



**Screening Andean dry bean
germplasm for root rot resistance
and phenotyping *Pythium* species
for pathogenicity and virulence**

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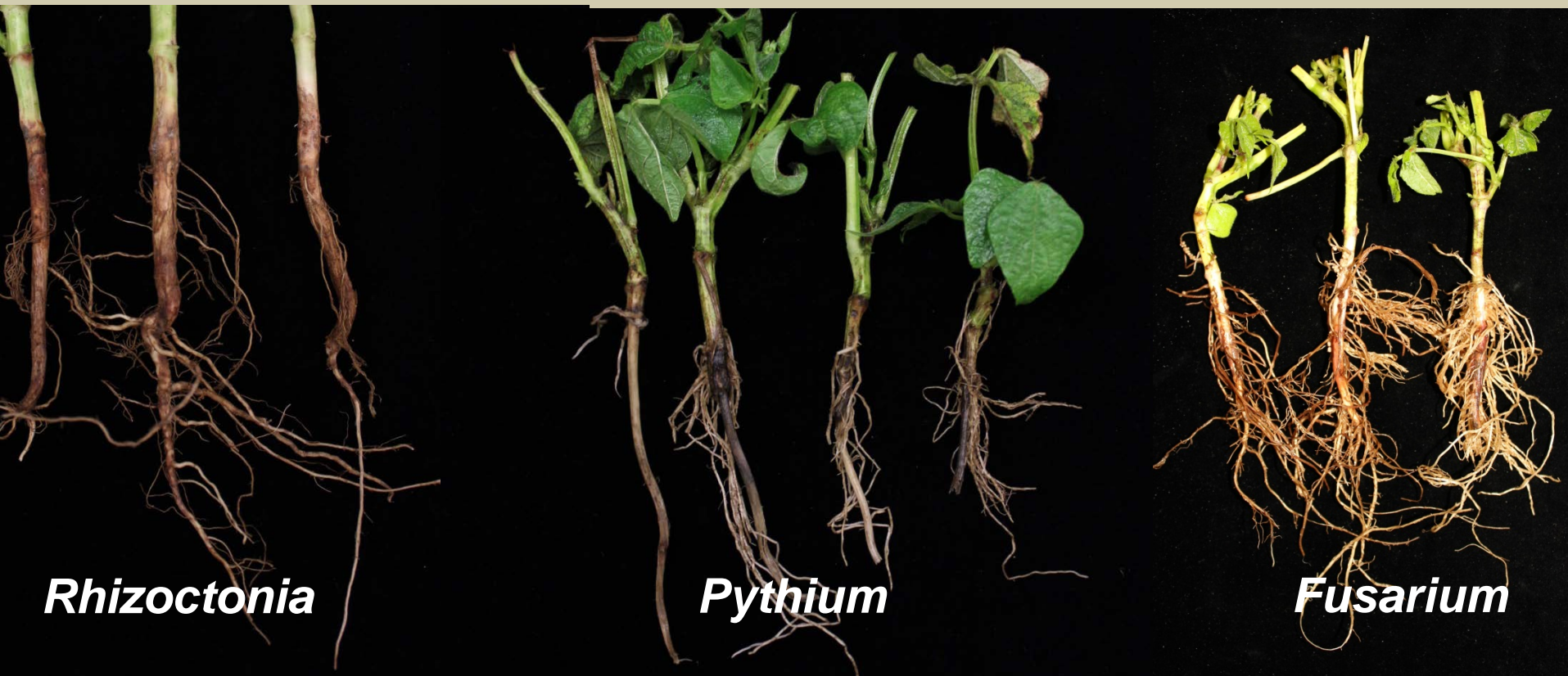
How do we tackle root rots?

- Pathogen surveys
- Characterizing pathogens
- Screening germplasm for resistance



Root rot pathogens in Michigan

- Isolation with WMS and CMA-PARP
- 2014, 196 plants, 9 locations
- 139 isolates



2014 survey results

- **42% - *Rhizoctonia***
 - Multiple AG groups
- **38% - 9 *Fusarium* spp.**
 - *F. oxysporum*, *F. brasiliense*, *F. cuneirostrum*, *F. lateritum*, *F. acuminatum*, *F. sporotrichioides*, *F. solani* complex
- **20% - Oomycetes (9 *Pythium* and 2 *Phytophthora*)**
 - *Py. sylvaticum*, *Py. myriotylum*, *Py. acanthicum*, *Py. ultimum*, *Py. irregular*, *Py. heterothallicum*, *Py. coloratum*, *Py. oopapillum*, *Py. sp.*, *Ph. gonapodyides*, *Phytopythium vexans*

**Phenotyping *Pythium* species
for pathogenicity and virulence**

Phenotyping *Pythium* species for pathogenicity and virulence

Panel of 20 *Pythium* species

- Prevalence in the U.S.
- Virulence (high and low)
- Known & unknown pathogens



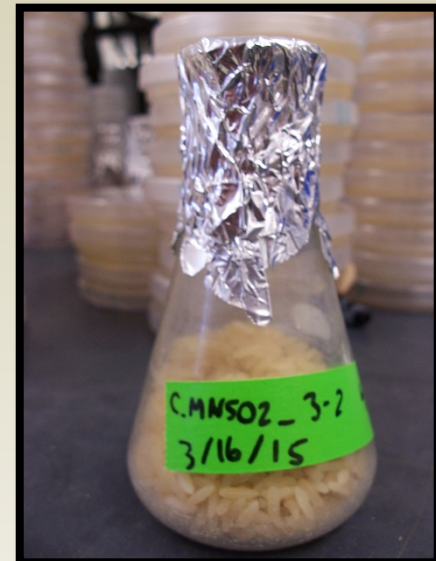
'Zorro' black – Meso-American



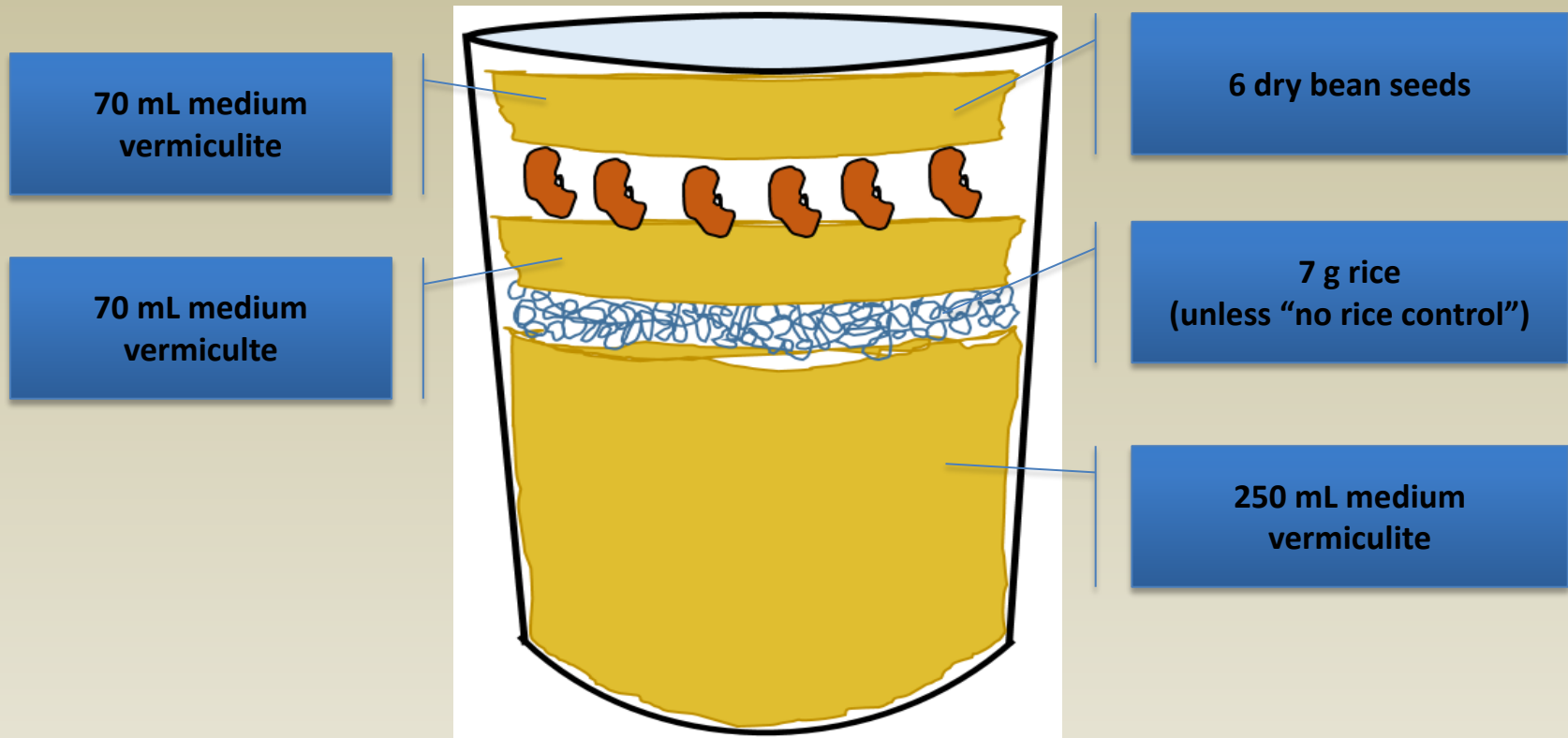
'Red Hawk' kidney - Andean

Preparing Inoculum

- Autoclaved (sterilized) rice as an inoculum substrate
- Added five plugs from pathogen culture
 - Three isolates of each species tested
- Incubated at room temperature for 10-14 days

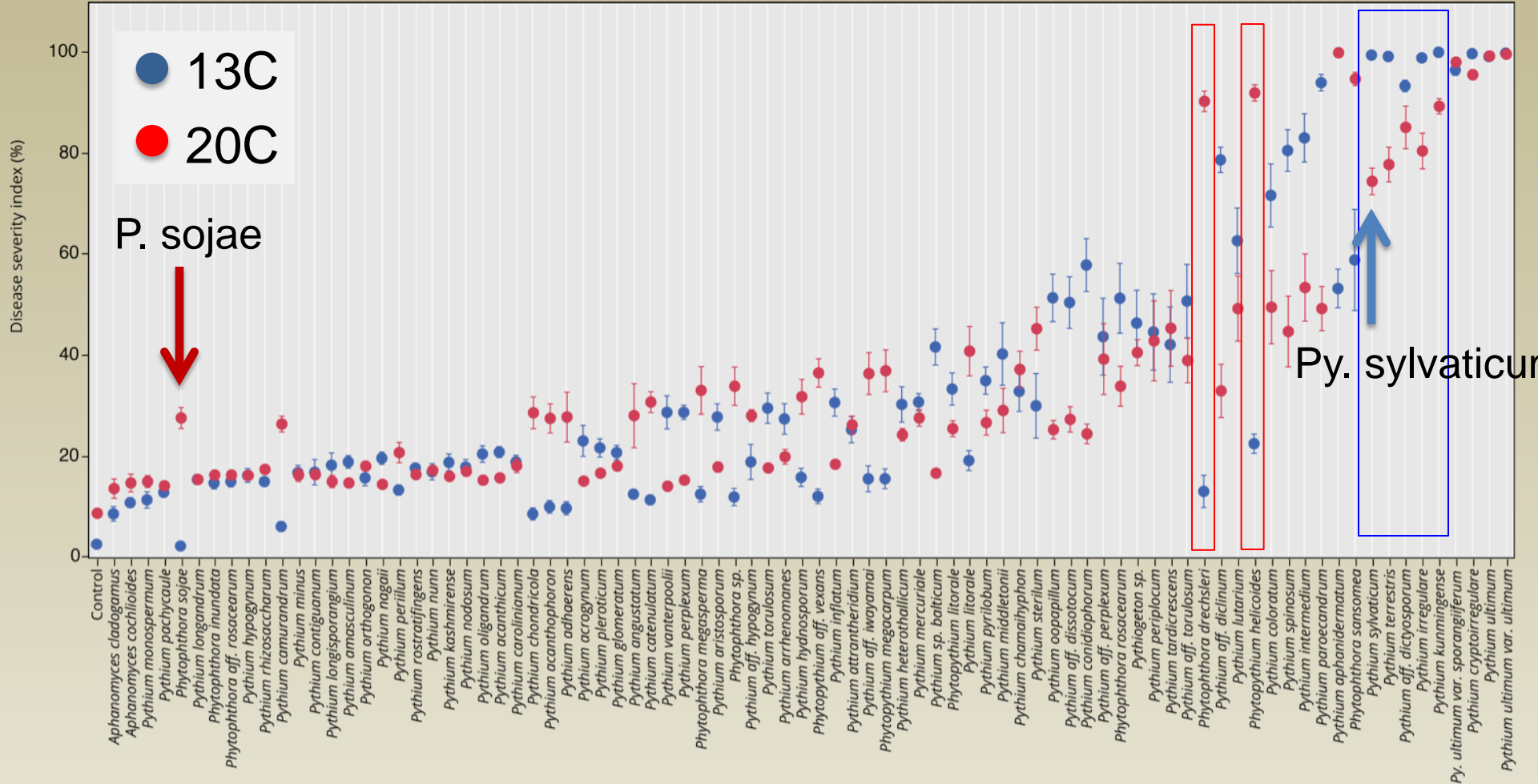


Cup Assay - -growth chamber 20C



	Emergence % control				Root dry wt % control			
	Red Hawk		Zorro		Red Hawk		Zorro	
<i>Pythium sylvaticum</i>	101.9	A	96.6	A	43.9	F	48.2	D
<i>Pythium conidiophorum</i>	101.3	A	99.8	A	83.8	BCDE	87.8	ABC
<i>Pythium rostratifingens</i>	101.3	A	98.6	A	93.6	ABCD	98.8	A
<i>Pythium perplexum</i>	101.3	A	95.3	A	97.6	ABC	98.2	A
Control, no rice	100.4	A	97.4	A	102.7	A	100.2	A
Control, with rice	100.0	A	100.0	A	100.0	AB	100.0	A
<i>Pythium pachycaule</i>	100.0	A	98.6	A	90.7	ABCD	92.7	ABC
<i>Pythium heterothallicum</i>	99.4	A	99.4	A	78.8	CDE	99.5	A
<i>Pythium oopapillum</i>	99.4	A	96.6	A	97.0	ABCD	98.2	A
<i>Pythium</i> aff. <i>dissotocum</i>	98.1	A	98.4	A	91.5	ABCD	86.3	ABC
<i>Pythium coloratum</i>	98.1	A	95.7	A	76.3	DE	94.4	ABC
<i>Pythium attrantheridium</i>	96.9	A	99.4	A	78.6	CDE	95.7	AB
<i>Pythium torulosum</i>	96.9	A	96.4	A	90.7	ABCD	93.4	ABC
<i>Pythium acanthicum</i>	96.2	A	97.6	A	81.3	CDE	86.6	ABC
<i>Pythium</i> aff. <i>diclinum</i>	94.8	A	93.6	A	68.9	E	72.2	C
<i>Pythium lutarium</i>	92.3	A	86.5	A	67.8	E	75.6	BC
<i>Pythium irregulare</i>	91.8	A	97.1	A	30.5	FGH	29.9	DE
<i>Phytopythium</i> aff. <i>vexans</i>	67.9	B	63.2	B	39.5	FG	44.5	D
<i>Pythium ultimum</i> var. <i>sporangiiferum</i>	47.8	C	56.1	B	23.1	GHI	25.2	DE
<i>Pythium ultimum</i>	46.5	CD	20.3	C	18.2	HI	6.9	E
<i>Pythium myriotylum</i>	39.0	CD	32.4	C	24.9	FGH	27.6	DE
<i>Pythium ultimum</i> var. <i>ultimum</i>	29.7	D	51.9	B	12.0	I	17.2	E

Seed rot DI – 13°C (55°F) vs 20°C (68°F)



- *P. oopapillum* prevalent in cooler 2011 – more pathogenic at 55°F than 68°F
- *P. sojae* not very aggressive on seed, slightly more at warmer temp.

Screening Andean dry bean germplasm for root rot resistance

Screening for root rot resistance

GOLOLI
KASUKANYWELE
MBULAMTWE
KISAPURI
Incomparable
RH No. 2
RH No. 11
Rozi Koko
KIJIVU
MSOLINI
KABUKU
KIJIVU
Maulasi
W6 16560
Selian 97
Jesca
Uyole 96
A483
A193
G 5087
G 6239
Badillo
Colorado del Pais

PI527530
PI449428
Amarelo, Cela
Canario, Cela
Charlevoix
ND061106, ROSIE LRK
H9659-21-1
H9659-27-10
USDK-4
USCR-9
USWK-CBB-17
AC Calmont, DRK
Clouseau, LRK
Talon DRK ND061210
K11916, WK
K12803, WK
K11709, LRK
K11306, DRK
K13902, WK
K13602, LRK
BM3-056, NAVY
TARS TFR1, 10IS-2423
Snowdon, WK

Screening for root rot resistance

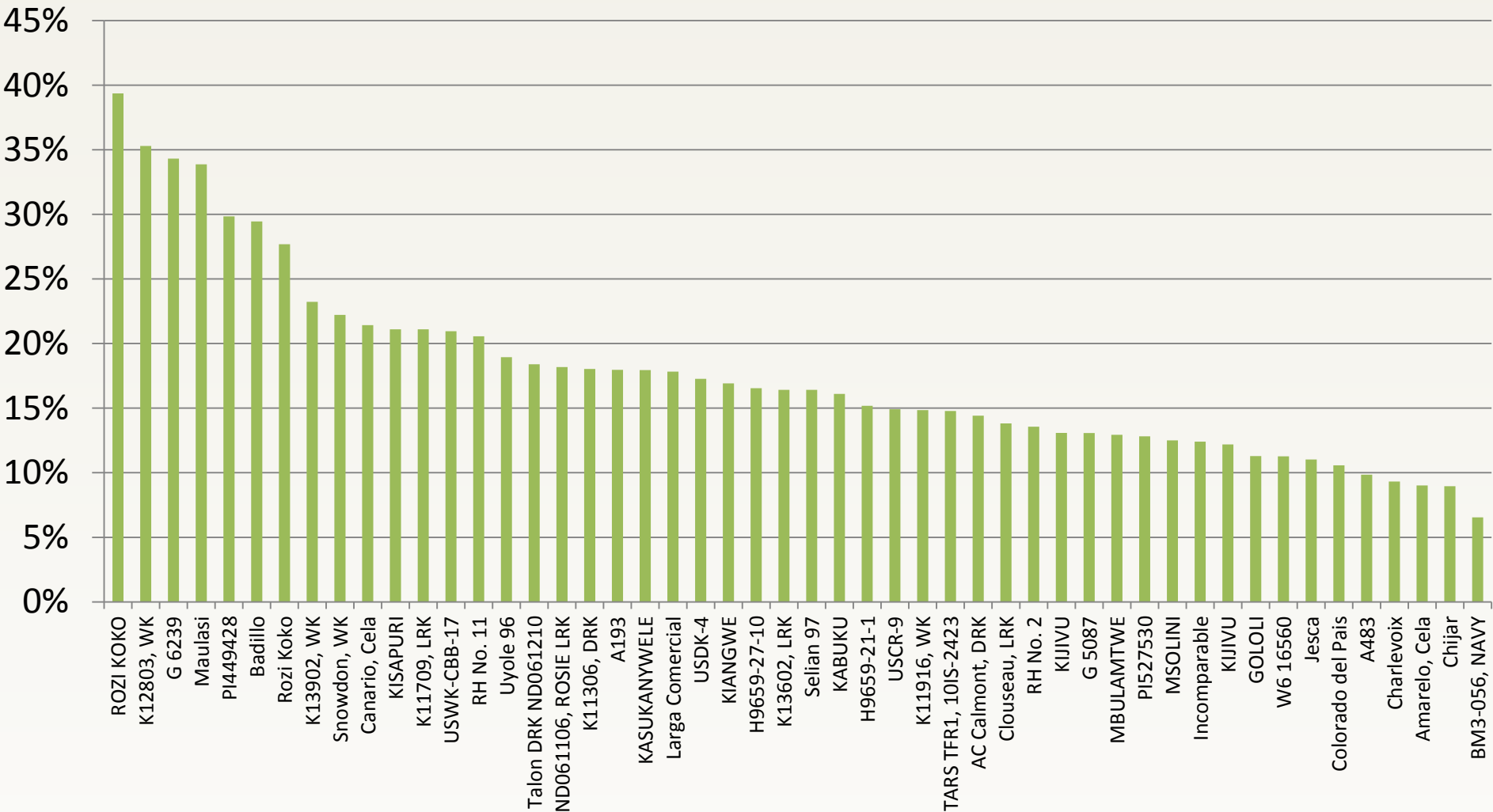
- *Rhizoctonia solani* (3ml/m)
 - (AG2-2IIIB + AG4)
- *Fusarium phaseoli* (23ml/m)
- *Pythium* spp. (23ml/m)
 - *P. torulosum* + *P. dissoticum*





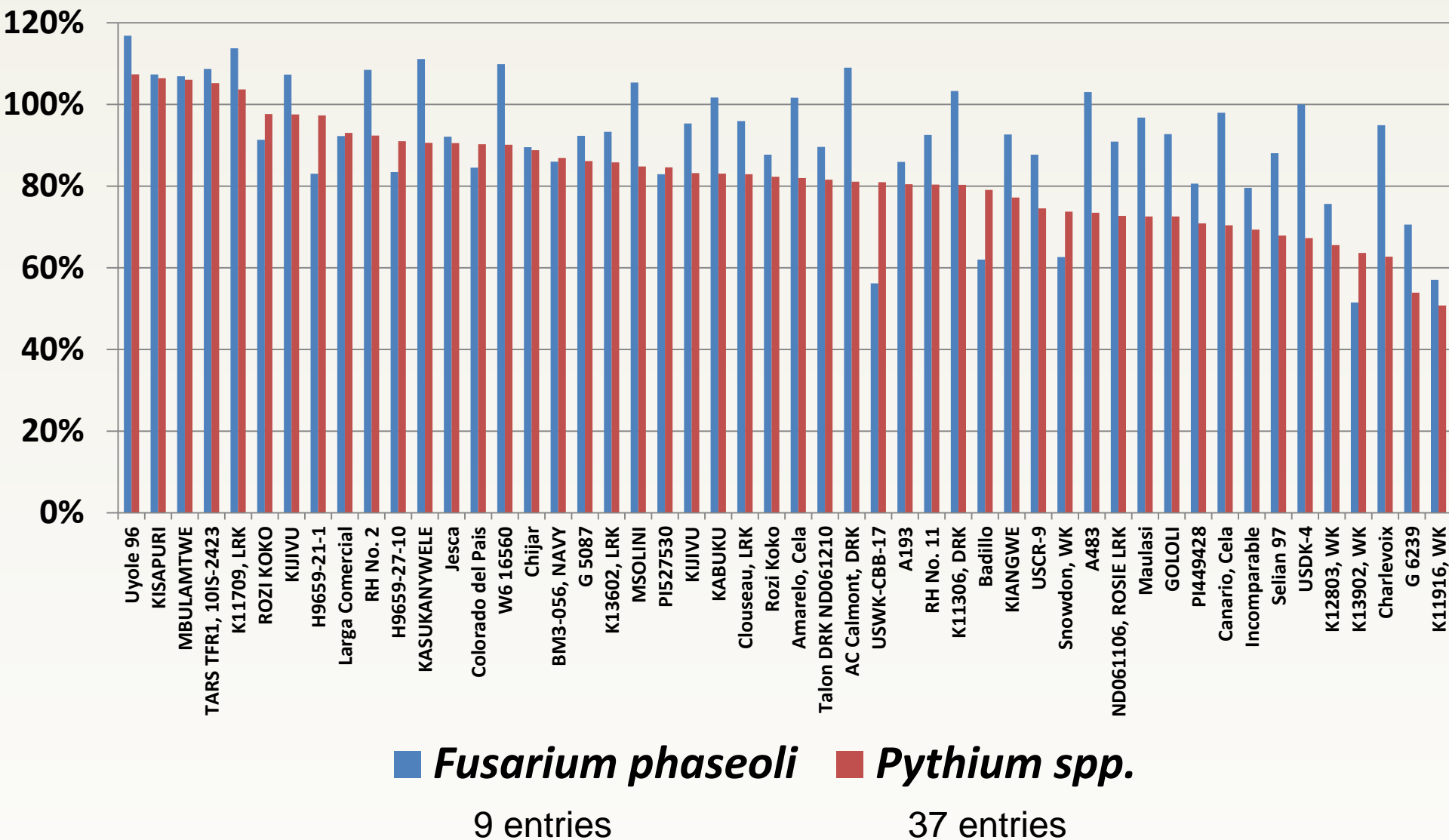
Rhizoctonia field inoculation

2014, Stand count (%) as affected by *Rhizoctonia solani* (AG2-2IIB + AG4)

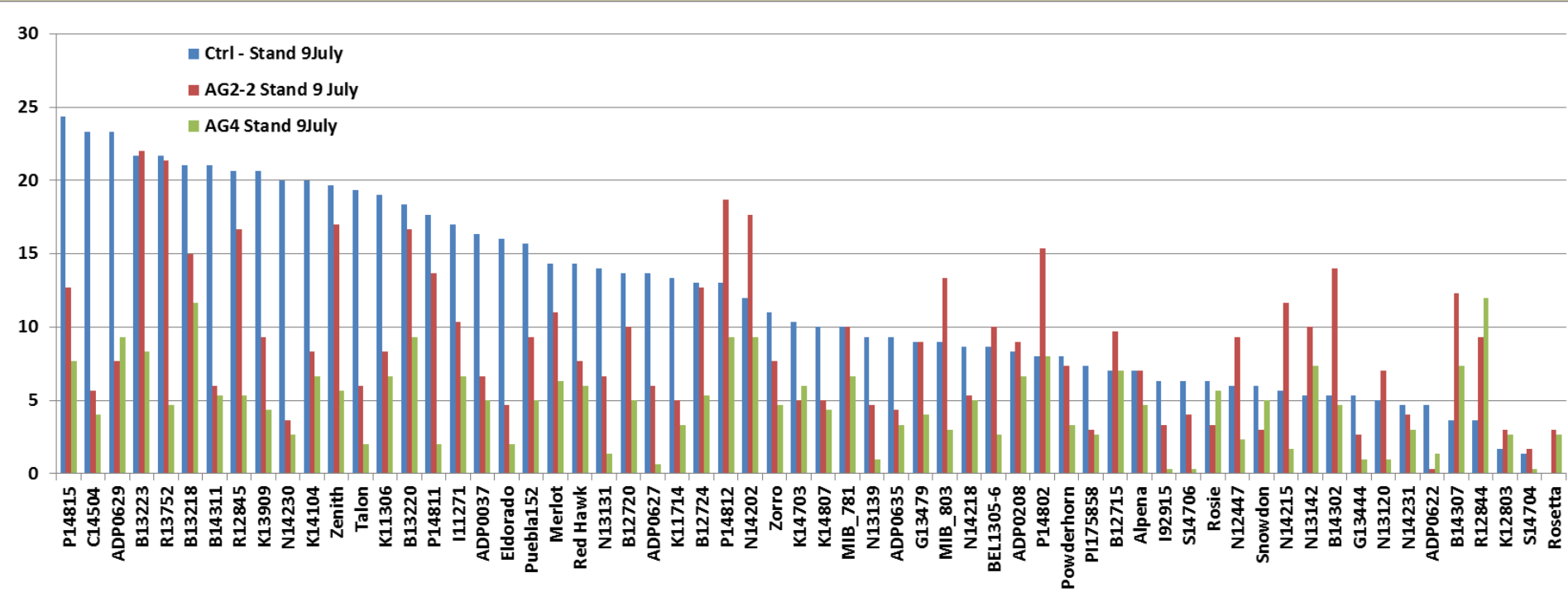


All significantly different to control

2014, Stand count (%) as affected by *F. phaseoli* and *Pythium* spp.



2015 ADP Stand counts (July-9)

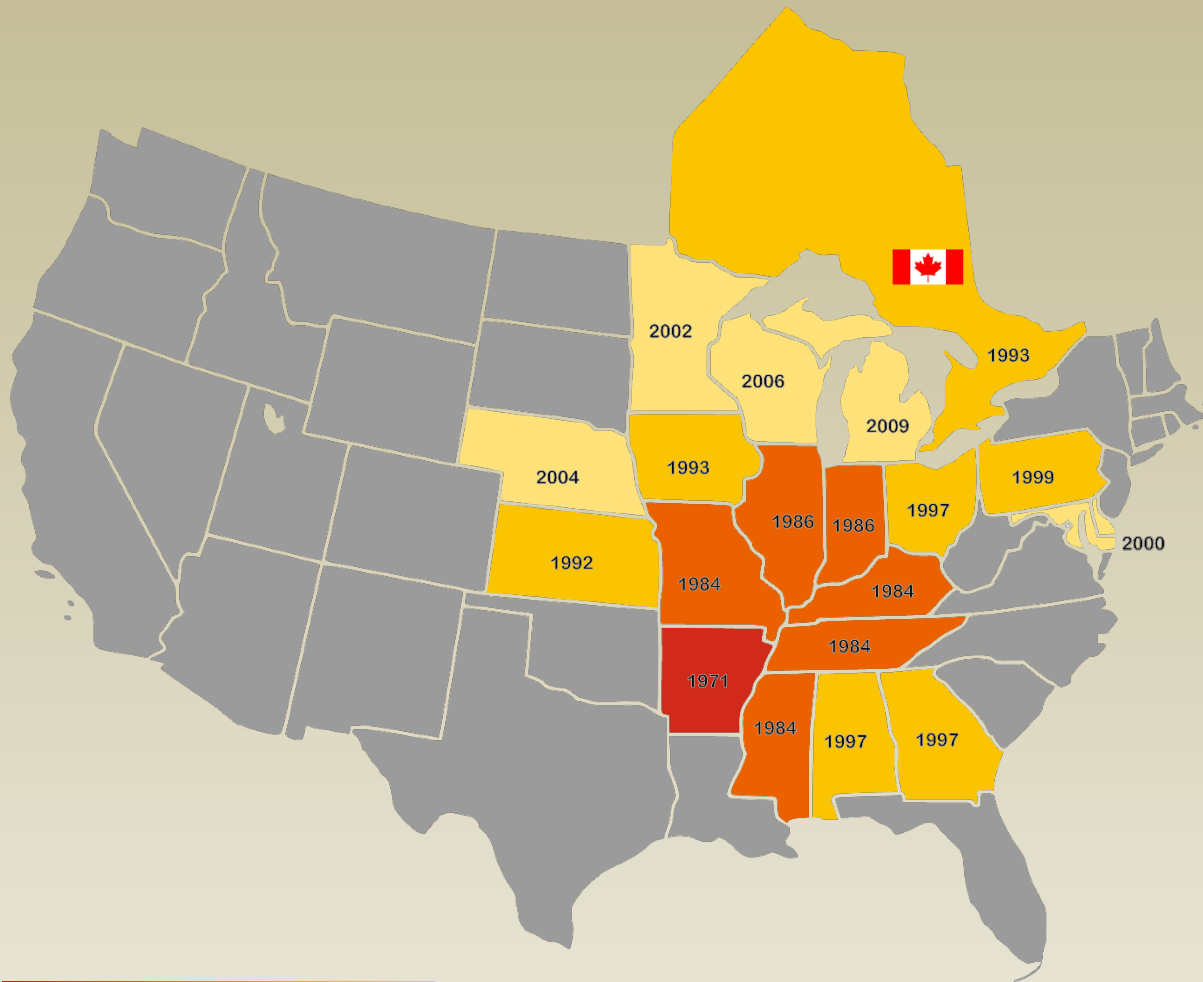


A close-up photograph of several soybean leaves. The leaves exhibit characteristic symptoms of Sudden Death Syndrome (SDS), including irregular, mottled patches of yellowing (chlorosis) and brown necrosis. The necrotic areas are often interveinal and can be quite extensive, particularly on the lower and older leaves. The background is a soft-focus green field under a clear blue sky.

Soybean sudden death syndrome (SDS)

North American distribution of SDS

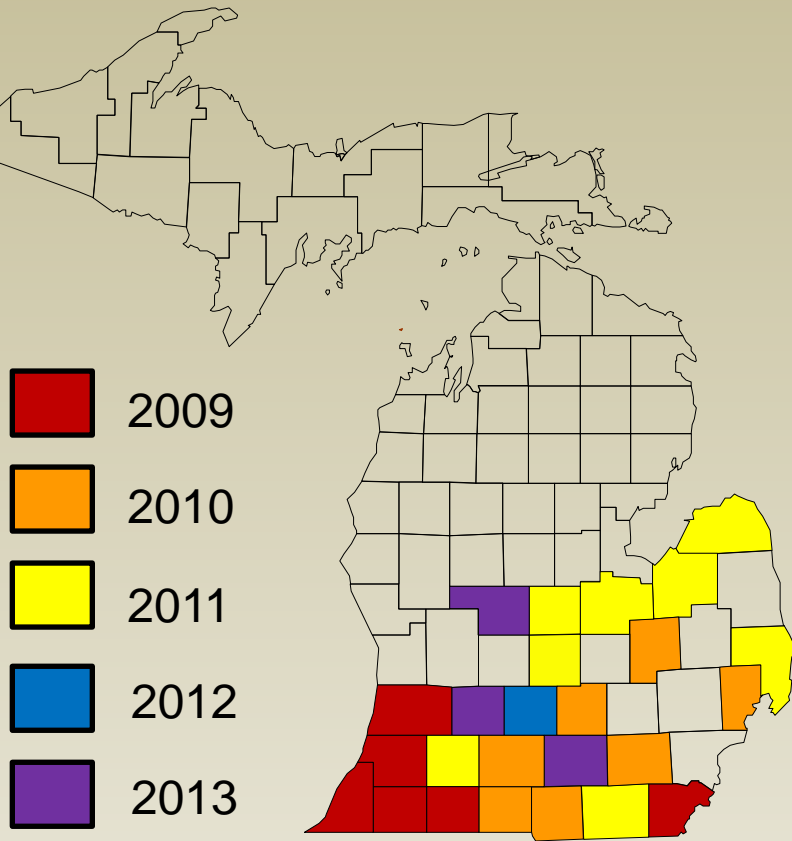
Fusarium virguliforme



- First discovered in 1971 in Arkansas
- 9 countries reported to have SDS

Past Present

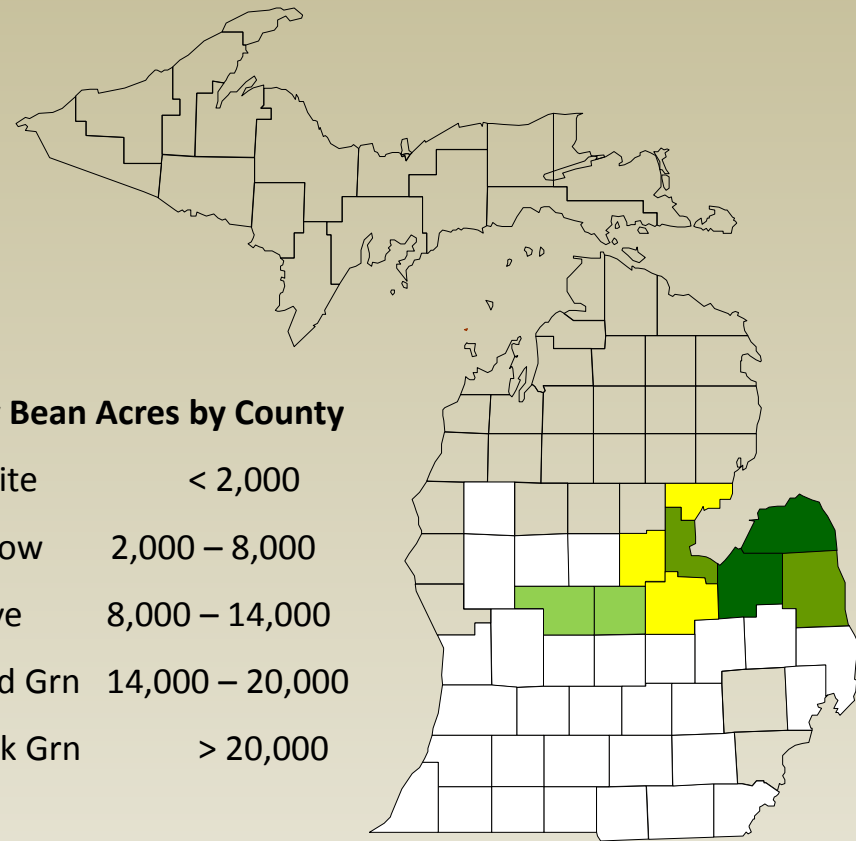
Impact of SDS on dry beans?



Confirmed SDS

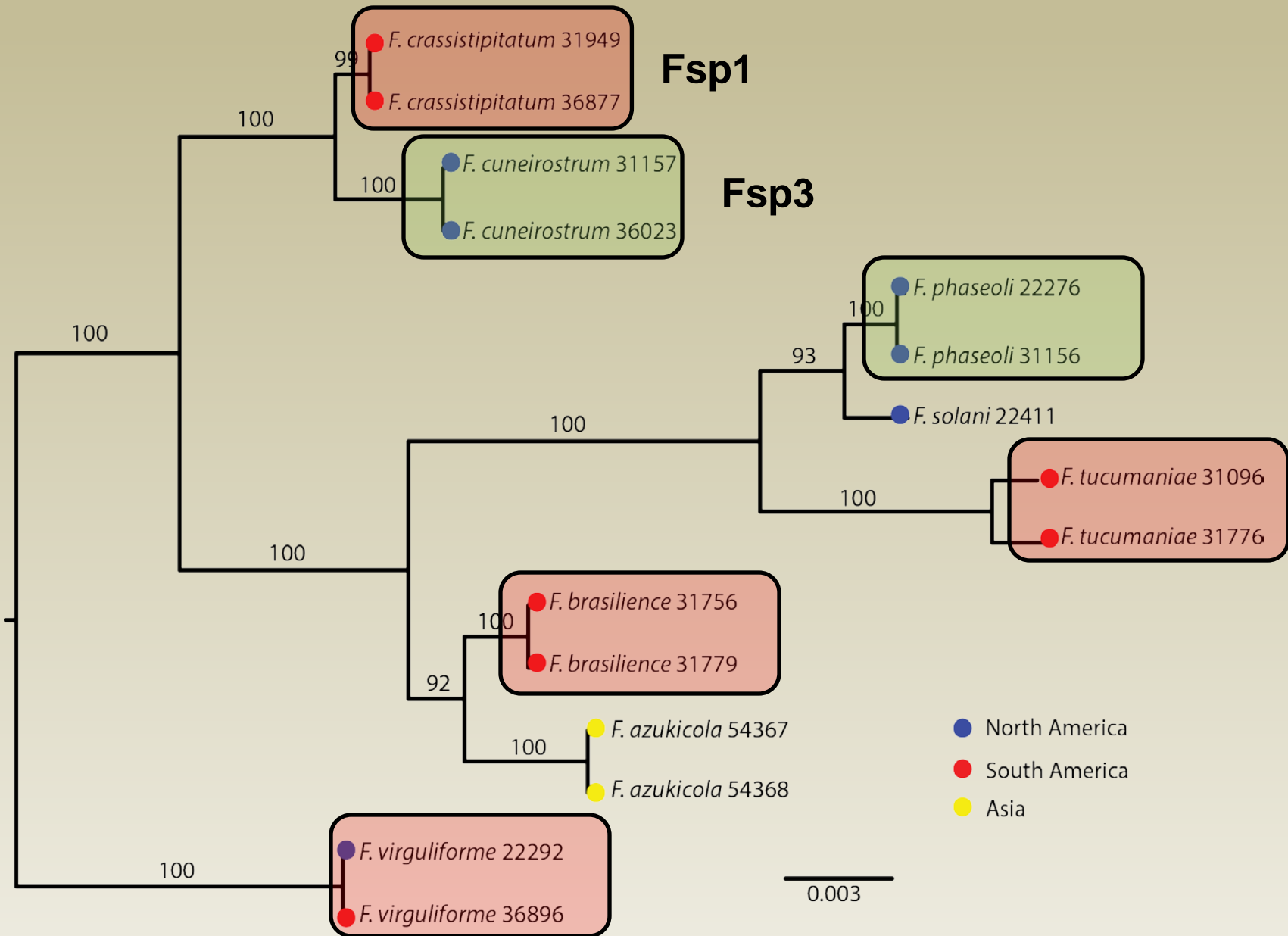
Dry Bean Acres by County

White	< 2,000
Yellow	2,000 – 8,000
Olive	8,000 – 14,000
Med Grn	14,000 – 20,000
Dark Grn	> 20,000



Dry bean Acres

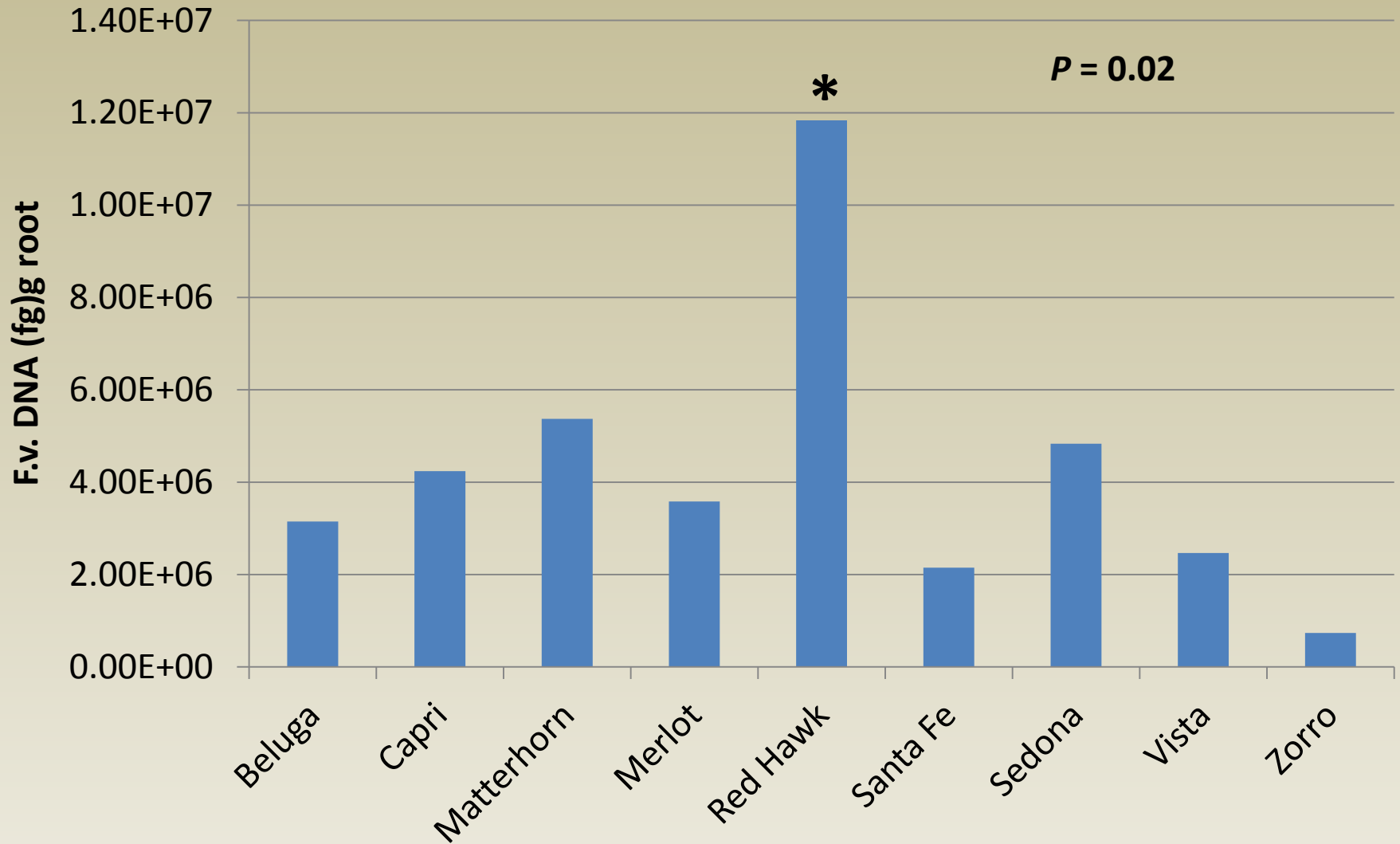
Clade 2 of *Fusarium solani* species complex



Dry beans – *F. virguliforme*?



F. virguliforme and dry beans



Foliar symptoms of *F. virguliforme*

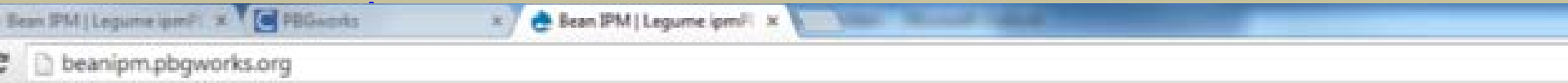
Time series studies:

- Field
- Greenhouse



Extension resources

- www.beanipm.pbgworks.org



Bean IPM

Legume ipmPIPE Diagnostic Series

Home

Pests

Symptoms

Management



Acknowledgements

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