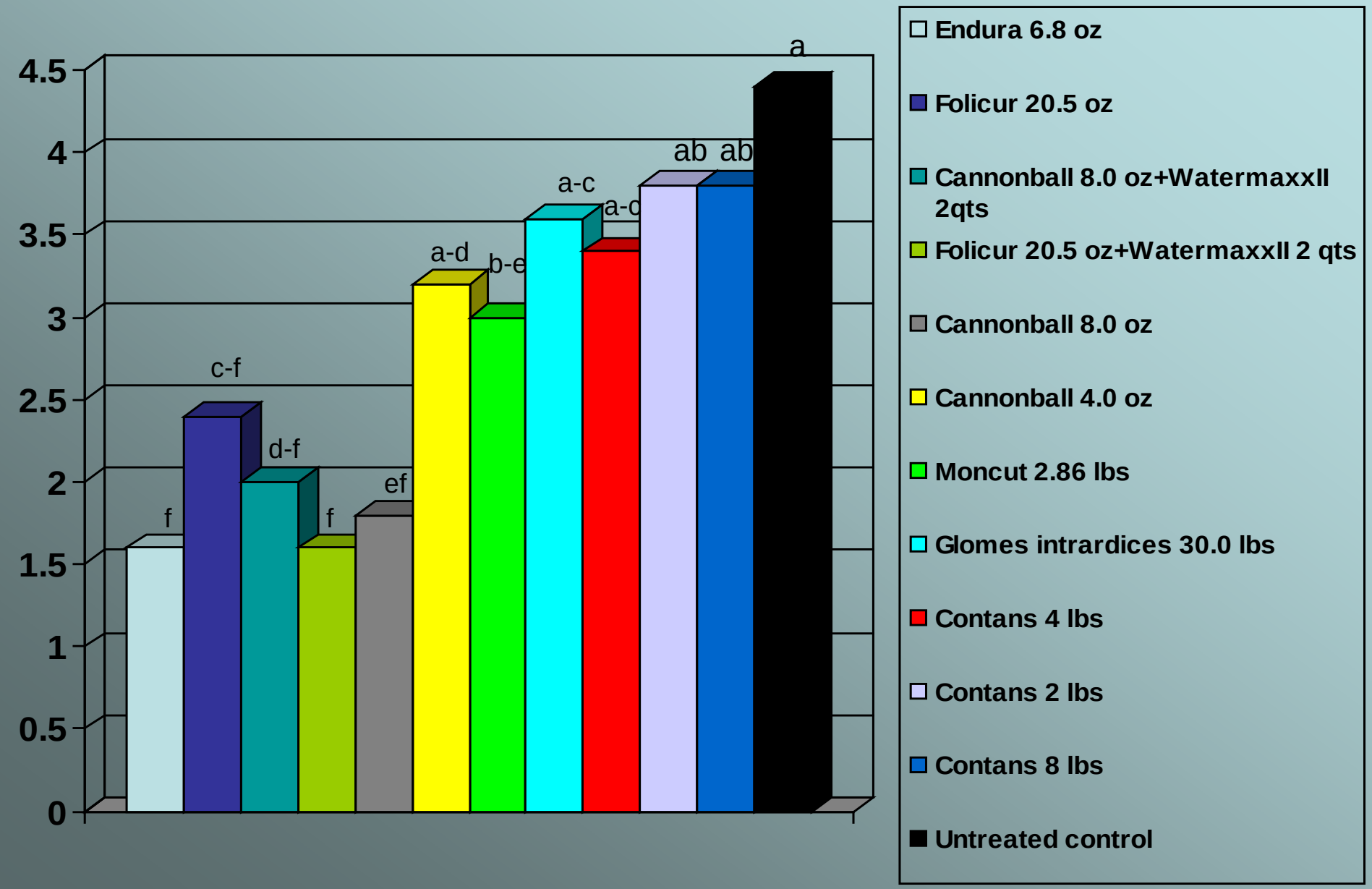
Date of application and materials applied			**Severity (0-10)**		**Weights (tons/acre)**	
15 Feb	**7 Mar**	**27 Mar**	**23 Apr**	**14 May**	**Fresh wt**	**Dry wt**
Cannonball 8.0oz	Folicur 20.5 oz	xxxxxx	2.52	3.00	4.63	3.82
Cannonball 8.0oz	Folicur 20.5 oz	Endura 6.8 oz	2.40	3.28	4.26	3.82
Folicur 20.5 oz	Cannonball 8.0oz	Endura 6.8 oz	2.24	3.00	4.43	3.91
Untreated control			2.40	3.28	4.07	3.83
$LSD_{0.05}$			NS	NS	NS	NS

At Planting Efficacy Trial

1. Moncut (flutolanil: Gowan) 2.86 lbs
2. Folicur 20.5 fl oz fp/a with WatermaxxII (soil adjuvant: Western Farm Service) 2 qts
3. Cannonball 50WP 8.0 oz fp/a with WatermaxxII 2 qts
4. Contans (*Coniothyrium minitans*) 2 lbs
5. Contans 4 lbs
6. Contans 8 lbs
7. Endura 6.8 oz
8. *Glomes intrardices* (Reforestation Technologies International) 30.0 lbs
9. Cannonball 50WP (fludioxonil: Syngenta) 4.0 oz
10. Cannonball 50WP (fludioxonil: Syngenta) 8.0 oz
11. Folicur (tebuconizole: Bayer) 20.5 fl oz
12. Untreated control

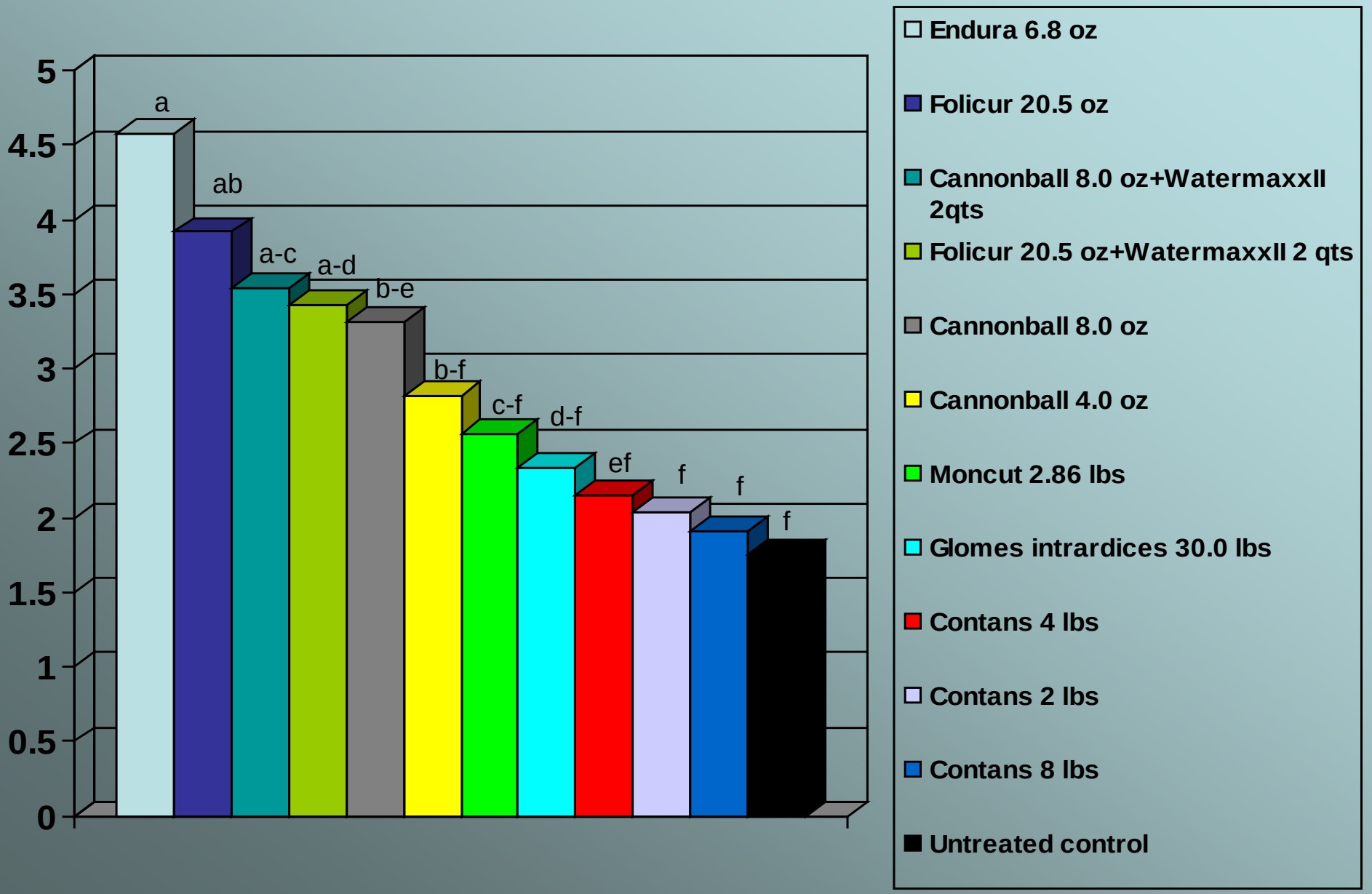
Efficacy Comparison

Above-ground symptom severity, 23 Apr



Efficacy Comparison In furrow

Fresh Weights (tons/acre)



Summary

- At planting application were effective, but drip applications did not reduce disease severity or increase yield – infection had occurred at time of first application
- Endura, Folicur, and Cannonball applied at planting resulted in increased yields
- Under the conditions of this study, biological control agents were not effective against white rot, but may show efficacy if applied the season before planting a susceptible crop.
- The use of soil adjuvant (Watermaxx II) with Folicur or Cannonball did not result in a detectable reduction of disease or increase in yields as compared with Folicur or Cannonball alone, under the conditions of this study

Acknowledgements

- CGORAB
- Larry Schwankl – UC, Kearney Ag Center
- James Gerik – USDA, Parlier
- Kurt Hembree – UCCE, Fresno
- Richard Molinar – UCCE, Fresno
- Con Agra
- Sentient Dehydrated Flavors
- Advan
- BASF
- Bayer
- Gowan
- Syngenta
- Western Farm Service
- Western Forestation Technologies

2007-08 Fresno Co. white rot trial report
http://cefresno.ucdavis.edu/files/58791.pdf

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