Pecan rootstock reactions in a cotton root rot nursery

2013-16

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Cotton

Cotton root rot disease

- Native fungus, *Phymatotrichopsis omnivora*
- SW USA, northern Mexico
- High temperature strain of a pathogen in the last Ice Age forests?
- Essentially one clone
- Wide dicot host range
- Native dicot plants have some resistance

“As individual trees have shown resistance toward the disease, some authorities are in hopes of securing strains immune or highly resistant of the trouble.”

J.H. Burkett, 1922 TDA Bulletin

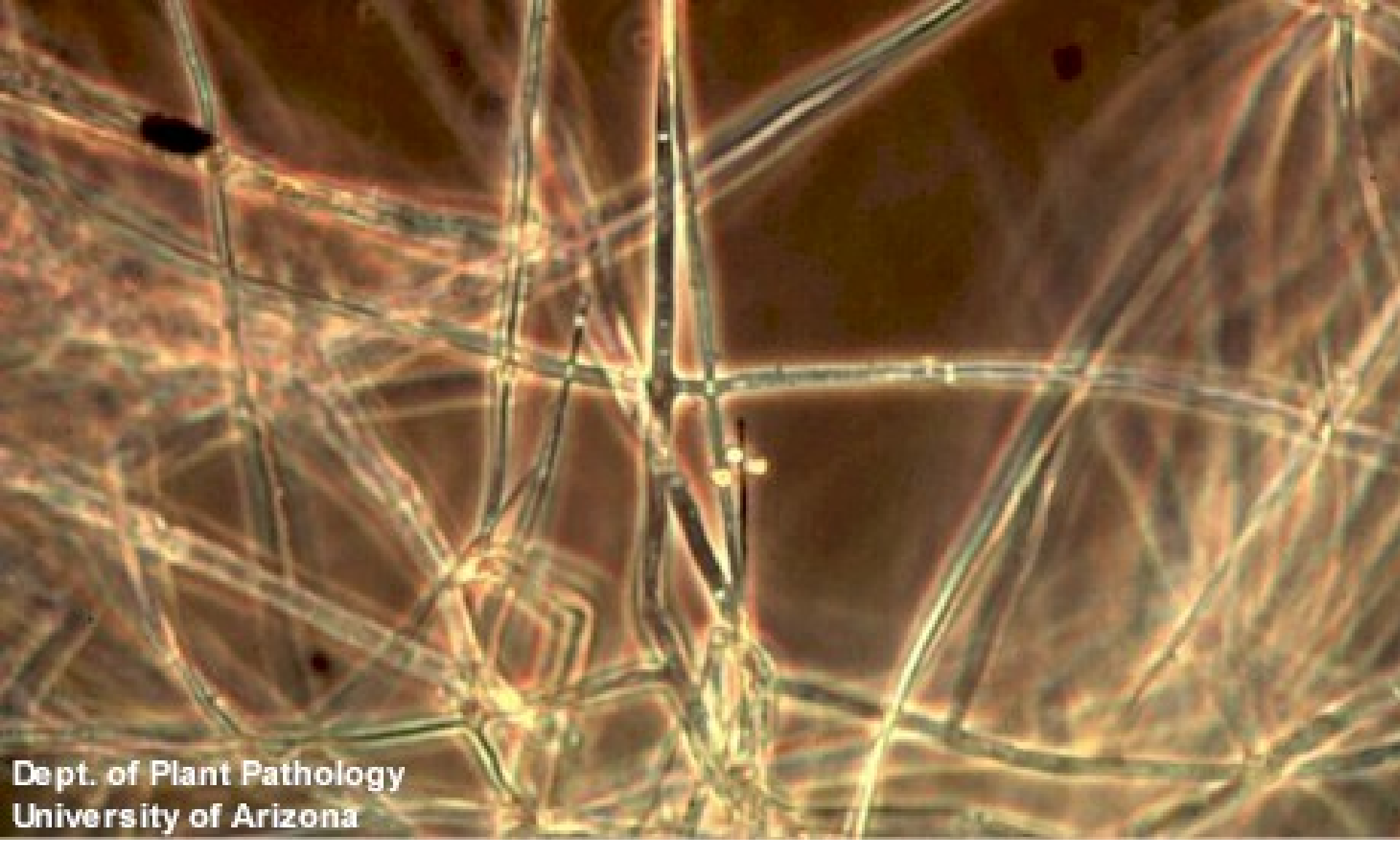
CRR risk factors

- Calcareous high pH soils
- High soil temperature in summer
- Periods of soil saturation: rains, irrigations
- Any stress that stops summer root growth
- Close plant spacing
- Monoculture with susceptible <u>rootstock</u>
- Heavy fruit load


Apple

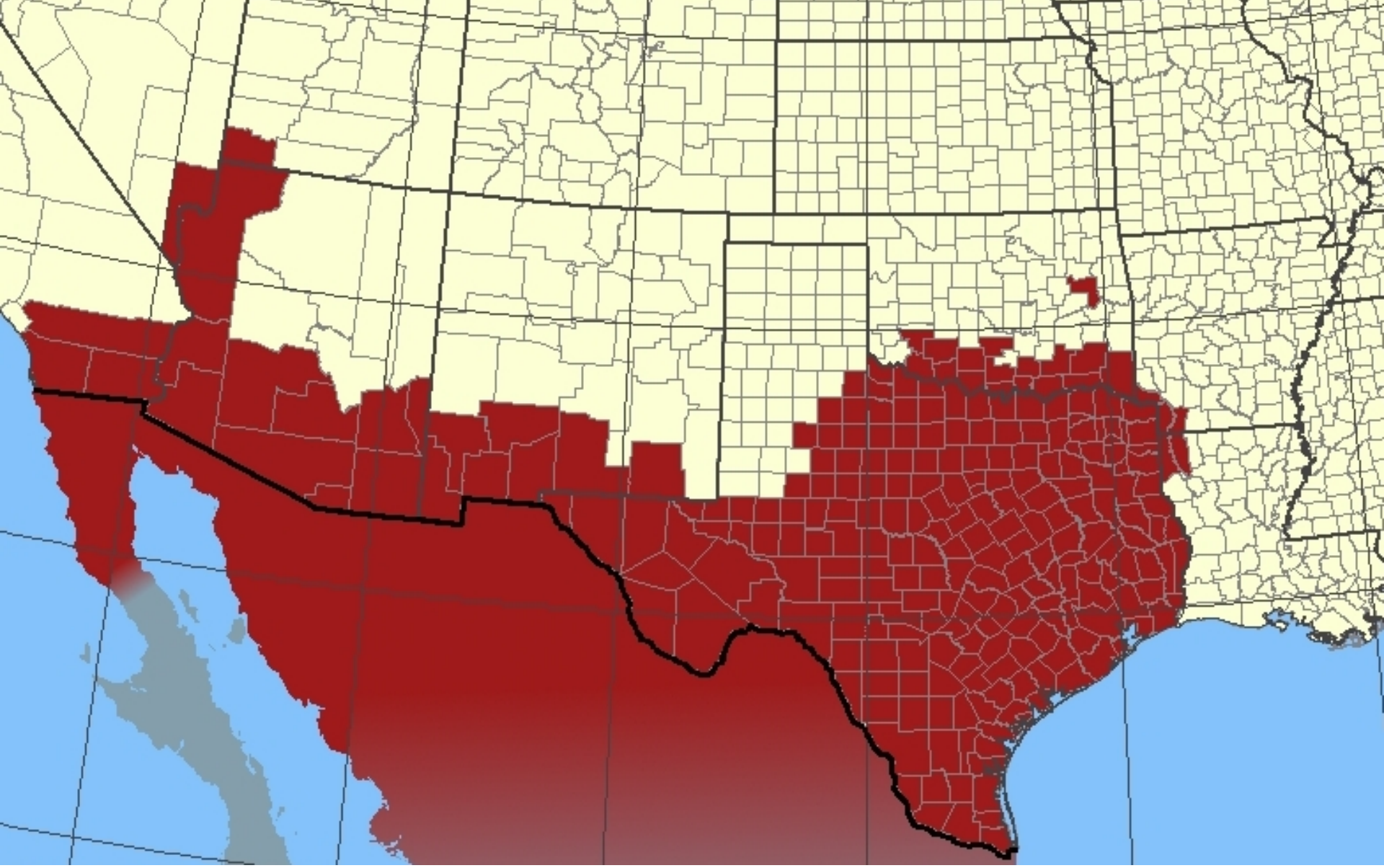
Cotton root rot of Pecan


Mary Olsen, Univ. of Arizona


Dept. of Plant Pathology
University of Arizona

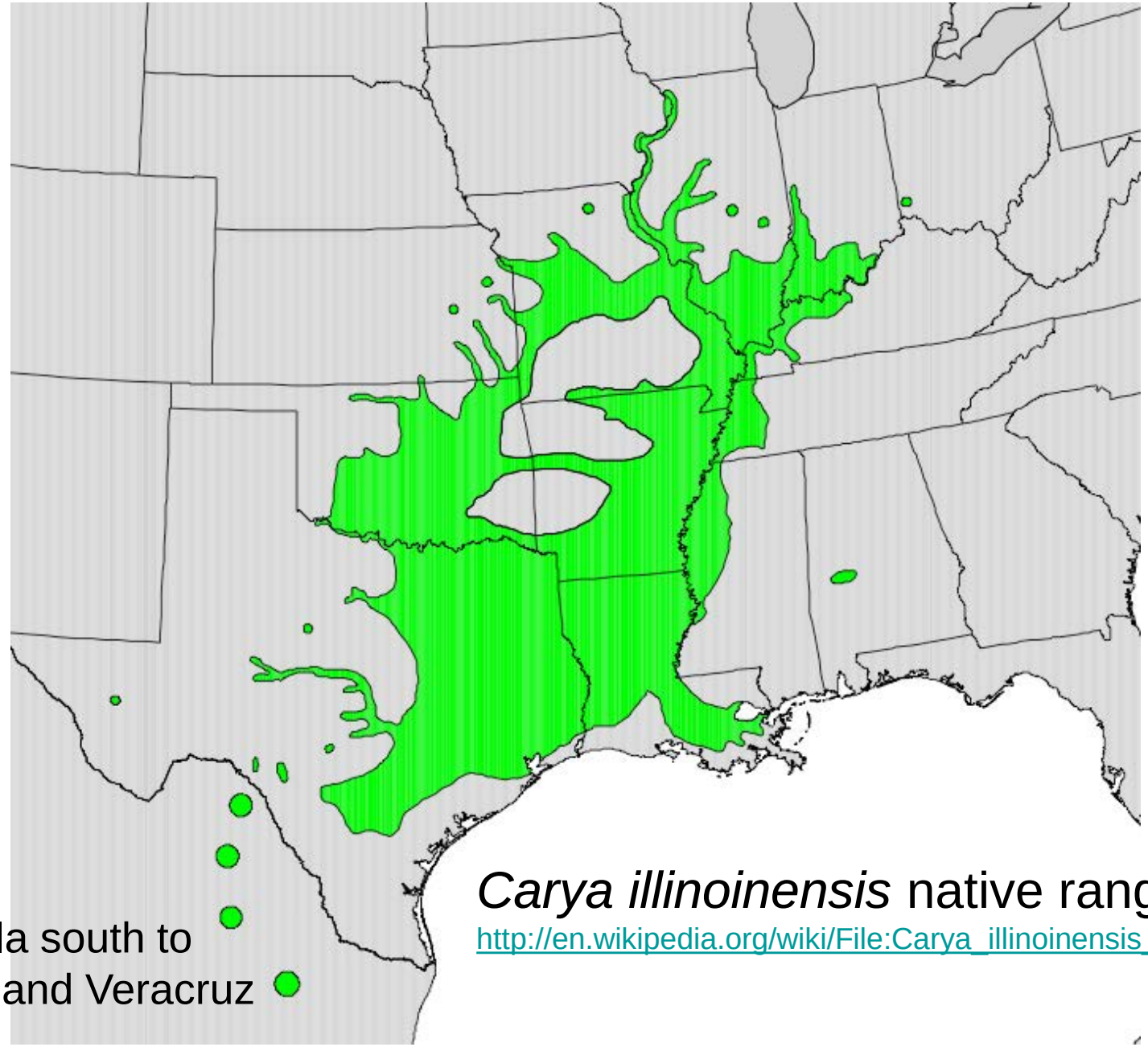
Spore mats on soil

Releases mating (?) spores



Phymatotrichopsis omnivora distribution in USA and Mexico

B.S. Richter 2007 http://www.cals.ncsu.edu/course/pp728/Phymatotrichopsis/



Carya illinoinensis native range.

http://en.wikipedia.org/wiki/File:Carya_illinoinensis_map.png

Coahuila south to
Jalisco and Veracruz

Positives

- Pecan evolved in Texas and NE Mexico; challenged by CRR fungus; great diversity among natives and named varieties
- In general, pecan is considered moderately resistant
- Rootstocks already used 100% for improved varieties

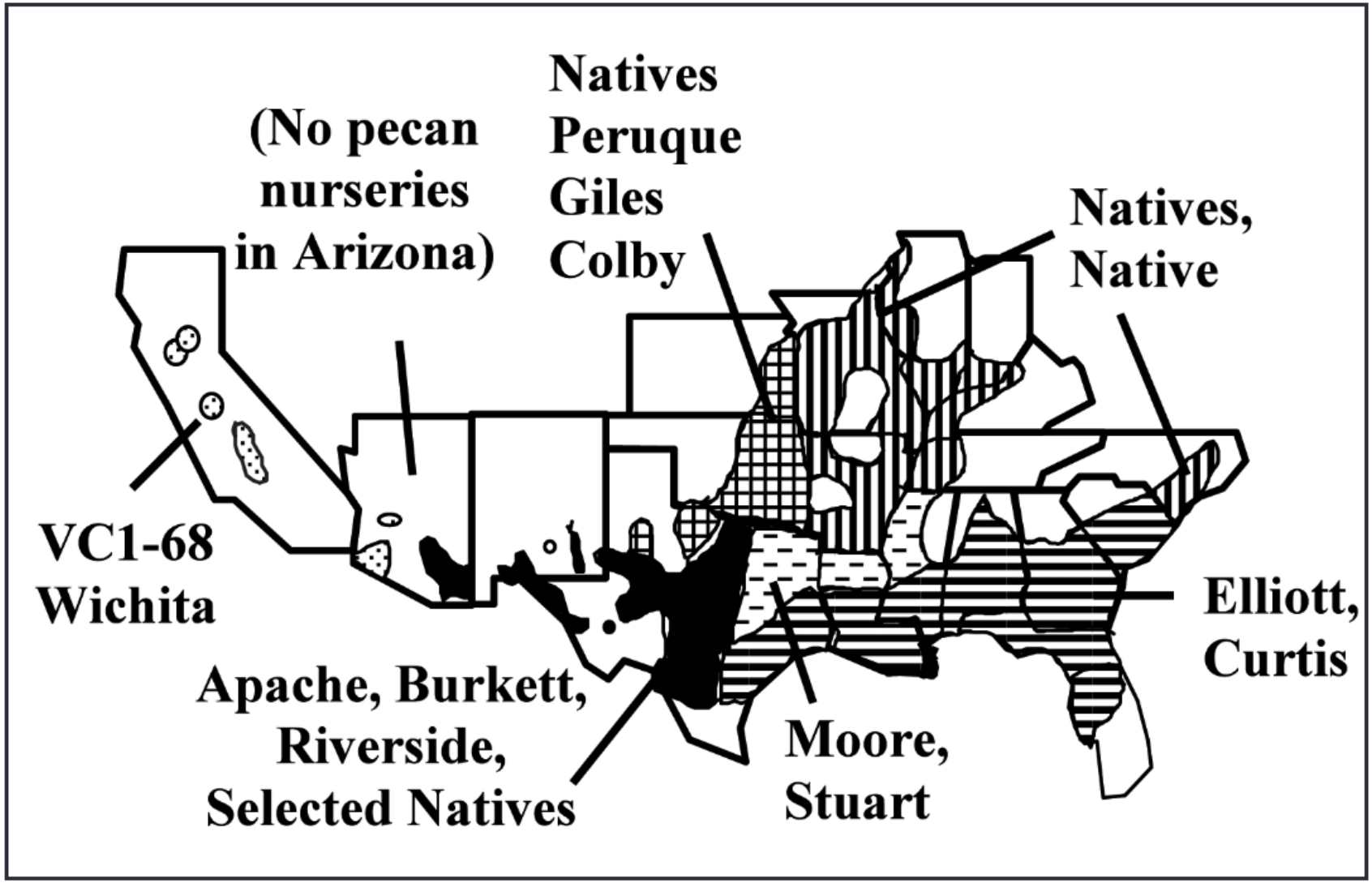


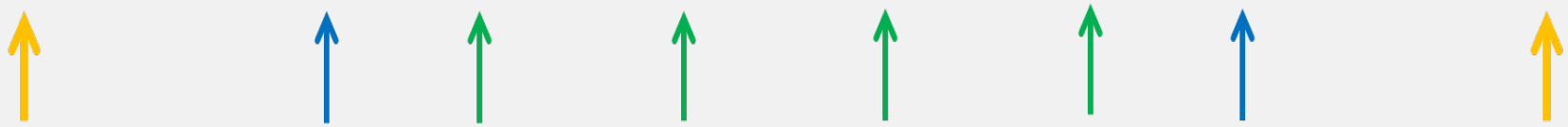
Figure 3. Seed stocks preferred by pecan nurserymen within regions.

L.J. Grauke, SEPGA presentation, 2010

Strategy

- Seedlings from N, E, S, W and Mixed provenances
- Site history of CRR
- Close plantings (2 ft) of 10-plants/plot
- 8 replications (fungus not evenly distributed)
- Ramped up disease by planting alfalfa
- Subsurface drip irrigation

Pecan Drip Alfalfa Drip Pecan



40-inch rows, 24-inch spacing

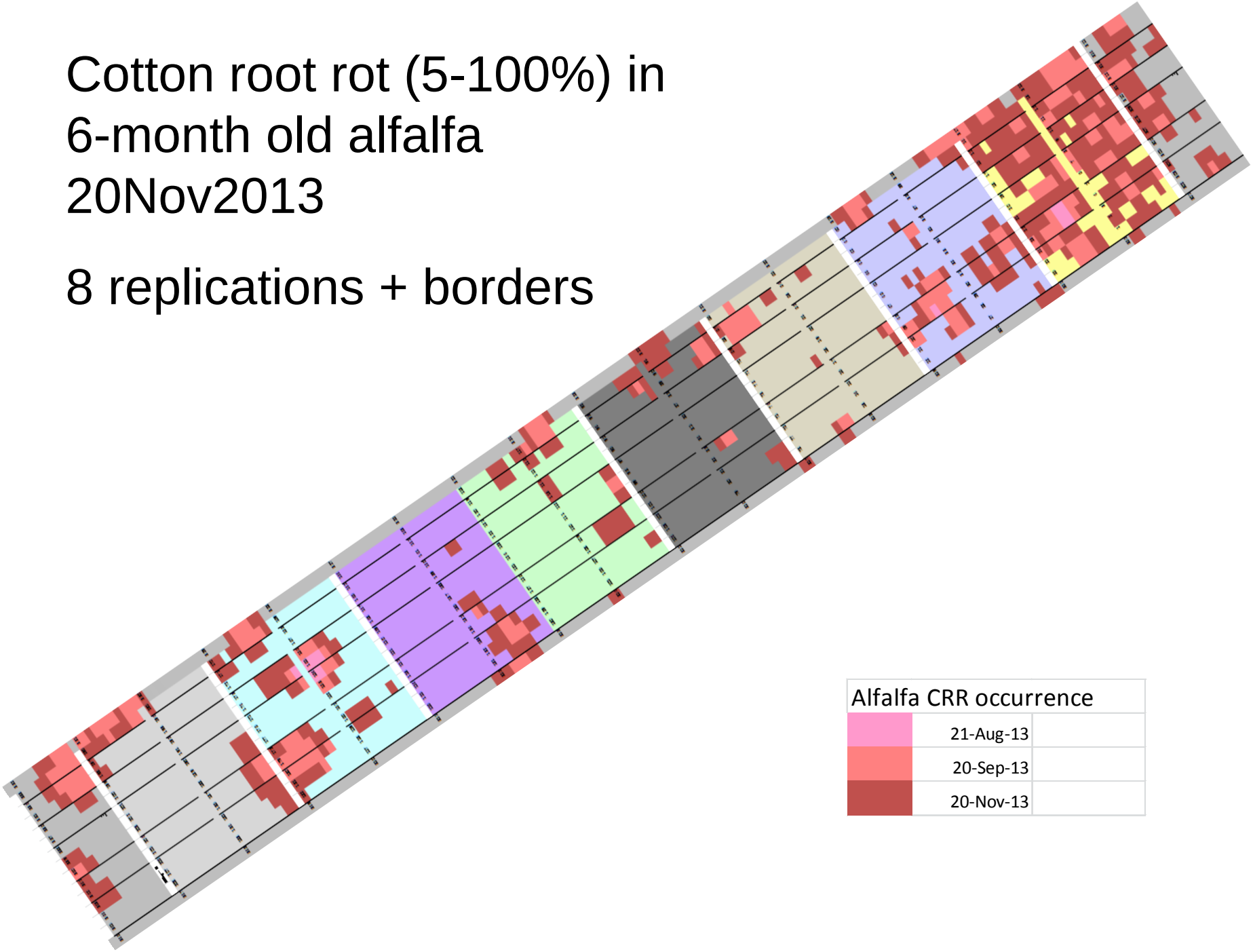
One plot, 20 feet; alleys 4 feet

Drip 8 inches both sides

Field after transplanting; note seedling alfalfa, 2013

Cotton root rot (5-100%) in 6-month old alfalfa 20Nov2013

8 replications + borders




U.S. Customs and
Border Protection
Office of Air and Marine
Uvalde Air Unit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Border Protection
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Uvalde Air Unit


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POISHO
CILIATA

Managing alfalfa

More CRR losses on west end; less disease in background

Data collection

- CRR in alfalfa (2013-2014 only)
- Dead seedlings – P.o. almost always on roots
- Height, lower stem diameter
- Bud break

- Survivors dug and examined

Data collection: disease

- Note dead seedlings
- Recover the roots
- Examine with magnification
- Record *Phymatotrichopsis omnivora*, root surface area (0, 0.01, 0.1, 1, ≥10%)

Recovery of roots from dead trees

- 2013,14,15 Hand digging
- 2016 Hand digging, air spade
- 2017 Excavator

As seedlings grew……


AIRMAN
PDS185S T4
AIRMAN
MMD
EQUIPMENT
Baker
Rentals
LLC
UVALDE, TEXAS
830•278•2894

Air-Spade, 90 p.s.i., Mach 2 air-jet

Root and column of soil exposed with Air Spade

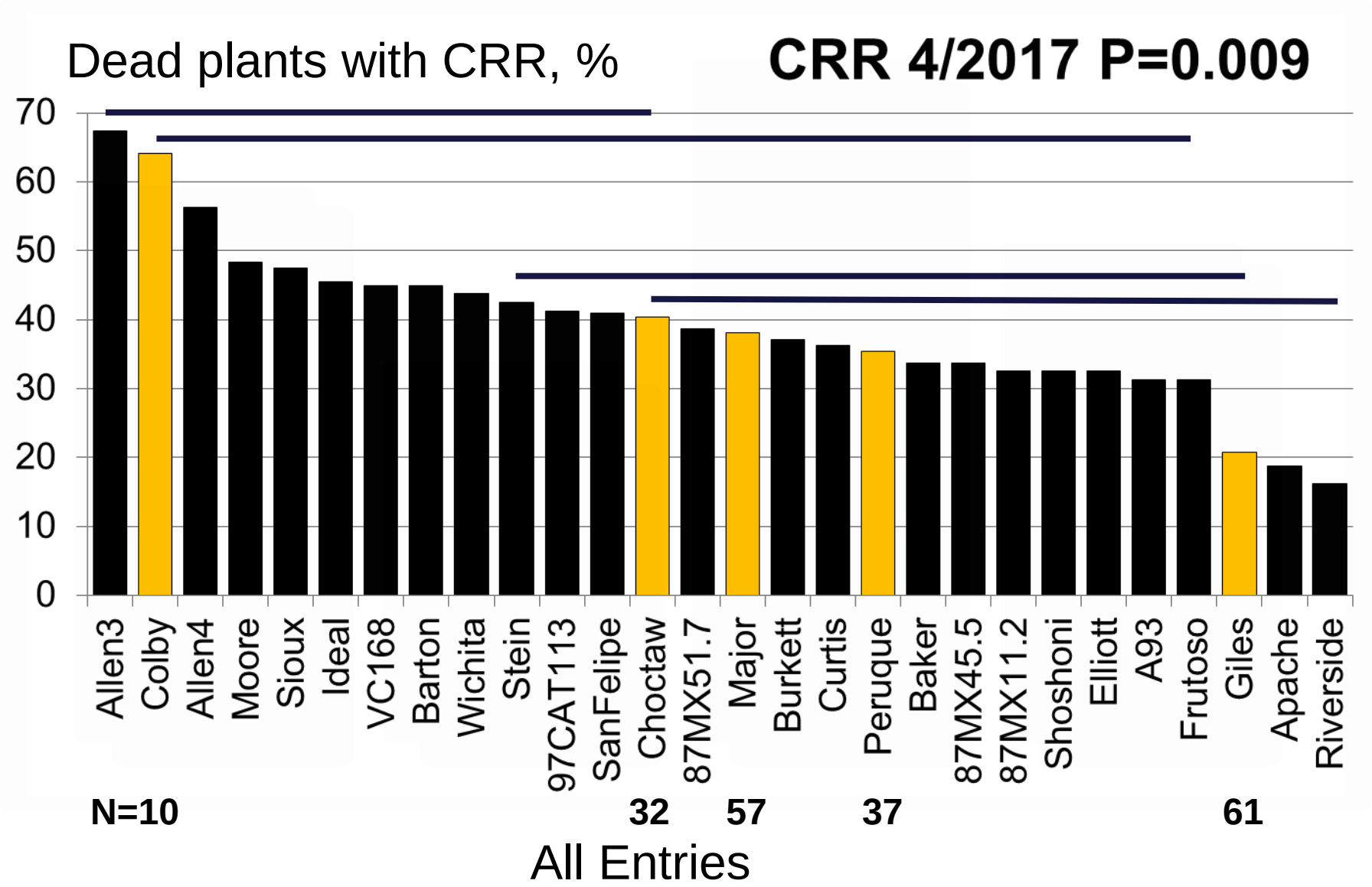
Recover and bag dead roots from soil column

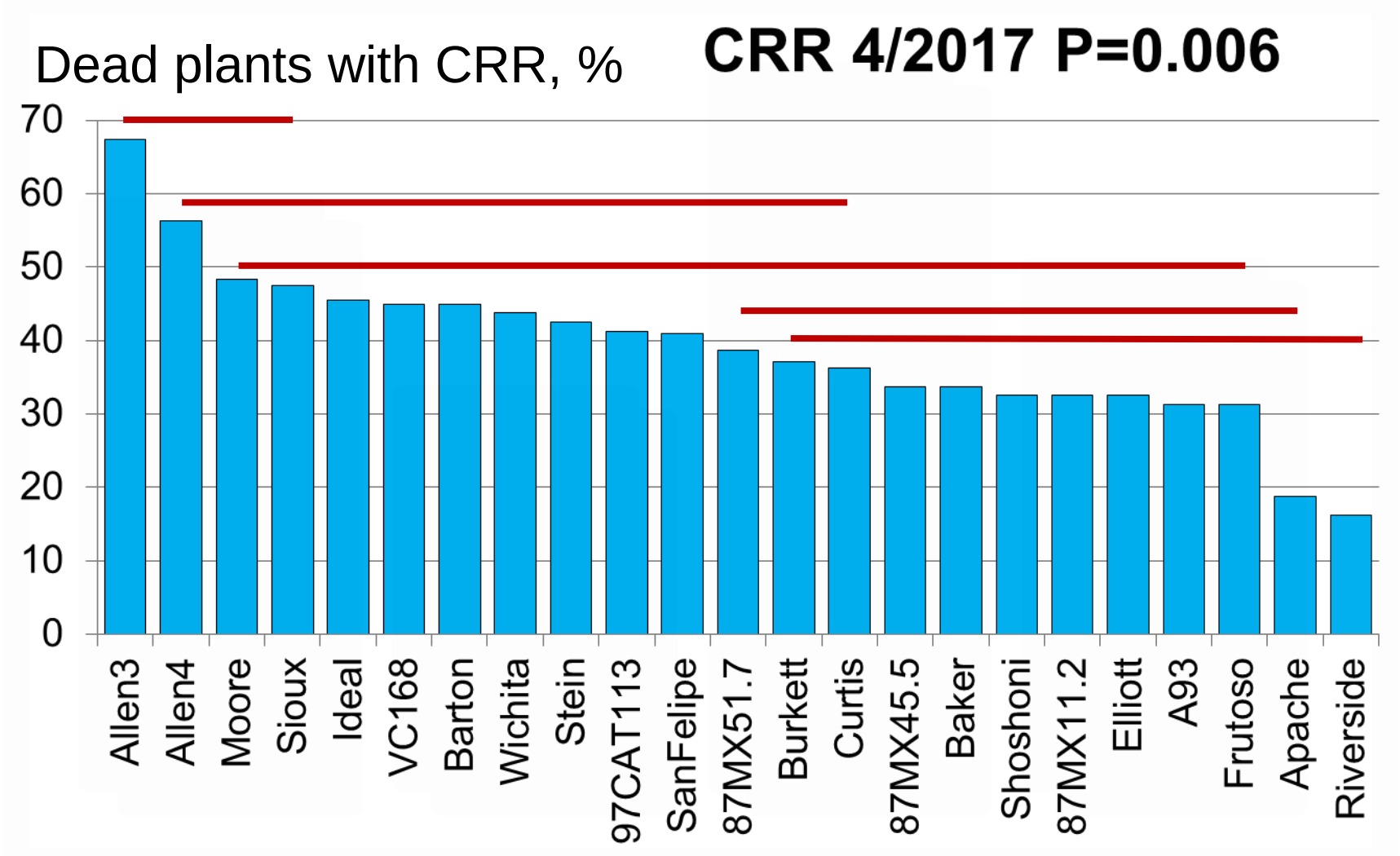

184


control vs. watering
525 PL 2

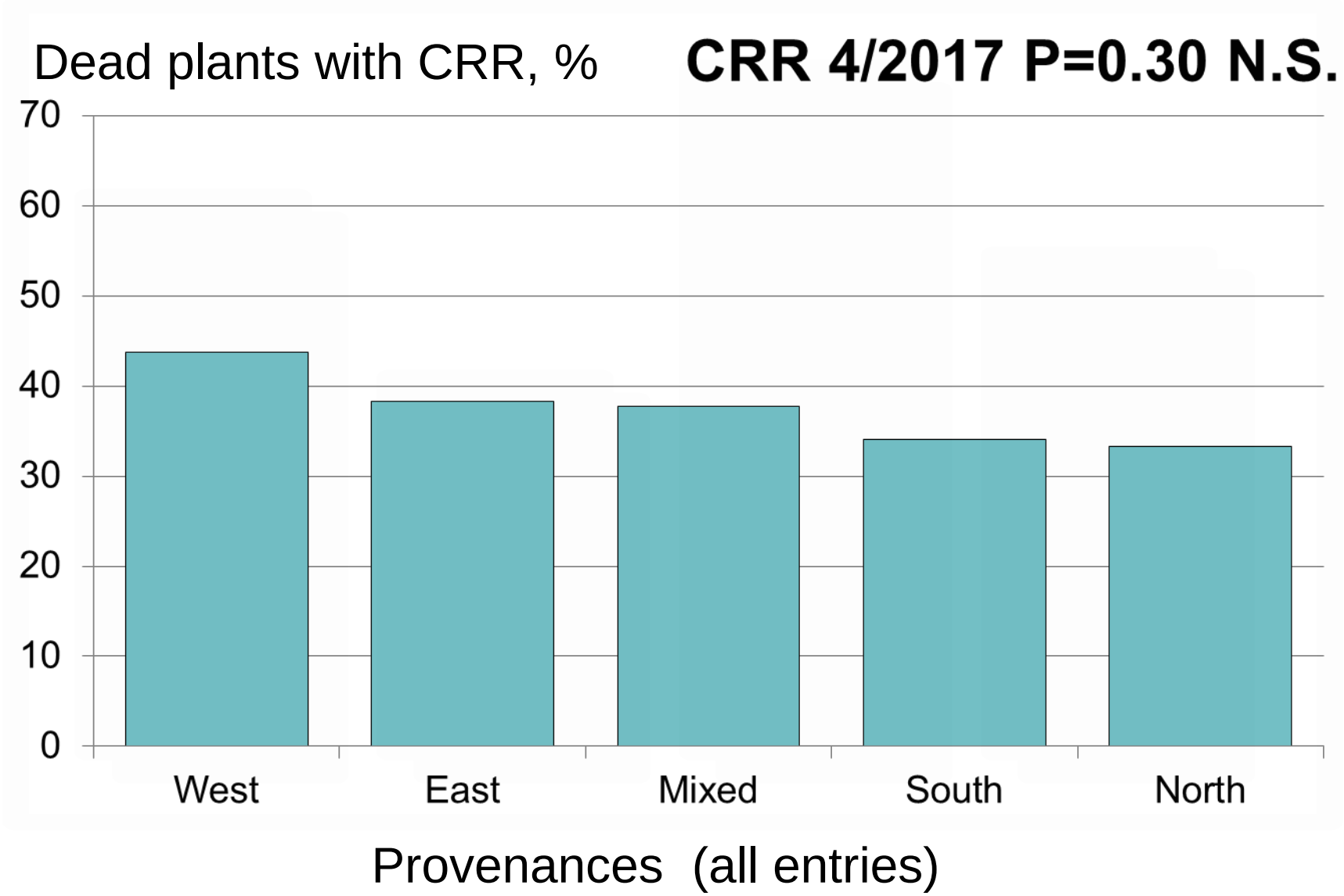
Statistics

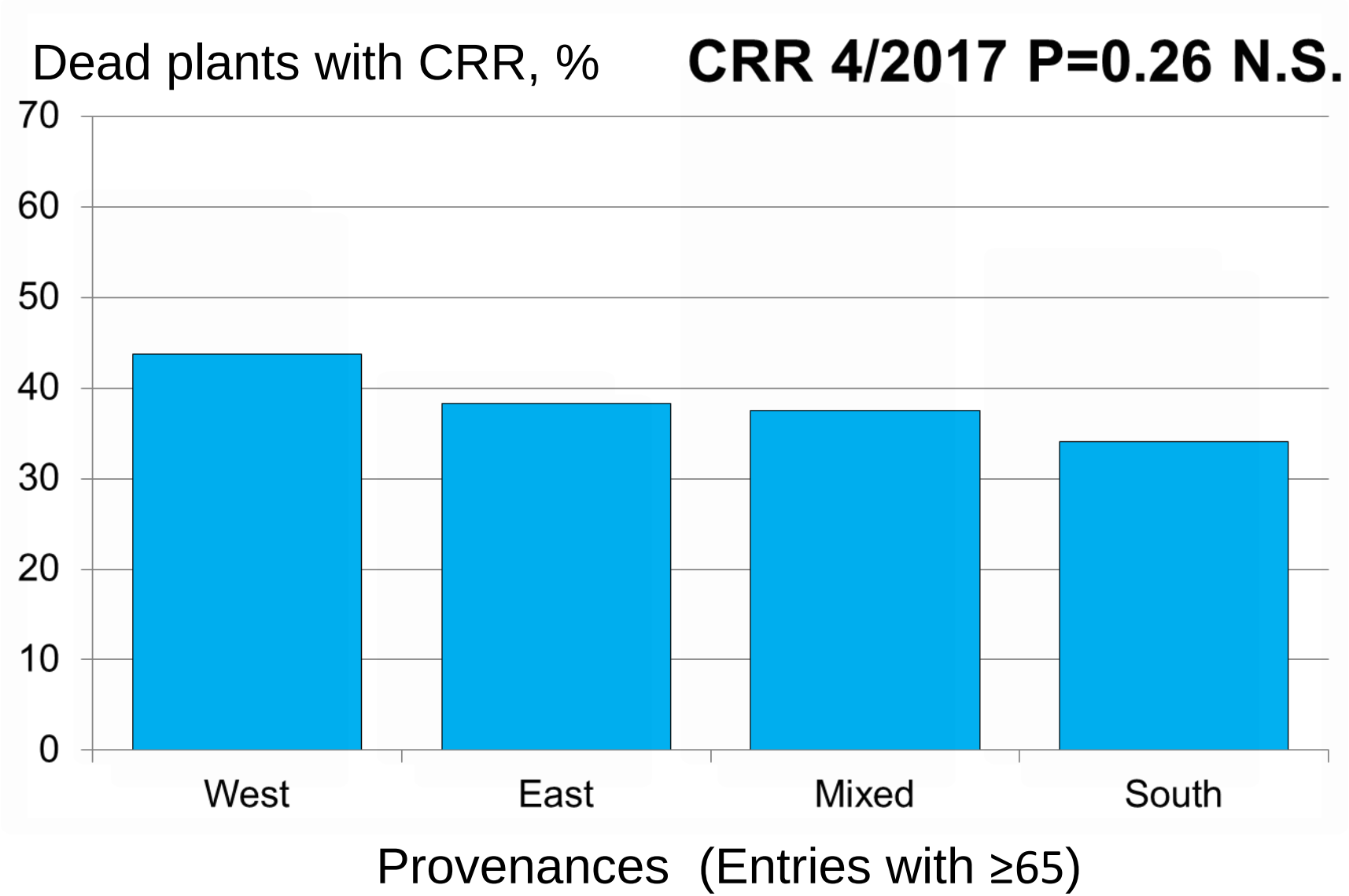
	Dead-All		Dead-Fewer		Survivor-All		Survivor-Fewer	
	Entry	Prov	Entry	Prov	Entry	Prov	Entry	Prov
CRR	**	NS	**	NS	NS	NS	NS	NS
P.o. root area	NS	NS	NS	NS	NS	NS	NS	NS
Mortality	**	NS	**	NS	-	-	-	-

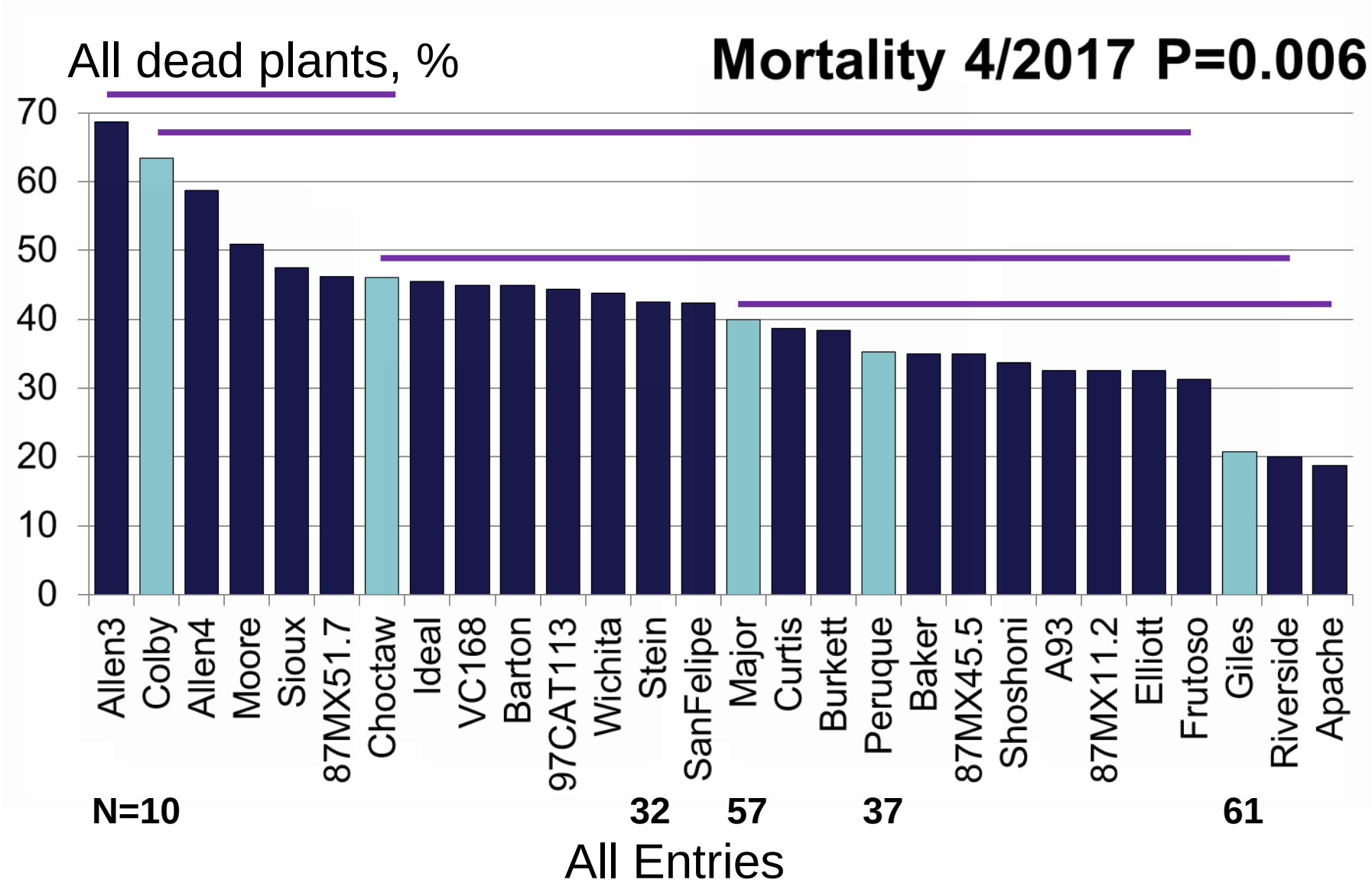

Dead plants with CRR, %
CRR 4/2017 P=0.009
70
60
50
40
30
20
10
0
Allen3
Colby
Allen4
Moore
Sioux
Ideal
VC168
Barton
Wichita
Stein
97CAT113
SanFelipe
Choctaw
87MX51.7
Major
Burkett
Curtis
Peruque
Baker
87MX45.5
87MX11.2
Shoshoni
Elliott
A93
Frutoso
Giles
Apache
Riverside
N=10
32
57
37
61
All Entries

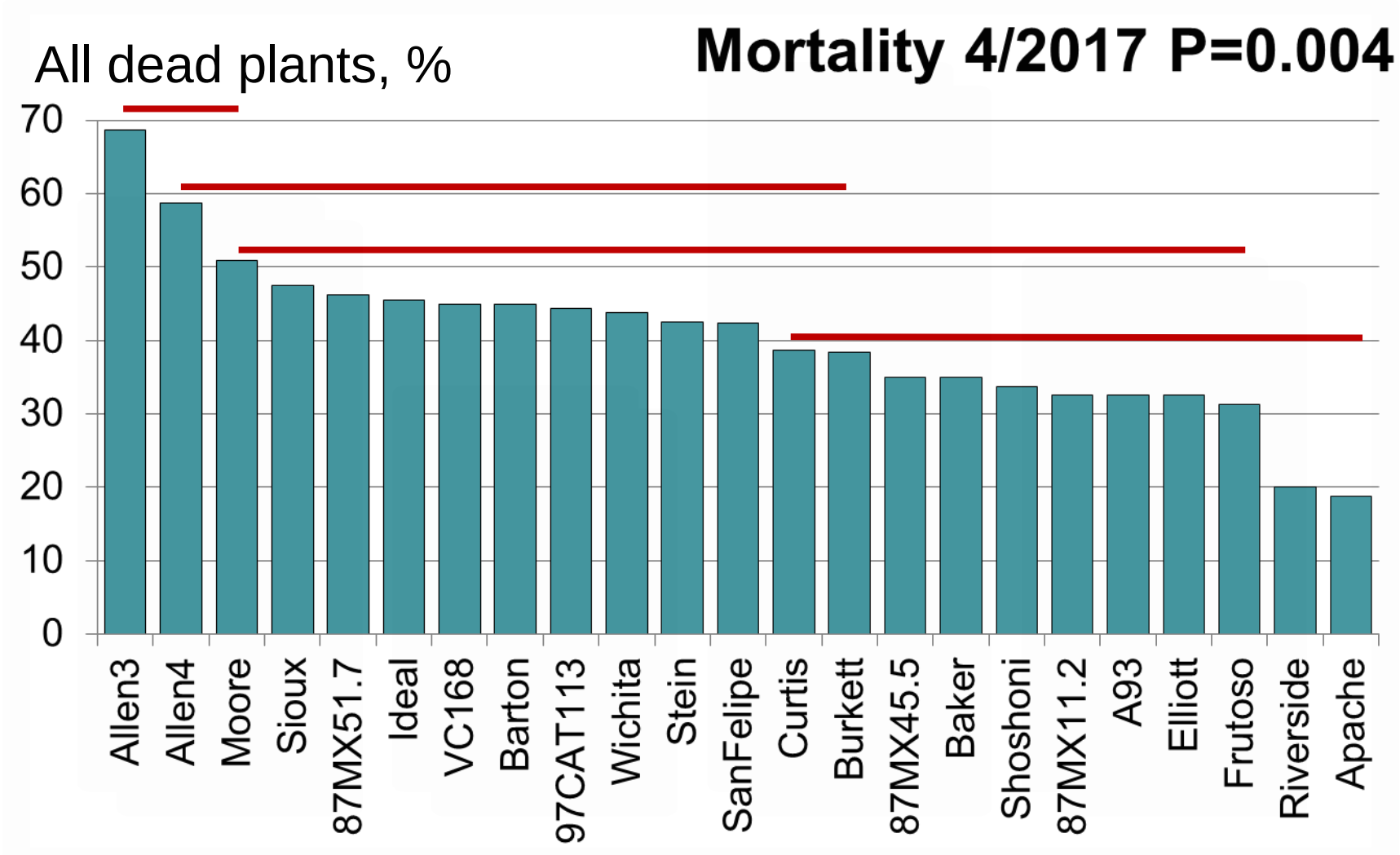


Entries with ≥ 65 plants

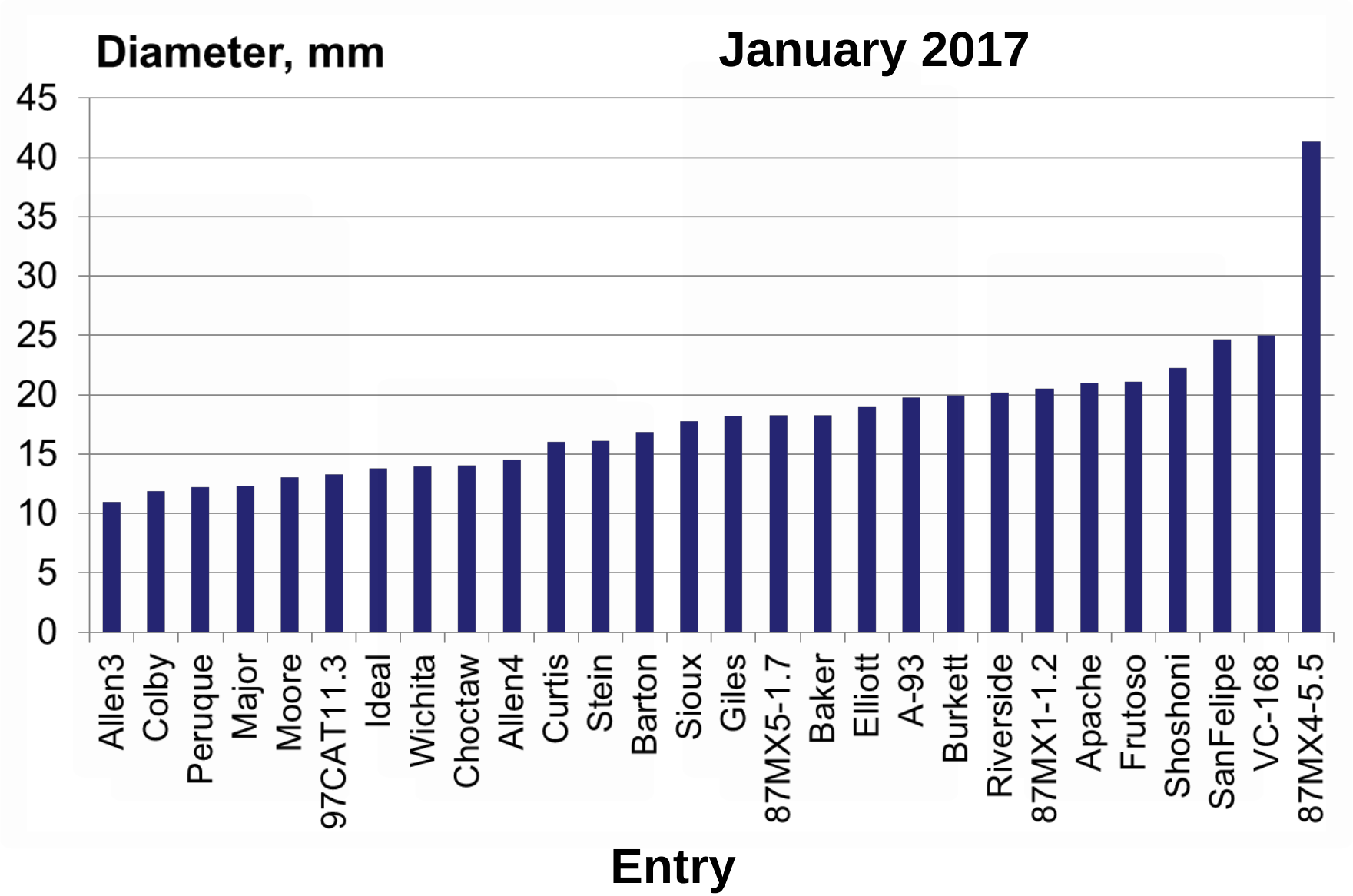

Dead plants with CRR, %
CRR 4/2017 P=0.30 N.S.
70
60
50
40
30
20
10
0
West
East
Mixed
South
North
Provenances (all entries)

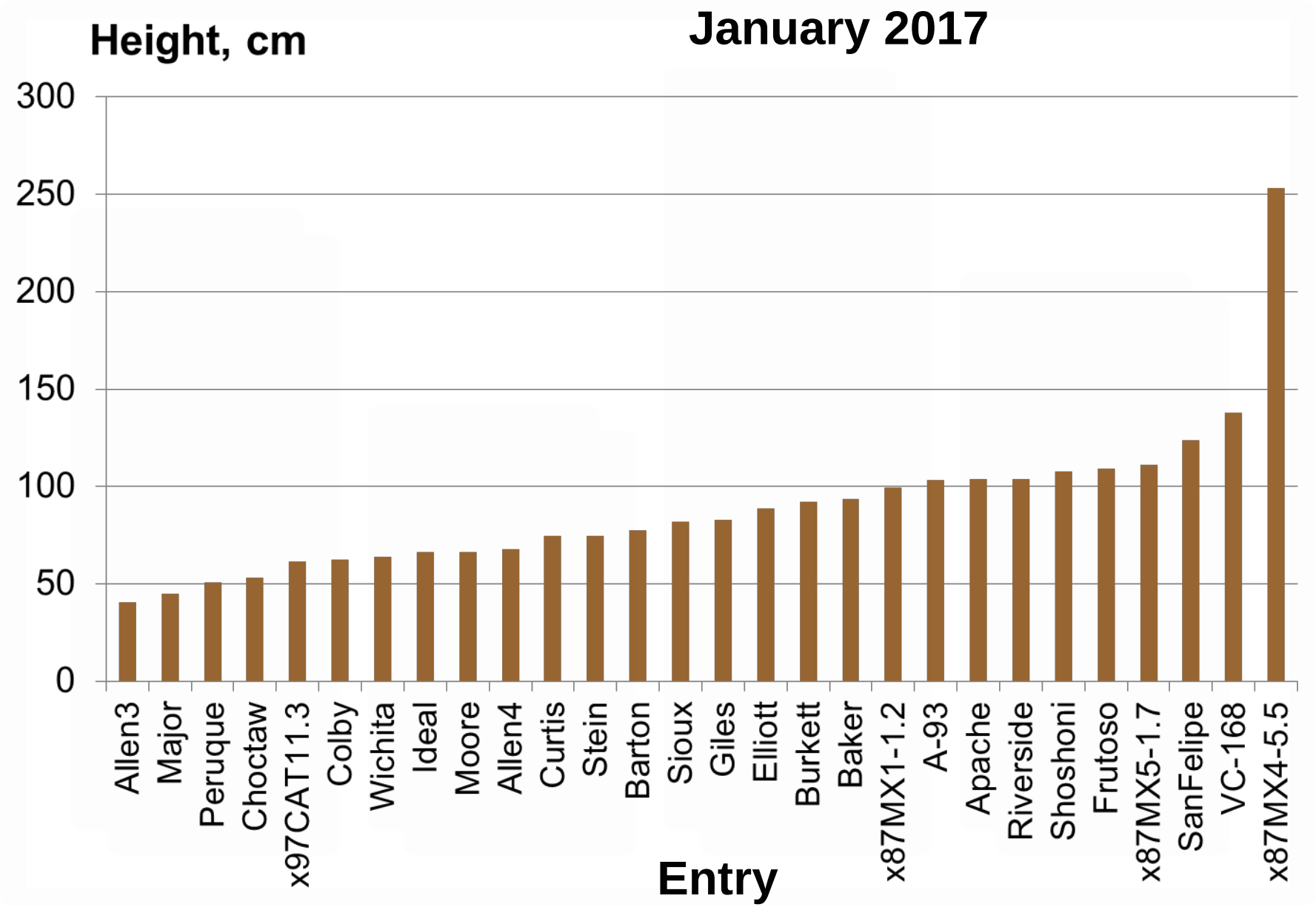

Dead plants with CRR, %
CRR 4/2017 P=0.26 N.S.
70
60
50
40
30
20
10
0
West
East
Mixed
South
Provenances (Entries with ≥65)

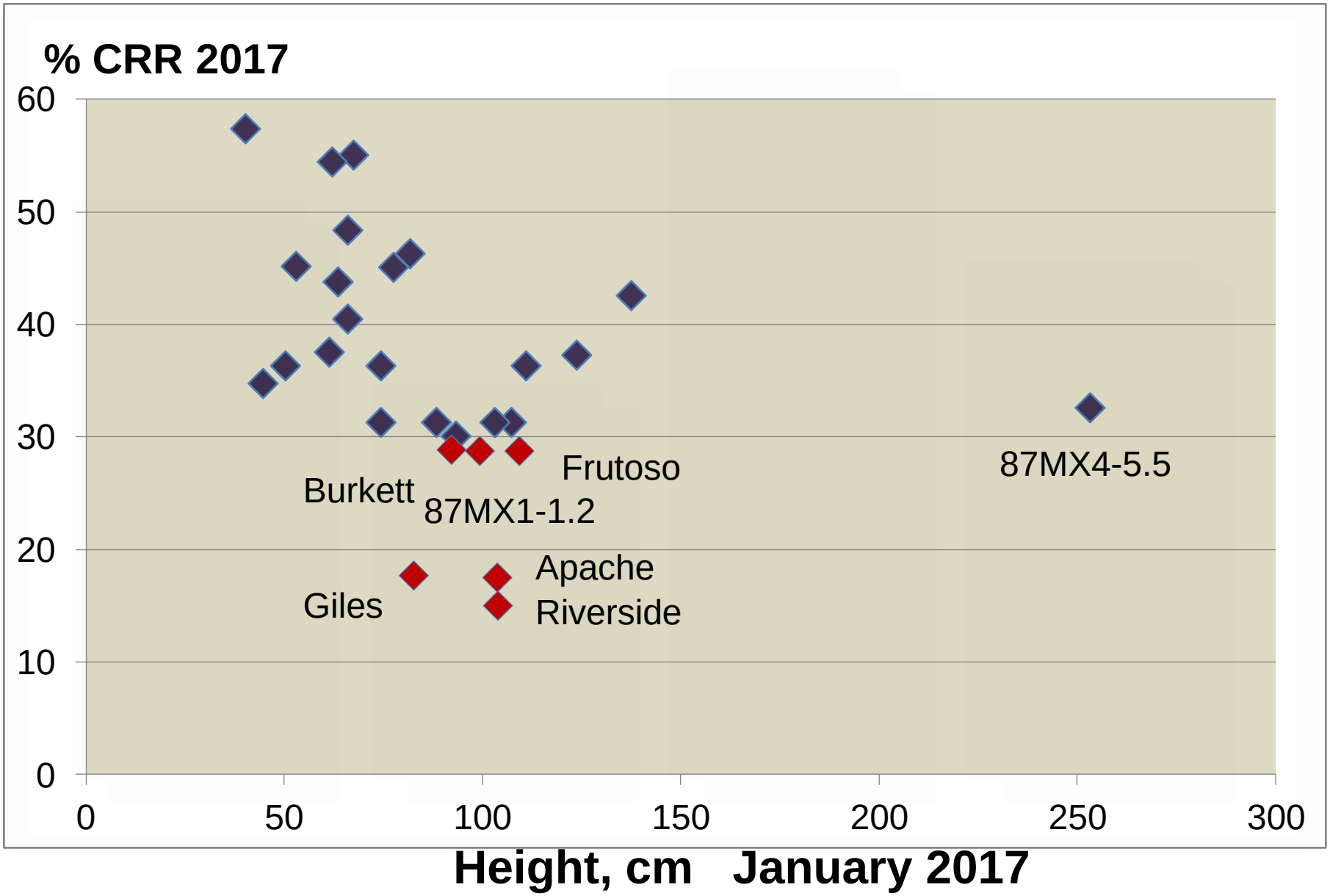

All dead plants, %
Mortality 4/2017 P=0.006
70
60
50
40
30
20
10
0
Allen3
Colby
Allen4
Moore
Sioux
87MX51.7
Choctaw
Ideal
VC168
Barton
97CAT113
Wichita
Stein
SanFelipe
Major
Curtis
Burkett
Peruque
Baker
87MX45.5
Shoshoni
A93
87MX11.2
Elliott
Frutoso
Giles
Riverside
Apache
N=10
32
57
37
61
All Entries

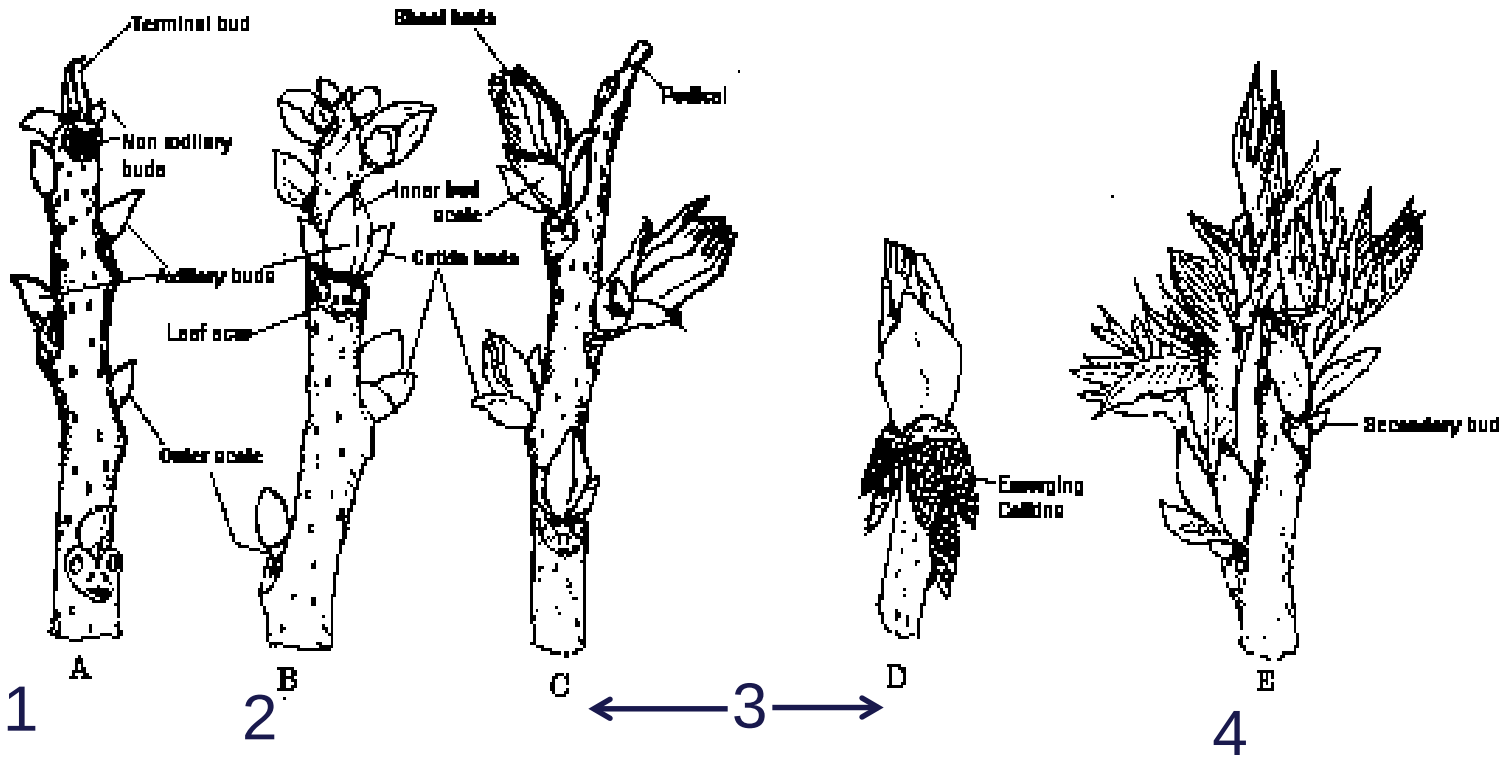


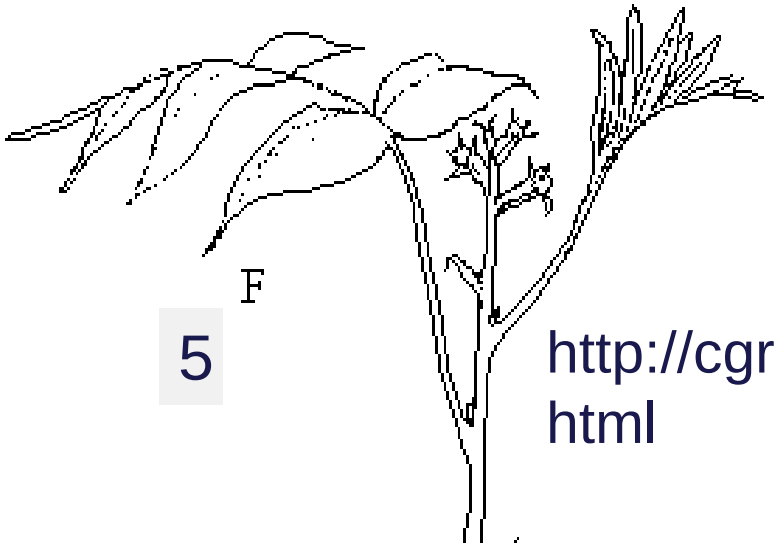
Entries with ≥ 65 plants


Diameter, mm
January 2017
45
40
35
30
25
20
15
10
5
0
Allen3
Colby
Peruque
Major
Moore
97CAT11.3
Ideal
Wichita
Choctaw
Allen4
Curtis
Stein
Barton
Sioux
Giles
87MX5-1.7
Baker
Elliott
A-93
Burkett
Riverside
87MX1-1.2
Apache
Frutoso
Shoshoni
SanFelipe
VC-168
87MX4-5.5
Entry


January 2017
Height, cm
300
250
200
150
100
50
0
Allen3
Major
Peruque
Choctaw
x97CAT11.3
Colby
Wichita
Ideal
Moore
Allen4
Curtis
Stein
Barton
Sioux
Giles
Elliott
Burkett
Baker
x87MX1-1.2
A-93
Apache
Riverside
Shoshoni
Frutoso
x87MX5-1.7
SanFelipe
VC-168
x87MX4-5.5
Entry


% CRR 2017
60
50
40
30
20
10
0
0
50
100
150
200
250
300
Burkett
87MX1-1.2
Frutoso
87MX4-5.5
Giles
Apache
Riverside
Height, cm January 2017





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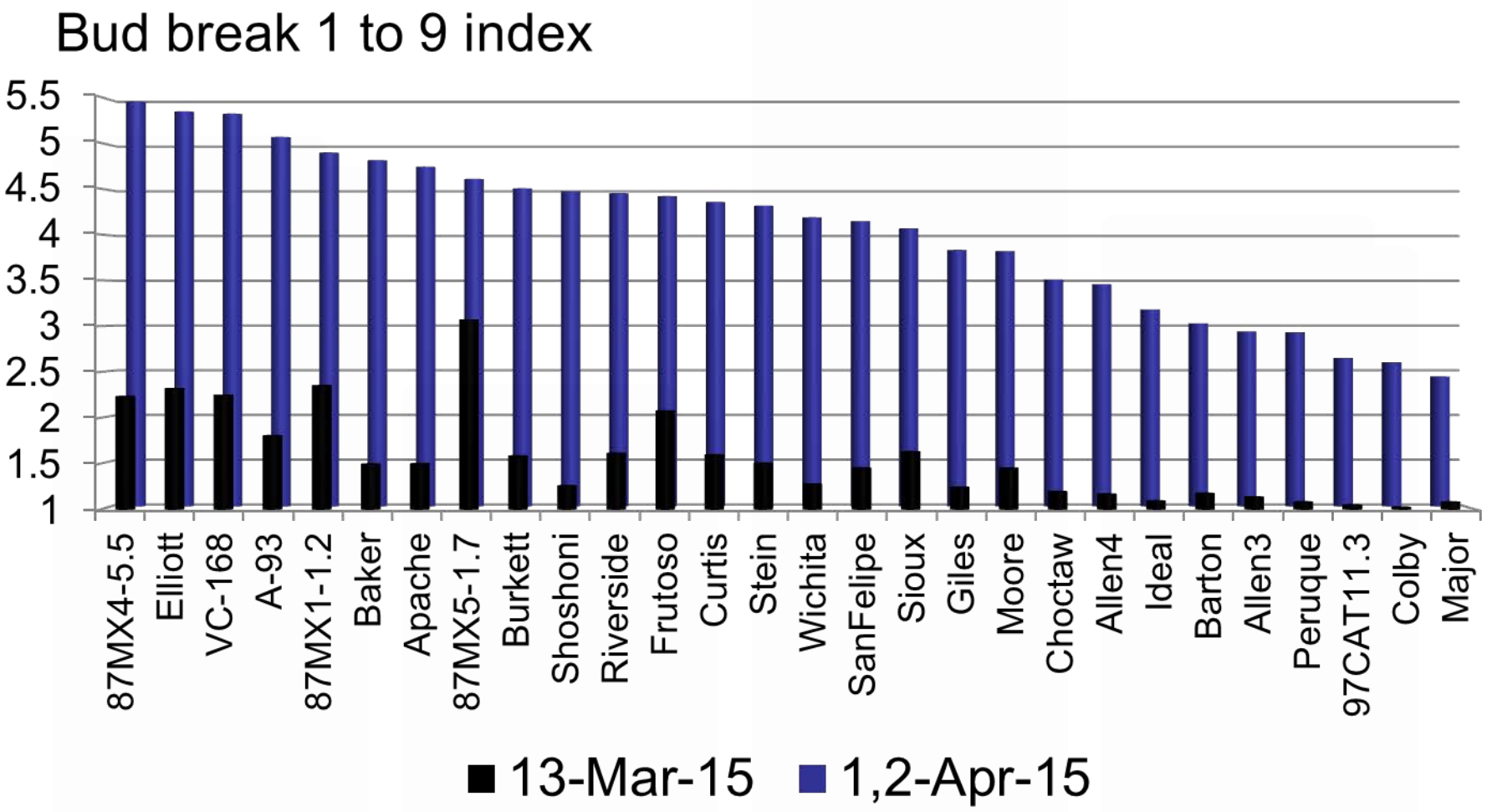
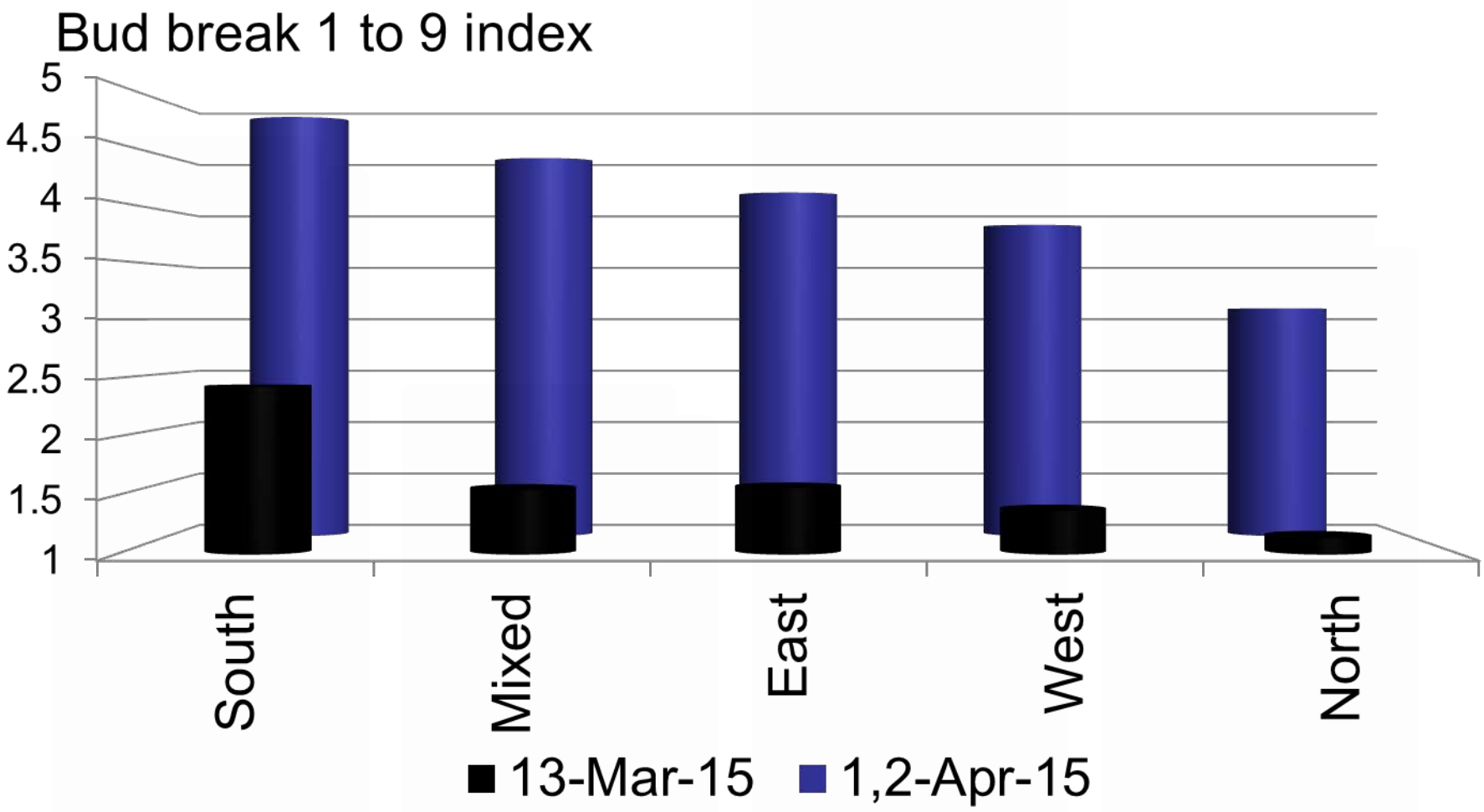
http://cgru.usda.gov/carya/Manual/BUDBRK.html


Bud break 1 to 9 index
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
87MX4-5.5
Elliott
VC-168
A-93
87MX1-1.2
Baker
Apache
87MX5-1.7
Burkett
Shoshoni
Riverside
Frutoso
Curtis
Stein
Wichita
SanFelipe
Sioux
Giles
Moore
Choctaw
Allen4
Ideal
Barton
Allen3
Peruque
97CAT11.3
Colby
Major
13-Mar-15
1,2-Apr-15


Bud break 1 to 9 index
5
4.5
4
3.5
3
2.5
2
1.5
1
South
Mixed
East
West
North
13-Mar-15
1,2-Apr-15


‘Riverside’ BWV 3-16 4 Apr 2017

87MX4-5.5 is a seedling grown from seed collected 8 Sept 1987 from this tree, growing in Ixmiquilpan, Hidalgo, Mexico, on the property of Norodino Rodriguiz.
The original tree was 60 ft in height, 84 cm diameter, with moderate branching, no observed nutritional deficiencies, good health, heavy crop, when collected by Grauke, Payne, Wood and Parfitt.

Seedlings were planted in provenance orchards in College Station, TX and Byron, GA.

The Ixmiquilpan population is characterized by low, wide spreading canopies due to almost indeterminate terminal growth that begins early in the year and extends until very late, sometimes December.

87MX4-5.5, CSV 16-8

Seed from these two trees were planted in the Cotton Root Rot Nursery at Uvalde, TX.

87MX4-5.5 produces the largest seedlings in the test, but trees from Mexico (Southern Provenance) produce larger seedlings than US seedstocks.

Genomic tests are being run on 70 seedlings from each of these two mother trees to determine if they cross pollinated each other, and if pollen parent contributes to seedling vigor.

College Station provenance orchard 5 Apr 2017

87MX4-5.5

- Largest height and diameter
- Best in nematode screeing
- Tolerates Na & Cl (Miyamoto)
- Performs well in inoculation with *Tuber lyonii*

GBS Sequencing

- Genotype By Sequence analysis
- Patricia Klein & Nolan Bentley
- 87MX5-1.7 pollen contributes to vigor of 87MX4-5.5 ?
- Establish relationship between genetic composition and field performance

Conclusions

- CRR screening is challenging, but possible
- No immunity in pecan, but some field resistance in seedling stage
- Rootstock choice should be considered for CRR management, and could become more important
- Consider tree size, fruitfulness, freeze risk, salt tolerance, water use, etc.