Globodera Alliance Newsletter

November, 2015, Issue 1

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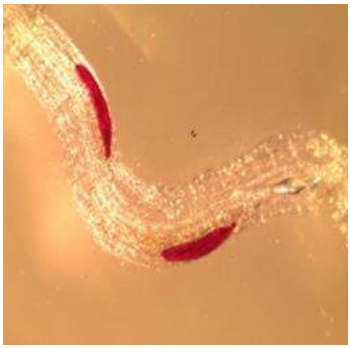
Welcome to GLOBAL's newsletter

Welcome to the first newsletter of the GLOBAL group ("GLOBAL" stands for "*Globodera* Alliance", a group of 18 research, extension, and education professionals, located in Idaho, Oregon, New York, Canada, and Scotland.) GLOBAL members include faculty from the University of Idaho, Oregon State University, Cornell University, USDA ARS, Agriculture Canada, and the James Hutton Institute.

GLOBAL is a five-year $3.2 million project funded by the US Department of Agriculture. The project title is "Risk assessment and eradication of *Globodera* spp. in U.S. production of potato", with research focused on the potato cyst nematodes *Globodera pallida* (pale cyst nematode), *G. rostochiensis* (golden nematode), and the related species *G. ellingtonae* that has recently been found in Oregon and Idaho.

The GLOBAL team is also helped by an advisory board consisting of potato industry representatives as well as state and federal regulators.



G. pallida (pale cyst nematode) juveniles inside a potato root (LM Dandurand)

Globodera spp. nematodes and potato production

- Over 1 million acres in the U.S. are planted to potato, with an estimated farm gate value of $4.2 billion and total value of production more than $4 trillion

Potato is the most important non-grain food crop in the world. In the U.S., more than 1 million acres are planted to potato, with an estimated farm gate value of more than $4 billion, and a total value of production in excess of $4 trillion. Potato production in the U.S., and the viability of international markets for U.S. potatoes, are threatened by the presence and potential geographic spread of invasive cyst nematodes: *G. rostochiensis* ("golden nematode") and *G. pallida* ("pale cyst nematode"), collectively known as potato cyst nematodes, are of worldwide regulatory concern, and are two of the most economically important pests of potato, causing up to 80% yield loss in infested fields.

Cysts of golden nematode (above; ARS), and pale cyst nematode (below; Bonsak Hammeraas, Norwegian Institute for Agricultural and Environmental Research)

The potato cyst nematode life cycle

Nematode juveniles and adults resemble worms, earning them the common name "roundworms." They have six life stages: egg, four juvenile stages, and adult. Most species have both male and female adult forms, and reproduce sexually. Potato cyst nematodes in the genus *Globodera* are obligate parasites of several solanaceous plant hosts. *Globodera* are among the most challenging plant pests to control, because the "cyst" is actually the body of a dead female nematode containing hundreds of eggs. Cysts with viable eggs can persist in soil for decades, where they remain relatively resistant to chemical and biological stresses, until eggs are stimulated to hatch by root exudates from susceptible plant hosts such as potato. For that reason, movement of soil containing cysts (such as residual soil on harvested plant parts, or on farm equipment) is typically how these nematodes move from one field or geographic location to another. Eggs in cysts can remain viable for many years in the absence of solanaceous hosts. When eggs hatch, the second-stage juveniles emerge and swim short distances to host plant roots, where they penetrate, feed, and complete their life cycle. Extensive nematode feeding saps plant nutrients and can result in greatly reduced crop yields. Potato tubers themselves are not attacked. Left uncontrolled, over time nematode populations can increase dramatically in a potato field.

Methyl bromide fumigation has historically been used to control nematodes and other pests in a number of crops (USDA photo)

Nematode control approaches

Planting resistant crop varieties has historically been one of the most effective control measures for many plant diseases. However, there are currently no russet varieties with resistance to potato cyst nematodes. One major goal of the GLOBAL project is to develop such new varieties. The fumigant methyl bromide has also been used extensively for the eradication of cyst nematodes and other soilborne plant pathogens. However, use of this chemical has been increasingly restricted. Other nematode control measures, including the use of non-host trap crops, microbial biocontrol agents, and plant products that contain naturally-produced nematicidal compounds, are promising control approaches. In our next few newsletters, we will describe our ongoing research in each of these areas.

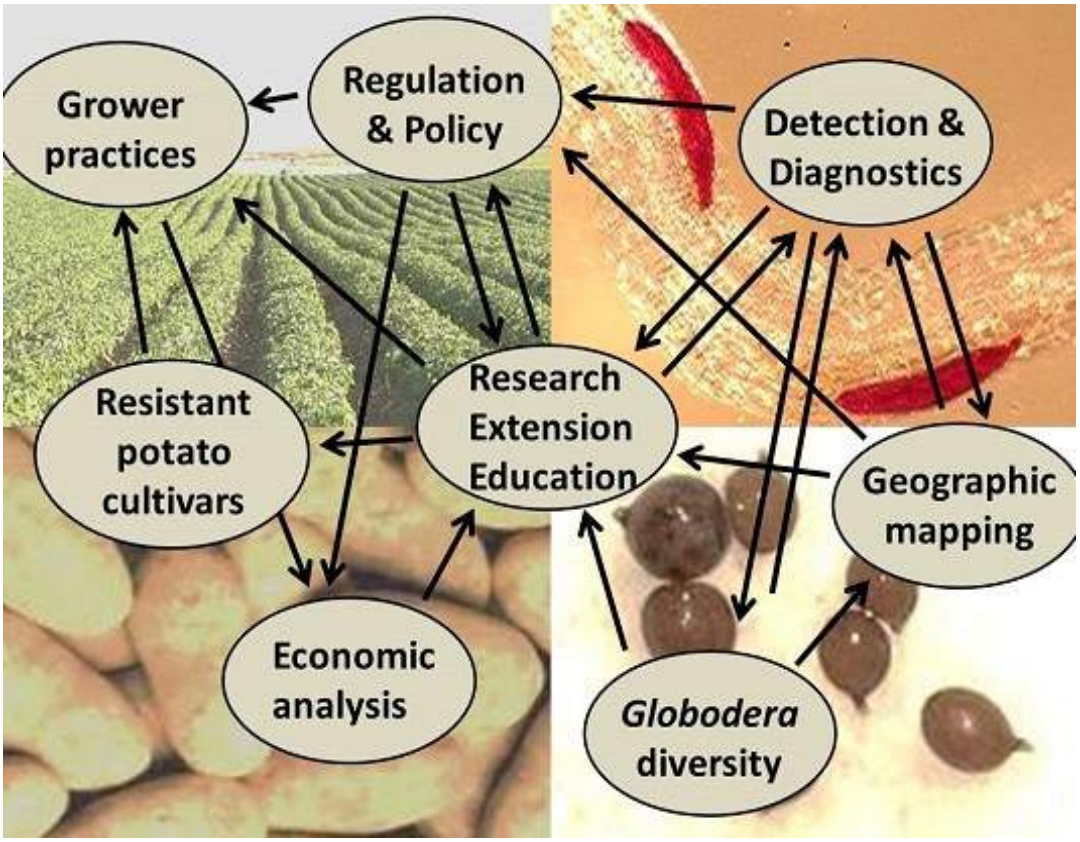
Specific objectives of the GLOBAL project

1. Genomic approaches to risk assessment of *Globodera*. Understanding the molecular basis underlying virulence will inform detection and diagnosis, guide the deployment of resistance, and reduce the threat of new *Globodera* introductions. We will genetically characterize *Globodera* populations from the U.S. and other countries, using cutting-edge genomics technologies, and will link this genetic diversity to virulence variants and to pathotypes.

2. Enhance potato breeding for resistance to *Globodera*. We will develop molecular markers for resistance sources against *Globodera* and use these to accelerate the development of commercially acceptable varieties for the U.S.

3. Enhance stakeholder engagement, knowledge and action related to *Globodera* and consequences on the U.S. potato industry. Together with stakeholders, we will develop and disseminate innovative extension and outreach materials and presentations on the impacts of *Globodera* on trade relations, agriculture policies, economics, and potato production, to empower the potato industry to make optimal decisions to minimize adverse economic impacts to U.S. agriculture and food security. We will develop coupled models of nematode population dynamics *x* potato cropping system *x* pest economic impacts, to predict effects of susceptible vs. resistant potato cultivars on crop loss.

4. Develop educational programs, using *Globodera* as a model, to teach concepts of ecological, agroeconomic, and global trade aspects of invasive plant pathogens. Our transdisciplinary project will incorporate several educational priorities, including increased participation of students in the agricultural and socioeconomic sciences, and enhanced understanding of the trade-offs implicit in effective but environmentally sound pest management.



GLOBAL transdisciplinary interactions and synergies are shown here

GLOBAL Investigators

- Louise-Marie Dandurand, PhD, Univ. of Idaho, GLOBAL Director
- Inga Zasada, PhD, USDA ARS, GLOBAL Co-Director
- Vivian Blok, PhD, James Hutton Institute, Scotland
- Glenn Bryan, PhD, James Hutton Institute, Scotland
- Walter De Jong, PhD, Cornell University
- Dee Denver, PhD, Oregon State University
- Eric Grenier, PhD, INRA, France
- Pam Hutchinson, PhD, University of Idaho
- John Jones, PhD, James Hutton Institute, Scotland
- Guy Knudsen, PhD, JD, University of Idaho
- Joe Kuhl, PhD, University of Idaho
- Chris McIntosh, PhD, University of Idaho
- Benjamin Mimee, PhD, Agriculture and Agri-Food Canada
- Rich Novy, PhD, USDA ARS
- Mike Thornton, PhD, University of Idaho
- Xiaohong Wang, PhD, USDA ARS and Cornell University
- Jonathan Whitworth, PhD, USDA

GLOBAL's Advisory Board

GLOBAL's advisory board consists of potato industry, state and federal regulatory, and academic individuals who have volunteered their time and efforts. We thank them!

- Bill Brewer, Oregon Potato Commission
- David Chitwood, PhD, USDA ARS
- Lorin Clinger, potato grower
- Tina Gresham, PhD, USDA APHIS PPQ
- Russell Ingham, PhD, Oregon State University
- Andrew Jensen, PhD, Northwest Potato Research Consortium
- Jonathan M. Jones, USDA-APHIS
- Daniel Kepich, USDA-APHIS
- Patrick Kole, JD, Idaho Potato Commission
- James LaMondia, PhD, Connecticut Agricultural Experiment Station
- Brian Marschman, USDA APHIS PPQ
- John Pickup, PhD, Science and Advice for Scottish Agriculture (SASA)
- Bryan Searle, potato grower
- Andrea Skantar, PhD, USDA ARS
- Raina Spence, Washington State Potato Commission
- Michael Wallace, USDA APHIS PPQ
- Alan Westra, Idaho Crop Improvement Association
- Melanie Wickham, Empire State Potato Growers, Inc.
- Ryan Krabill, United States Potato Board

Upcoming events: Idaho Potato Schools, Pocatello, ID, Jan 18-19, 2016

(concurrently) GLOBAL investigators and advisory board meeting

Contact us:

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