

Developing Soybean Rust Resistant Varieties for Ontario

Purpose:

Currently there is no effective resistance to Asian soybean rust (*P. pachyrhizi*) in commercially available North American soybean varieties. The development of incorporating a novel set of resistance genes against a new disease threat such as soybean rust can be difficult, time consuming and requires considerable commitment. The purpose of this multi-year project is to not only evaluate potential sources of resistance (PI lines) to Asian soybean rust but to develop soybean rust resistant varieties for the Ontario and Canadian market.

One of the benefits of working with our U.S. colleagues in an integrated North American soybean rust approach has been access to germplasm and resources which would otherwise be unavailable. This cooperation has provided Ontario public breeding programs at Agriculture and Agri-Food Canada in Harrow and Ottawa as well as the University of Guelph programs in Guelph and Ridgetown with access to the USDA soybean rust nursery and screening trials in Quincy, Florida. The ability to test Ontario soybean lines in the southern US under significant and consistent soybean rust disease pressure allows us to speed variety development.

Methods:

- 1) Ontario soybean breeders at the University of Guelph (Guelph , Ridgetown Campus) and Agriculture and Agri-Food Canada (Harrow and Ottawa) in conjunction with OMAFRA (Ridgetown) have grown 49 Plant Introduction lines (PIs) determined by the USDA to contain a variety of different sources of resistance to Asian soybean rust. Observations were taken in order to determine the agronomic applicability to these PIs to the Ontario growing conditions. Similar trials were done throughout the U.S. by the USDA (Illinois).
- 2) The University of Guelph and Agriculture and Agri-Food Canada breeders have been making crosses using the USDA PIs as well as those obtained from Brazil by Vaino Poysa, AAFC soybean breeder at Harrow with various adapted lines from their Ontario breeding programs.
- 3) Selections (lines) derived from these crosses were grown by the breeders in Ontario to evaluate them for maturity, yield, lodging, pod shattering, plant height, oil, protein and other agronomic measures necessary for Ontario conditions.
- 4) 343 lines developed by the AAFC and the University of Guelph were included in the cooperative soybean rust screening trial in Quincy, Florida conducted by the USDA. This location has consistent soybean rust pressure and has been the primary soybean rust research and education centre in North America.
- 5) Soybean rust disease ratings were recorded for each of the 343 Canadian derived lines based on a 1 (resistant) to 5 (susceptible) score in Quincy, FL. Additional

observations were made on these lines to identify partial resistance, also referred to as rate reducing resistance or tolerance.

6) Further selections continue to be made from lines identified in the Quincy USDA Asian soybean rust nursery for Ontario maturity, seed yield, etc.



Nursery rows of breeding lines evaluated for soybean rust resistance in Quincy, Florida.

Results and Summary:

The USDA soybean rust nursery was first utilized in 2007 for the screening of Canadian derived lines. By using the Quincy nursery, we were able to confirm and progress with Ontario breeding lines derived from crosses between Ontario adapted lines such as OAC Kent with soybean rust resistance sources PI 471904, PI 200455, PI 200451 and PI 200488. Of the 296 lines sent to Florida for screening in 2008, 14% were resistant (rating 1 or 2), with 13 having a rating of 1 (“no rust”). In 2009, 343 lines were evaluated in Florida and 15.5% were resistant (rating 1 or 2).

A number of the lines are expressing “classic” red-brown lesion types which indicate a tolerance or partial resistance. The benefit to the producer is these soybean lines displaying “rate-reducing resistance” slows disease development

and the lesions produce less spores. Varieties expressing the “tolerant trait” have been demonstrated to have less yield loss due to soybean rust.

This project has resulted in the development of potential Asian soybean rust lines for Ontario as well as the northern soybean production areas of North America. We have been able to incorporate various known soybean rust resistance genes as well as develop lines which are expressing significant tolerance or partial resistance to Asian soybean rust. Seed of resistant or tolerant lines was distributed to the Canadian public soy breeder collaborators of this project and are available to other breeders on request.

Next Steps:

Work to date has been very promising and as stated above our aim is to develop new lines resistant to soybean rust for Ontario. This multi-year international project will continue in 2010 and is part of international partnership with the USDA soybean breeding program. The information generated from this project is being incorporated into the USDA soybean germplasm database. Participation allows access to research, resources such as the Quincy soybean rust nursery, etc which would otherwise be cost prohibitive to Ontario.

Acknowledgements:

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Location of Project Final Report:

The report can be located on the Grain Farmers of Ontario website or from the project contacts.