Resistance to Asian Soybean Rust

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Outline

- Background on resistance.
- Screening for resistance.
  - Ft. Detrick
  - University of Georgia
- Genetic basis of resistance.
- Future directions.

Resistance to Soybean Rust

- Resistance to soybean rust is easy to find however, durable resistance is difficult.
- Four soybean rust resistance genes were identified (*Rpp1*, *Rpp2*, *Rpp3*, and *Rpp4*) and isolates of the pathogen have been found that defeat each gene.
- Brazilian researchers have found resistance genes that also have been defeated by the pathogen.
- Need to find durable, quantitative resistance.

Soybean Rust Resistance Reactions

Immune

Red Brown

Tan

Germplasm Screening Ft. Detrick

- The US soybean germplasm collection has been screened for resistance to soybean rust at Ft. Detrick (Glen Hartman, Monte Miles and Reid Frederick).
  - 17,000 plant introductions (PIs) tested with a cocktail of four isolates.
  - PIs identified as potentially resistant in the first round are being retested in single isolate screens. (Plant Health Progress)
- Germplasm evaluation continuing at Ft. Detrick.

Germplasm Screening Summer 2005

- 772 PIs showing potential resistance from the Ft. Detrick screening were evaluated for rust resistance in the field during 2005.
- The PIs were tested in 62 environments in 23 states and 3 foreign locations.
- U.S. field rust resistance data were only obtained at Attapulgus, GA.

Germplasm Screening Attapulgus, GA

- The 778 PIs were tested in the field (Roger Boerma and Dan Phillips).
- Lines were planted on Sept. 2 and rated in December.

Germplasm Screening Attapulgus, GA

- Artificial lighting was used until October 1 to keep the plants vegetative and to compress flowering and maturity dates.
- Rust inoculum was sprayed on plants.
- From this testing, a list of 73 PIs with the greatest resistance was compiled and distributed to soybean breeders and pathologists.

List 1. Mean Rust Incidence Rating of 2.0 or lower and Canopy Development Rating of 3.0 or higher

Genotype	MG	Cultivar	province	country	Lesion Type
PI398399	V		Kangwon	Korea, South	T
PI408283	V		Kyongsang Nam	Korea, South	T
PI437658	I		Unknown	China	T
PI506965	VI	Kuro Chouhin 14	Kanto	Japan	RB
PI522189	I		Unknown	Moldova	T
PI567046A	VIII		Central Java	Indonesia	RB
PI567058D	IX		Unknown	Indonesia	T
PI567104B	IX		East Java	Indonesia	T
PI567139B	IX		Bali	Indonesia	nd
PI567141	IX		Bali	Indonesia	nd
PI567189A	IV	Ekhabac	Unknown	Vietnam	RB
PI567190	VI	Halang 4 thang	Unknown	Vietnam	RB
PI567238	IX		Yunnan	China	T
PI605823	IX		Ha giang	Vietnam	nd
PI605838	V	Xanh si man	Ha giang	Vietnam	M
PI605854B	V		Tuyen quang	Vietnam	M
PI605865B	V		Lao cai	Vietnam	RB
PI605891A	V		Son la	Vietnam	nd
PI606397B	V	(Hat nho duc trong)	(north)	Vietnam	RB
PI606405	V	Madrak	(north)	Vietnam	M
PI615437	VI	A.9	(north)	Vietnam	RB

Germplasm Screening Griffin, GA Greenhouse

- 328 PIs with some level of resistance were tested in a greenhouse in Griffin, GA during the winter of 2005-2006.
- Inoculated with a rust spores collected in the southeastern US during the fall of 2005.

Germplasm Screening

- Reasonable consistency between Georgia field and greenhouse results.
  - Of the best 21 lines from the field, ½ in the top 10% in the greenhouse test.
- Consistency important because
  - Concerns about the correlation of adult plant and seedling resistance.
  - Concerns about isolate differences.

Germplasm Screening

	Ft. Detrick Greenhouse					
Accession	Brazil	Paraguay	Zimbabwe	Thailand	Georgia Field	Georgia G.H
	AUDPC Counts (sporulating lesions)				1-5 scale	No. lesions
PI 594538A	1	2	1	3	3.5	21
PI 561356	2	2	1	3	3.5	21
PI 84674	64	34	337	52	2.5	16
PI 200492 (*Rpp1*)	4	69	105	71	3.0	0
Williams 82	139	112	171	230		

Mapping Resistance Genes

- Major rust resistance genes have been mapped.
  - *Rpp1* (Hartman, Cregan, Nelson, Frederick)
  - FT-2 resistance source (PI 628932) (Brazilian researchers)
  - Hyuuga (PI 506764) (Boerma)
- These genes could be bred into lines through marker assisted selection.
  - Stack these resistance genes?
  - Will these genes be defeated quickly?

Future Directions

- Continue to refine the list of resistant PIs.
  - More information on the reaction of PIs to US isolates needed.
- Map resistance genes.
  - Qualitative
  - Quantitative
- Incorporate resistance into cultivars
- Evaluate the effectiveness of types of resistance on yield.

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