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Introgression of White Mold Resistance From the Secondary Gene Pool

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Overview

- Dry Bean White Mold
- Why Slow Improvement?
- An Integrated Breeding Strategy
- Introgression from the Secondary Gene Pool
- Progress and Prospects

Dry Bean White Mold

- Caused by *Sclerotinia sclerotiorum*
- Sclerotia Survive Years
- Seed Transmitted
- Cool Humid Weather
- Yield Loss 30%, >90%
- Inadequate Resistance
- Difficult Control

Why Slow Improvement of Resistance?

1. Low Level of Resistance
2. Resistance Quantitatively Inherited
   (h^2 0.01-0.67, >12 QTL Across Genome)
3. Architectural Avoidance
4. Large Environmental Influence
5. Inadequate Screening Method
6. Inadequate Breeding Method
7. Lack of Continuity

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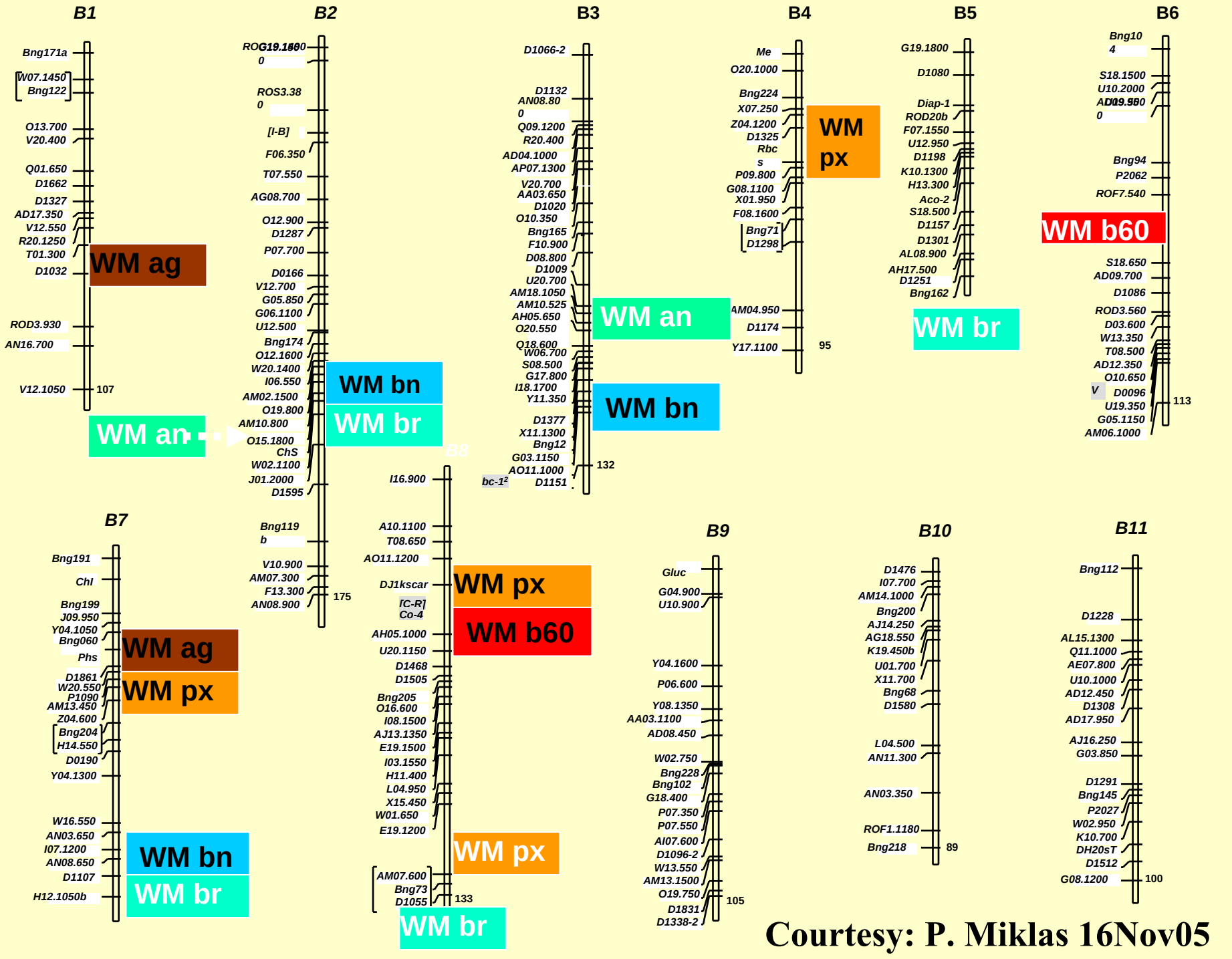


Courtesy: P. Miklas 16Nov05

An Integrated Breeding Strategy

1. Resistance From *Phaseolus* Species

2. Multiple Greenhouse and Field Tests

3. Inter-Institutional and Inter-Disciplinary Collaboration (CO, ID, ND, WA)

Integrated Breeding Strategy

Resistance from *Phaseolus* species

Pyramiding White Mold Resistance

(Gametic-Recurrent Selection)

New Resistance Introgression
(Inbred-Backcross)

Population Development Cycle 0

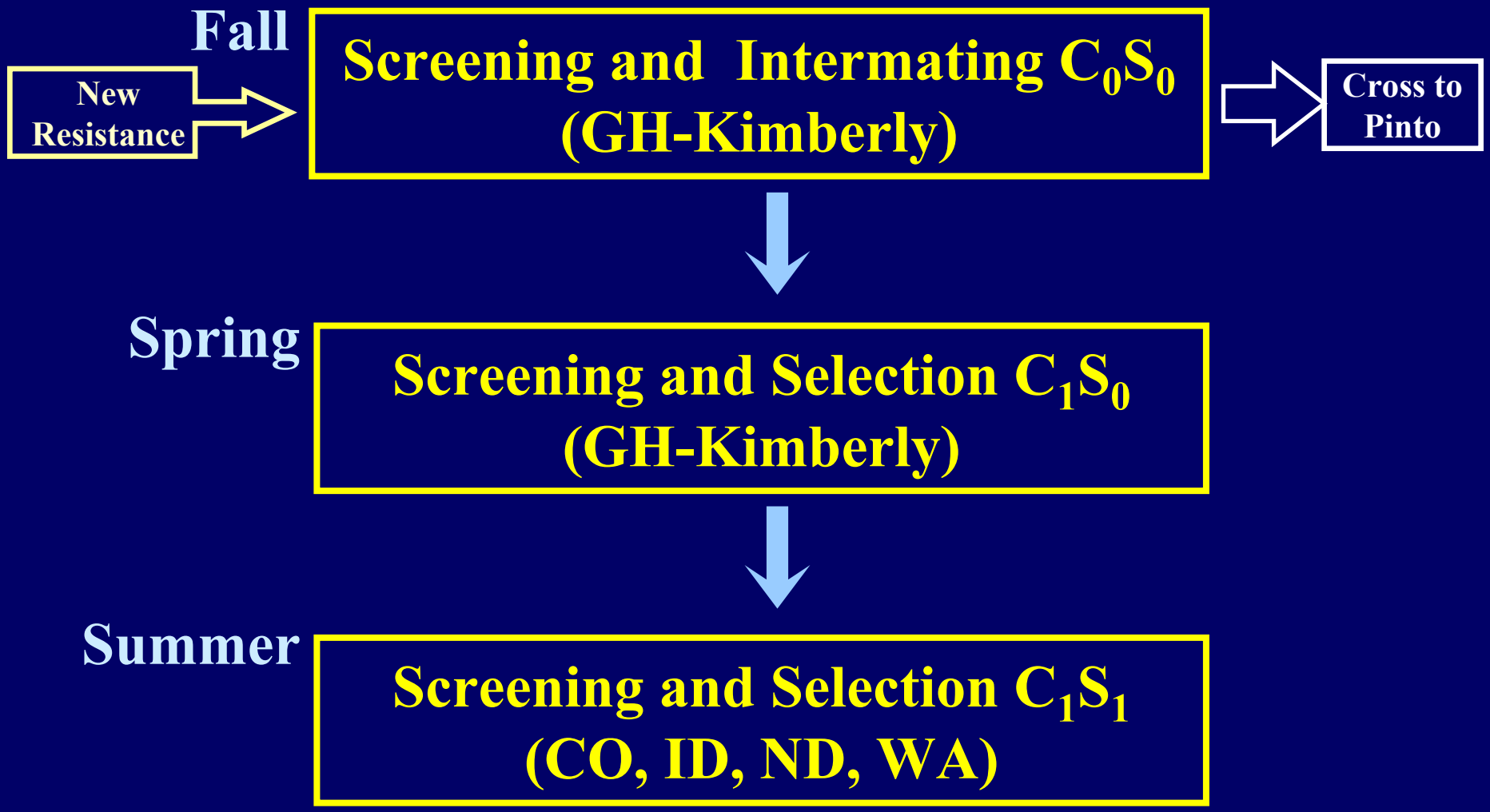
Cultivar Development
(Gamete Selection)

New Resistance → **Recurrent Selection Cycle 1** → Cross to Pinto

New Resistance → **Recurrent Selection Cycle 2** → Cross to Pinto

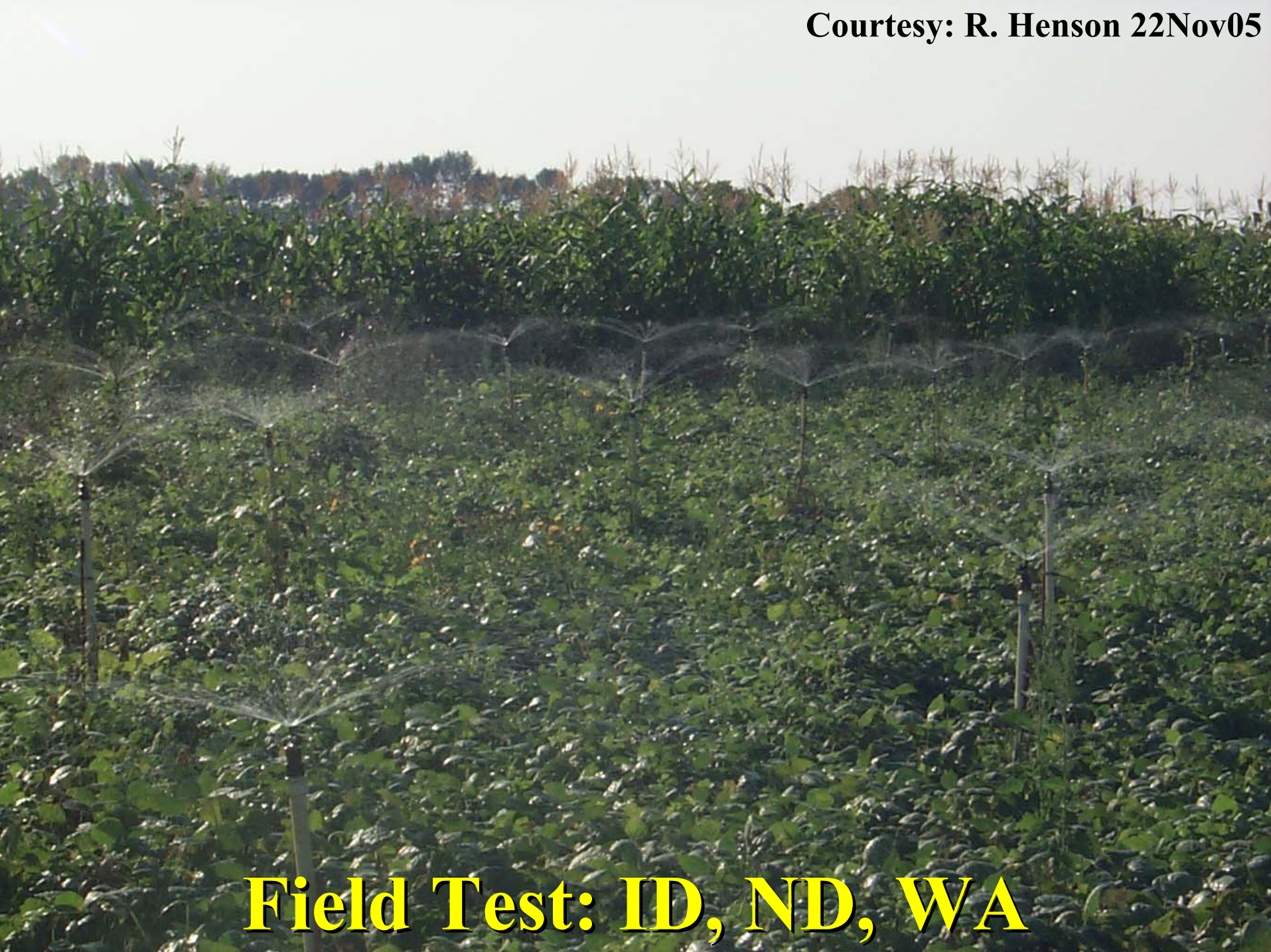
Measurement of Selection Gain

Gametic-Recurrent Selection Cycle 1



Greenhouse Test: CO, ID

Courtesy: R. Henson 22Nov05



Field Test: ID, ND, WA

Introgression From the Secondary Gene Pool

1. Screening of Known Resistant Germplasm:
   - *P. vulgaris*
   - *P. coccineus*
   - Breeding Lines and Cultivars
2. Inheritance of Known *P. coccineus* Resistance
3. Introgression From the Secondary Gene Pool
   - A. Development of Interspecific Breeding Lines (IBL) From Known Resistant *P. coccineus*
   - B. Screening of IBL From *P. coccineus, P. costaricensis* and *P. polyanthus* From CIAT, Cali, Colombia

Phaseolus Species in the Secondary Gene Pool

P. coccineus

P. costaricensis

Andean

P. vulgaris

Middle American

P. polyanthus

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Breeding Progress and Prospects

Screening of Known Resistant Germplasm: *P. vulgaris*, P. *coccineus*, and Breeding Lines and Cultivars-2003

Genotype	Entries	Range	WM Score
P. vulgaris	8	1.6-3.8	2.9
P. coccineus	30	1.6-4.8	3.2
Breeding Lines and Cultivars	54	2.4-9.0	7.2

Resistance in *Phaseolus* Species-2003

Primary Gene Pool

A 195

G 122

MO 162

ICA Bunsi

NY6020-4

Secondary Gene Pool

P. coccineus
(PI 433246)

P. costaricensis
(S 33720)

P. polyanthus
(G 35877)

Interspecific Breeding Lines

I9365-25

92BG-7

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Resistant (3)

Intermediate (5)

Susceptible (9)
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Inheritance of Known *P. coccineus* Resistance-2004

Identification	Disease Score	F_2 Segregation Ratio	*P* value
Othello	8.5		
PI 433246	3.8		
Othello / PI 433246		36R:10S	0.61
UI 320	5.2		
PI 439534	2.8		
UI 320 / PI 439534		32R:9S	0.63

A. Development of Interspecific Breeding Lines from Known Resistant *P. coccineus*

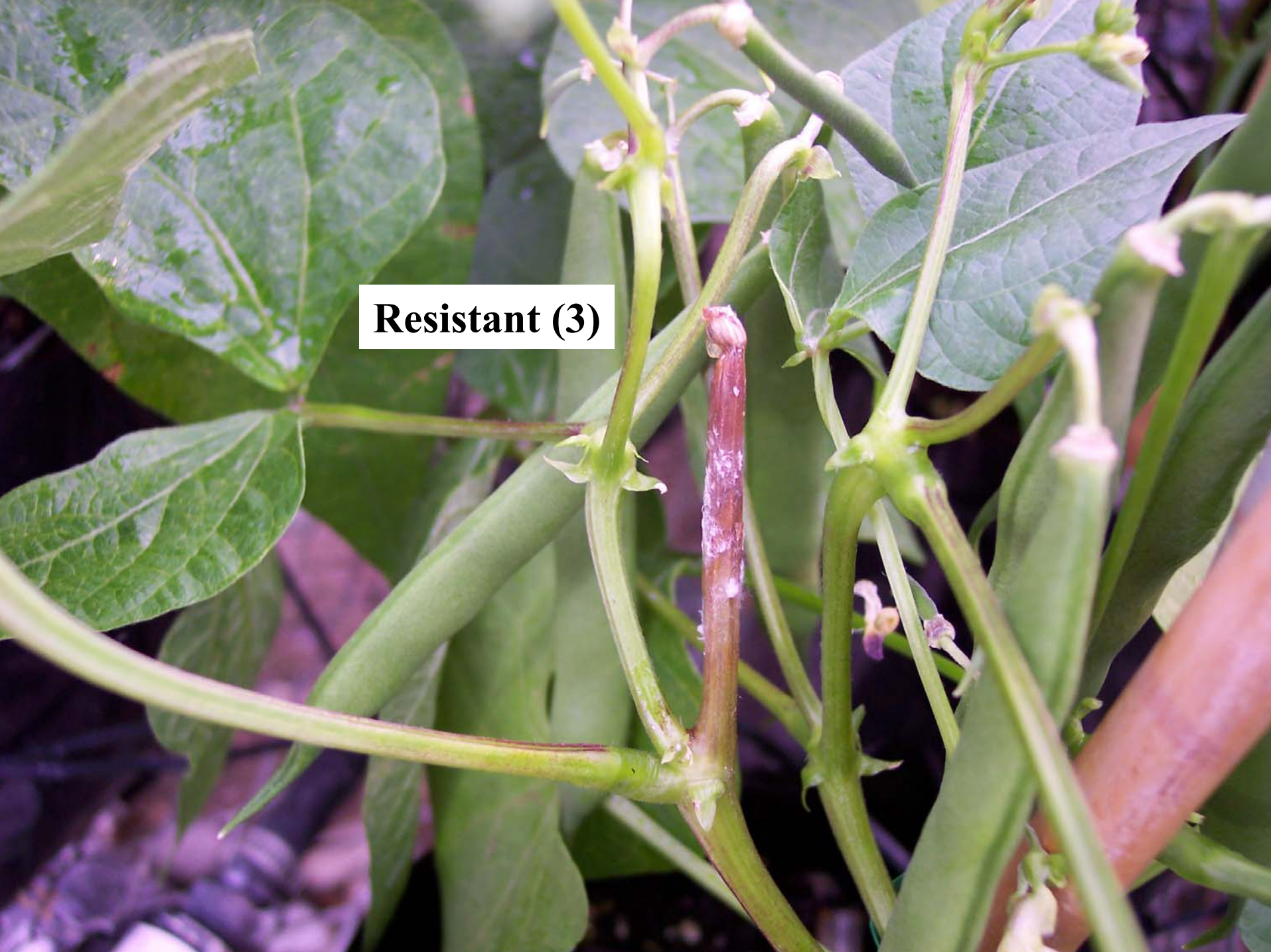
Identification	F_1 Seeds	F_4 Seeds
Othello / PI 433246	96	58
Othello // Othello / PI4343246	112	95 (F_3)
Othello /// Othello // Othello / PI4343246	191	63
UI 320 / PI 439534	122	26
UI 320 // UI 320 / PI 439534	154	143 (F_3)
UI 320 /// UI 320 // UI 320 / PI 439534	187	97

B. Screening of Interspecific Breeding Lines From *P. coccineus*, *P. costaricensis* and *P. polyanthus* From CIAT, Cali, Colombia

Genotype	Initial 2002	2005	
		Selected	WM Score
With *P. coccineus*	195	17	3.5
With *P. costaricensis*	187	5	3.4
With *P. polyanthus*	164	29	4.8
ICA Pijao	1	1	7.3
TOTAL	547	52	--

Susceptible (9)

Susceptible (9)
Intermediate (4)

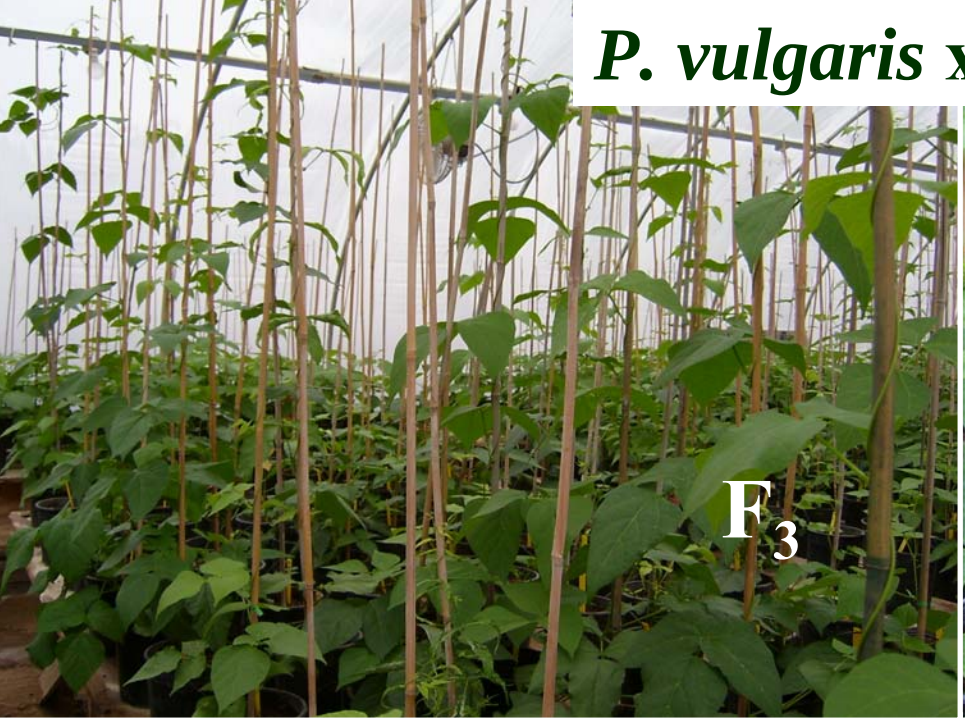

Resistant (3)

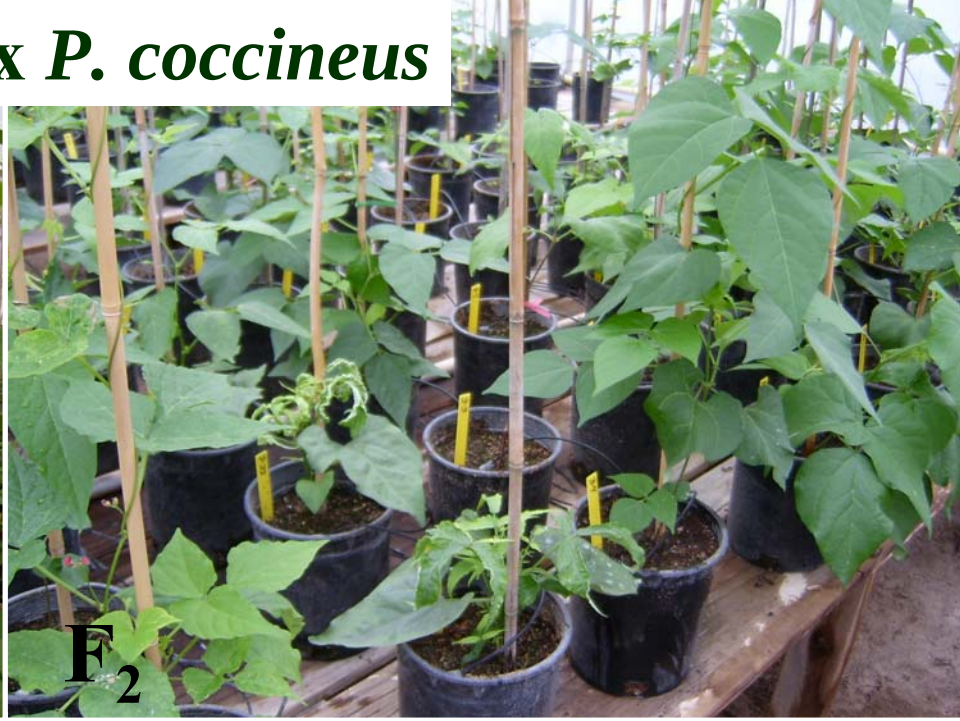
Resistant (2)

Problems of Interspecific Crosses

1. Rapid Return to *P. vulgaris*
2. Distorted Segregation
3. Residual Sterility
4. Resistance Instability
5. Delayed Maturity

P. vulgaris x *P. coccineus*





Future Prospects

- High Level Resistance Expected
- Resistance Pyramiding
- Transfer Into Pinto Bean
- Tagging *P. coccineus* Resistance
- Tagging A 195 Resistance

Project Collaborators

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Acknowledgments

This Project is Funded by the USDA-Sclerotinia Initiative

Since 2002

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