SOYBEAN PRODUCTION IN EAST AND SOUTH AFRICA AND RISK DUE TO SOYBEAN RUST

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Soybean production and utilization in developing countries is increasing rapidly due to demand from poultry millers and soybean based products such as soymilk, soy flour and soy protein. The growing demand coupled with attractive farmgate prices has stimulated significant interest in soybean production among small-holder farmers and larger commercially oriented growers. With the expected increase of area under production, both abiotic and biotic constraints will pose an increasing threat to sustained production. Asian soybean rust, caused by the fungus *Phakopsora pachyrhizi*, poses a particular risk as it has already devastated yields elsewhere in the world and is now established and spreading rapidly across Africa. Each infected plant can produce hundreds of thousands of infective urediniospores that can be readily transferred by prevailing winds to new and geographically diverse locations. In an attempt to mitigate the negative impact of Asian soybean rust to the soybean value chain, the distribution of this pathogen across East and South Africa will be mapped. This data will be combined with maps showing the pattern of soybean production in the region and environmental conditions conducive to the spread and establishment of the disease. Field based diagnostics will be supported by serological and molecular diagnostics. Variance of the pathogen will be characterized through genetic analysis and *in vitro* and *in vivo* pathogenicity studies. Results will be used to guide adaptive strategies for breeders and extension officers relying on the use of timely doses of appropriate fungicides.
Soybean production in East and southern Africa: Risk due to soybean rust

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Outline

• Introduction
• Soybean production in Africa
• Soybean rust
• Mitigation strategies
• Conclusion
Soybean suitability based on agro-climactic conditions

Suitability
- Not suited
- Very Marginal
- Marginal
- Suitable
- Very Suitable
- Excellent

www.iita.org IITA, 2008
Potential of production/suitability

Soybean suitability
- Not suitable
- Very Marginal
- Marginal
- Suitable
- Very Suitable
- Excellent

Soyabean growing conditions (FAO, ECOCROP)
Optimum temperature range: 20°C - 33°C
Optimum rainfall range: 600 mm - 1500 mm
Length of growing period (LGP): 75 days - 180 days
Absolute temperature range: 10°C - 38°C
Absolute rainfall range: 450 mm - 1800 mm

IITA, 2012
Regional production

- Southern Africa total production- 861,000 T in 2010 and demand of 2M T.

- Production and demand are dominated by South Africa, Zambia, Zimbabwe and Malawi.

- Uganda is the main producer in East Africa.

- Gradual increase in production in Kenya an Tanzania.
Regional production vs consumption

Soybeans

![Graph showing regional production vs consumption for Soybeans from 2000 to 2010. The production and consumption data are represented by bars and a line graph, respectively. The production data shows a steady increase, while the consumption data shows a slight increase of 3.2%. The graph is sourced from USDA FAS.]
Soybean Oil

(1000 MT)

+1.8%

Production
Consumption

USDA FAS

Highquest Partners, 2011
Soybean Meal and Oil Imports

Region-Wide Soybean Complex Imports

Government policies
Enabling environment
Increased production

Highquest Partners, 2011
Biotic & Abiotic Stress
Soybean rust

Caused by *Phakopsora pachryhizi* and *P. meibomiae*

Wide host range > 90 species
Soybean rust reports in Africa

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Why is soybean rust a threat

- Pathogen is airborne
- Long distance dispersal
- Premature defoliation
- Seed size reduced

Yield loss
Brazil - 30-75%
Uganda - 18-45%
South Africa 10-80%

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Rust mitigation

- Diagnosis
- Genetic characterization
- Characterization of virulence
- Disease mapping
- Risk of spread
Diagnosis

Understand cause of disease
Diseases that resemble soybean rust
Diagnosis

Optimize rapid diagnostic methods for rust identification

Immunofluorescence spore assay

Baysal-Gurel, F. et al., 2008

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Diagnosis

Seroological - ELISA

Molecular – PCR & Rt-PCR

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Genetic characterization

84 SSR genotypes in 116 isolates across Nigeria

Twizeyimana et al., 2011
Virulence characterization

Soybean rust host differentials
PI 200492 (Rpp1), PI 230970 (Rpp2), PI 462312 (Rpp3), PI 459025B (Rpp4), PI 200526 (Rpp5) and UG 5

Detached leaf assay

- 7 pathotypes identified in Nigeria - 116 isolates
- 6 pathotypes identified in Australia

(Twiziyemana et al, 2009)
Mapping of rust

Humidity - 75-80%

Rainfall
Mapping of rust  Temperature of the wettest month
Soybean rust incidence
Risk of spread - Why monitor soybean rust

Path of Hurricane Ivan 4-16 Sep 2005

Wind patterns

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Develop soybean rust mapper.
Conclusion

Raise awareness

Farmer field days
Conclusion

Collect more samples - DNA analysis

2 minute DNA Extraction dipstick

Whatman FTA Card

PhytoPASS

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Ramadhan Idd and Fen Beed, 2013
Conclusion

- Determine genetic groups – SSR
- Map pathotypes present in the region
- In country screening of cultivars
- Identify host differentials in the region
Conclusion

Monitor risk of spread

- Use sentinel plots
- Regular scouting
- Deploy resistant cultivars
- Link with breeders
- Spot sprays - fungicides
Research partners

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Thank you

Questions