The Future of Potato Nematode Management: A Systems Approach

PRESENTED BY

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Actionable Science Against Nematodes

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PotatoNematodes.org

Welcome

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John Lundeen

Director, Research and Analysis
Potatoes USA
PAPAS Advisory Committee

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Developing a systems approach to control nematodes that threaten the US potato industry.

IN THIS WEBINAR

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- About PAPAS
- Potato Nematode Damage
- Management challenges
- Economic impact
- Our Systems Approach
  - Decision support
  - Resistant varieties
  - New chemistries
  - Industry outreach

About PAPAS

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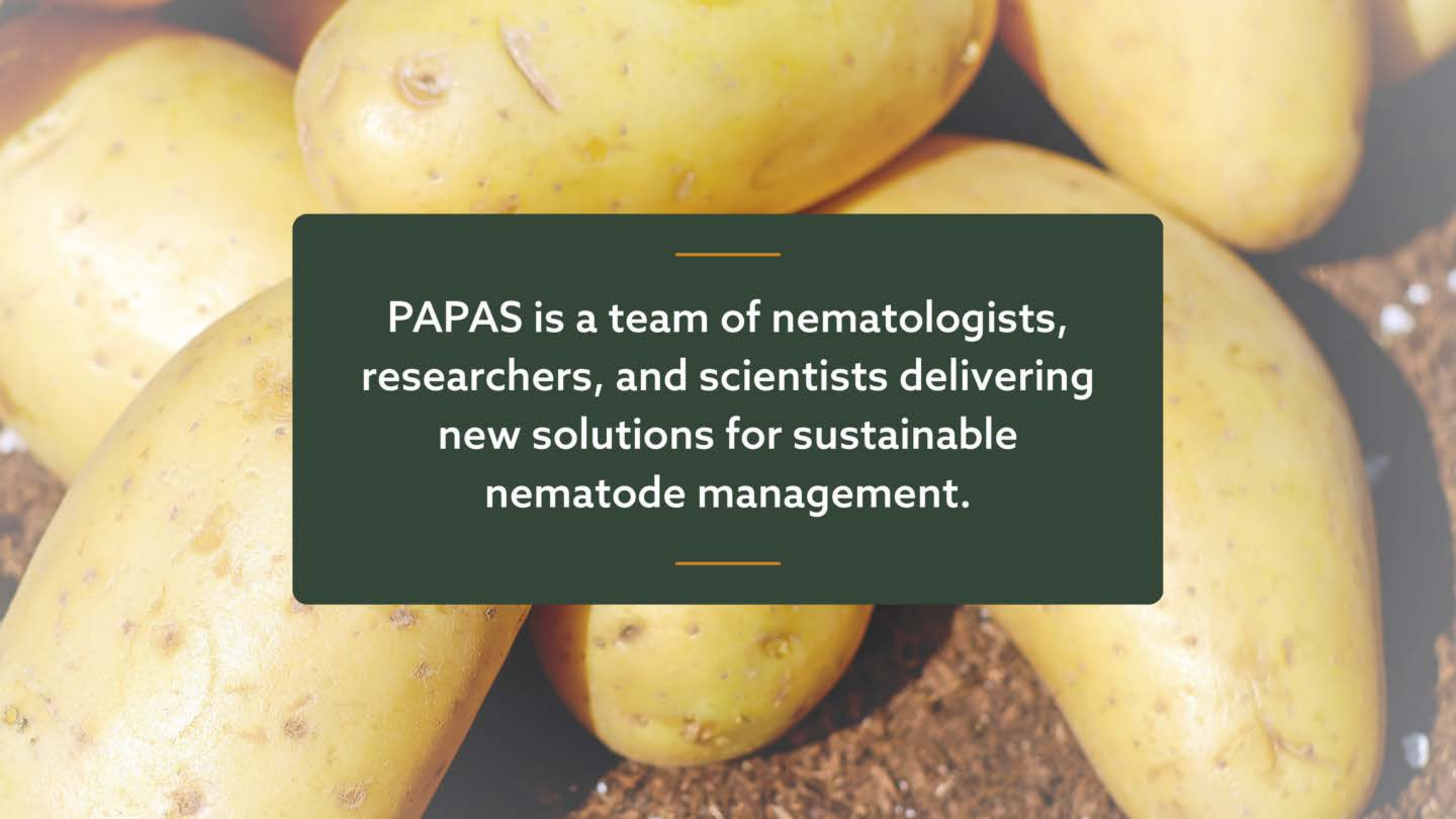
Louise-Marie Dandurand, Ph.D.

Plant Pathologist and Nematologist
Professor, University of Idaho
PAPAS Project Director



PAPAS is a team of nematologists, researchers, and scientists delivering new solutions for sustainable nematode management.

Why are potato nematodes a problem?

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Root-Knot Nematodes

Meloidogyne spp.
Columbia Root-Knot (*M. chitwoodi*)
Northern Root-Knot (*M. hapla*)

Infects tubers, causes defects and galls
Reduces yield and market value of tubers
Quarantine pest in certain export markets

Potato Cyst Nematodes

Globodera spp.
Pale Cyst (*G. pallida*)
Golden (*G. rostochiensis*)

Reduces yield (80%)
Found in Idaho and New York
Globally recognized quarantine pest

Addressing Nematode Management Challenges

- Little resistance in commercial varieties
- Lack of damage thresholds
- Molecular diagnostic options are limited
- Fewer and fewer nematicides are available

"One disaster away from disaster"

OUR OBJECTIVES:

1. Decision Support—Improve diagnostics, predictive models, and economic thresholds
2. Resistant Varieties—Accelerate development of nematode resistance in commercial potato varieties
3. New Chemistries—Analyze compounds of litchi tomato for novel nematicide production
4. Industry Outreach—Deliver information for more effective, sustainable nematode management

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Preventing spread is critical to protect crops.

To safeguard pest-free fields:

- Soil sample fields to find nematode presence
- Avoid movement of contaminated soil
- Plant nematode-free certified seed
- Properly dispose of culls and waste soil

Management of may require multiple methods.

If nematodes are detected in potato fields, consider:

- Rotation with non-host crops
- Use of a resistant variety (when possible)
- Planting trap crops and certified seed
- Evaluate nematicide or fumigant if needed

Economic Impact

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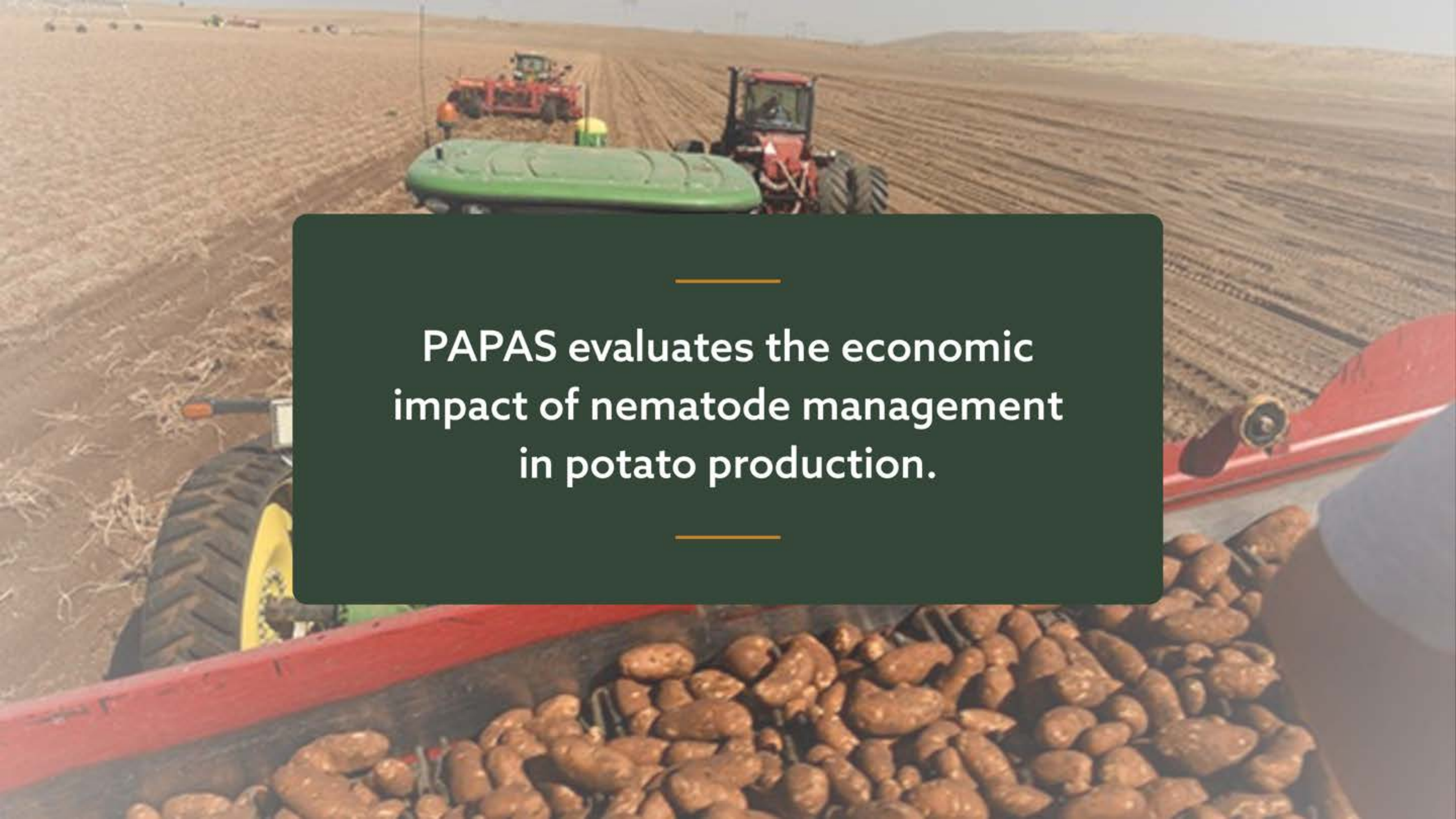
Philip Watson, Ph.D.

Professor, Agriculture Economics
University of Idaho
PAPAS Project Co-Director



PAPAS evaluates the economic impact of nematode management in potato production.

Potato Enterprise Budgets

Tracking expected costs and earnings to determine economic impact

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6 STATES

~70% US PRODUCTION

3 METHODS

OF MANAGEMENT

- **Fumigation**
- **Non-fumigation**
- **Resistant varieties (existing or new)**

Economic Impact Models

Estimating how nematode pressure and mitigation affect economic activity in each state

Nematicides represent roughly 20% of production costs

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Nematode Economic Loss Estimates

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Farmgate Revenues

-$332K to -$570K

PER 100 ACRES

Rotating to Cereal/Grain

-$290K to -$500K

PER 100 ACRES

With Economic Linkages

-$668K to -$1.8M

PER 100 ACRES

Resistant varieties ('King Russet') provide the most profitable and economically viable strategy, boosting state economic activity and benefiting the broader US potato industry.

*uncertainty around licensing fees

Improving Potato Nematode Management

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Benefits to Growers

Improved varieties and management options can both reduce pesticide use and help farmers with their bottom lines.

Benefits to Consumers

Improved food security with a more available and affordable supply of high quality potatoes.

Decision Support

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Inga Zasada, Ph.D.

Research Plant Pathologist/Nematologist
USDA ARS
PAPAS Project Co-Director

PAPAS OBJECTIVE 1

Provide better decision support to potato growers with improved diagnostics, predictive models, and economic thresholds.

Decision Support

Faster, more reliable molecular diagnostic assays

Reduce risk from nematode damage

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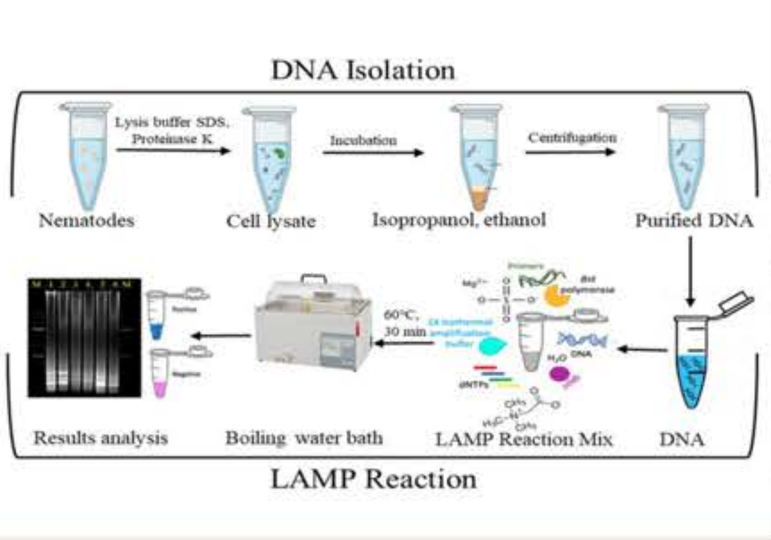

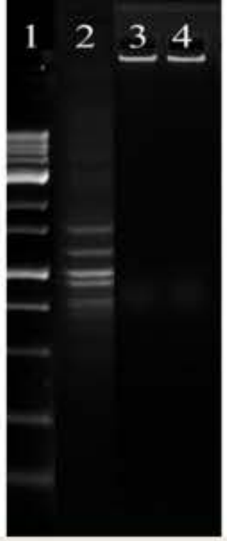

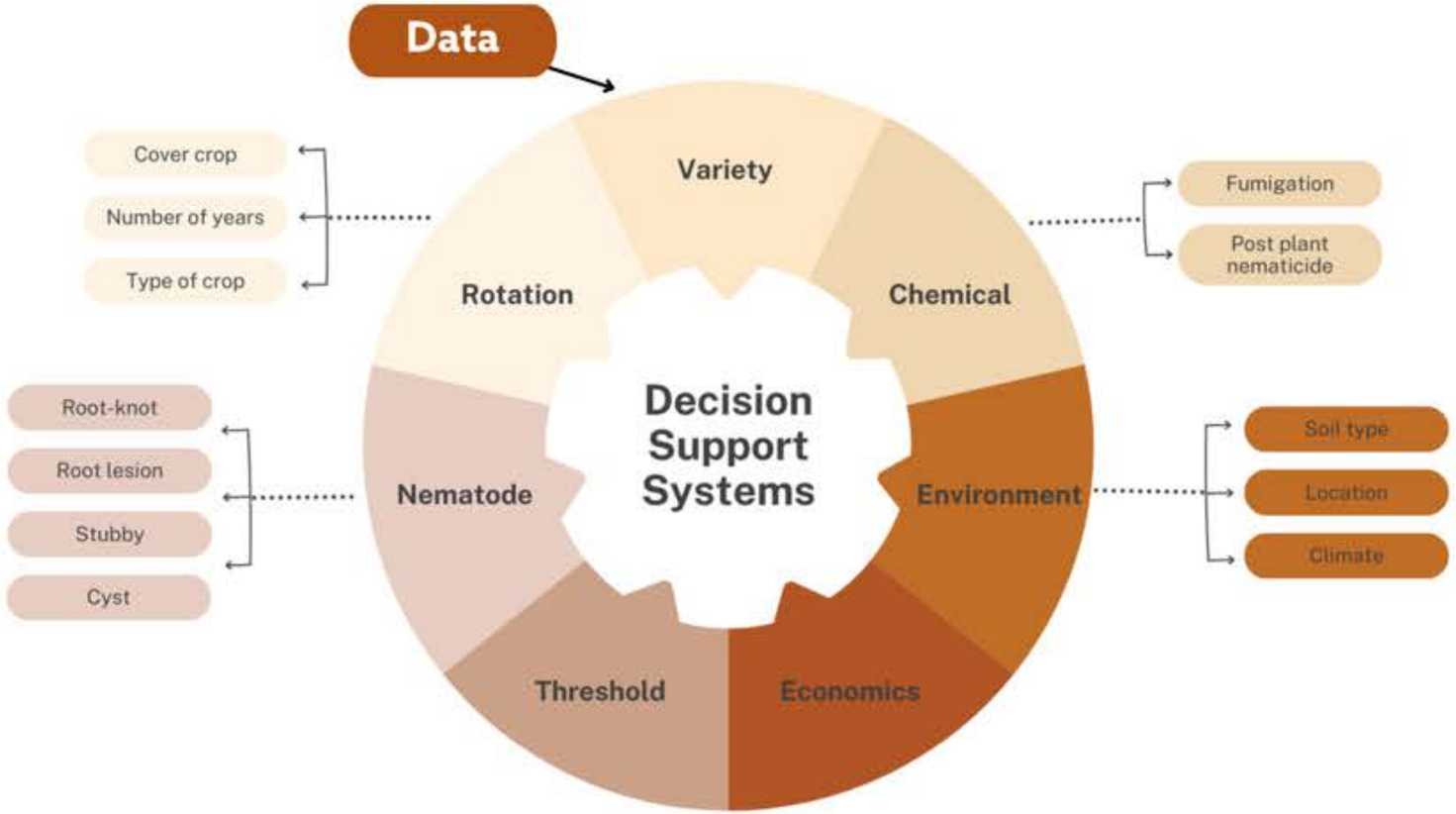

Columbia root-knot nematode can cause severe damage at low densities.

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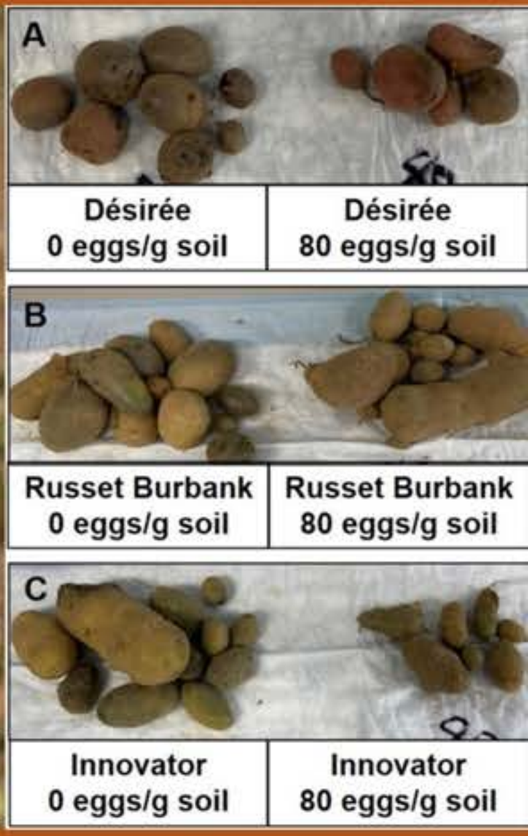

Our methods will help detect the pest at low levels.

Resistant Varieties

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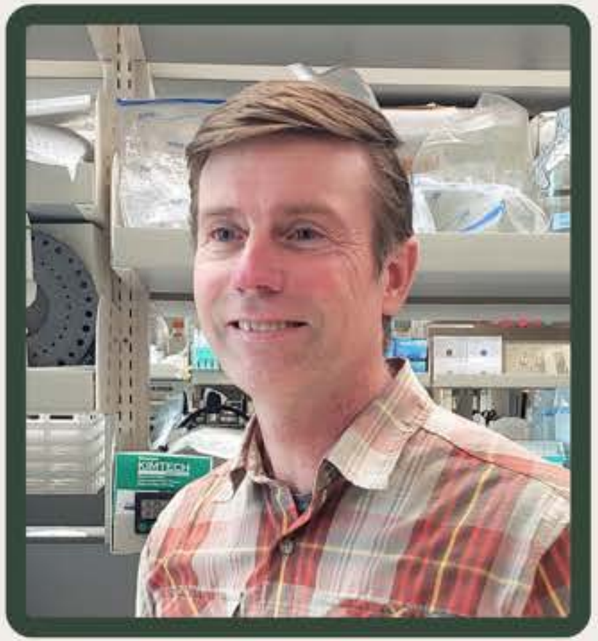

Joseph Kuhl, Ph.D.

Professor, Plant Genetics
University of Idaho
PAPAS Project Co-Director

PAPAS OBJECTIVE 2

Accelerate development of commercial potato varieties with nematode resistance through traditional breeding methods.

Evaluating New Sources of Resistance

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Exploration of novel pathways for nematode immunity in litchi tomato

Cell death on the top (left) and bottom (right) of the leaf

Evaluate select Solanum species for their response to root-knot and potato cyst nematodes

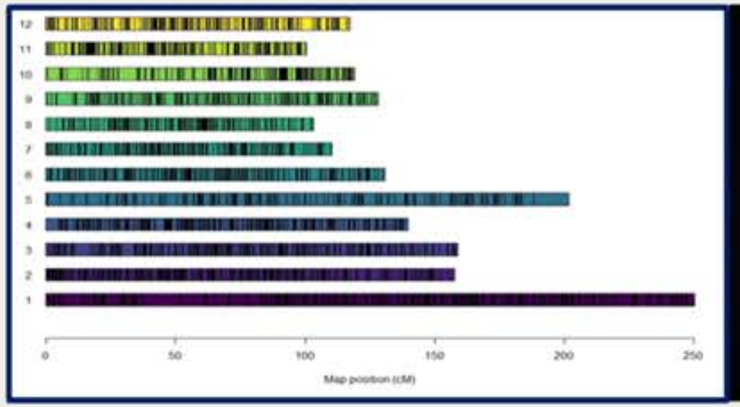
Wild potato clone with hybridization tags during winter crosses

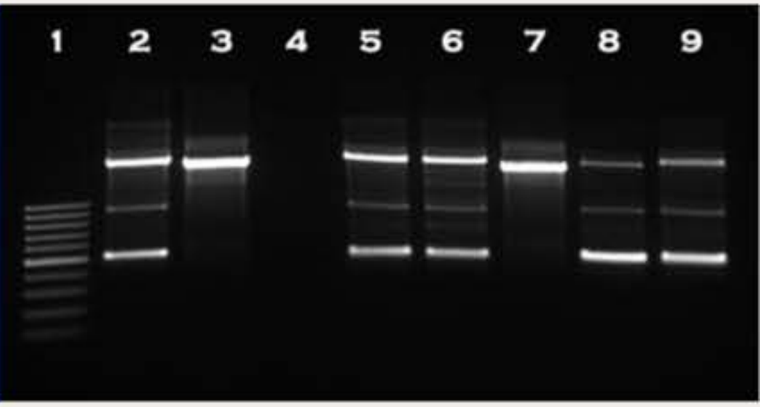
Development and application of new molecular markers linked to resistance for breeding

Two breeding clones selected with resistance to potato cyst nematode

Use of Molecular Markers with Conventional Breeding

- Identify progeny with desired resistance gene using a molecular marker
- Challenge the plant with nematode to confirm resistance





Crosses made by breeders incorporate resistance genes into new varieties

- Acceptable phenotypes are entered into trials to further evaluate yield, quality, storage, and processing/fresh pack suitability
- Varieties that graduate successfully from trials may be named and released to the potato industry
- Process can take 10-15 years

New Chemistries

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Cynthia Gleason, Ph.D.

Associate Professor, Plant Pathology
Washington State University
PAPAS Project Co-Director

PAPAS OBJECTIVE 3

Explore novel nematicide production from compounds of litchi tomato (*Solanum sisymbriifolium*).

Litchi tomato

- **Resistant to broad range of plant-parasitic nematodes**

  No potato cultivar currently in use has this spectrum of resistances

- **Naturally produces compounds toxic to nematodes**

  Analyzing genes and chemicals that produce this anti-nematode defense

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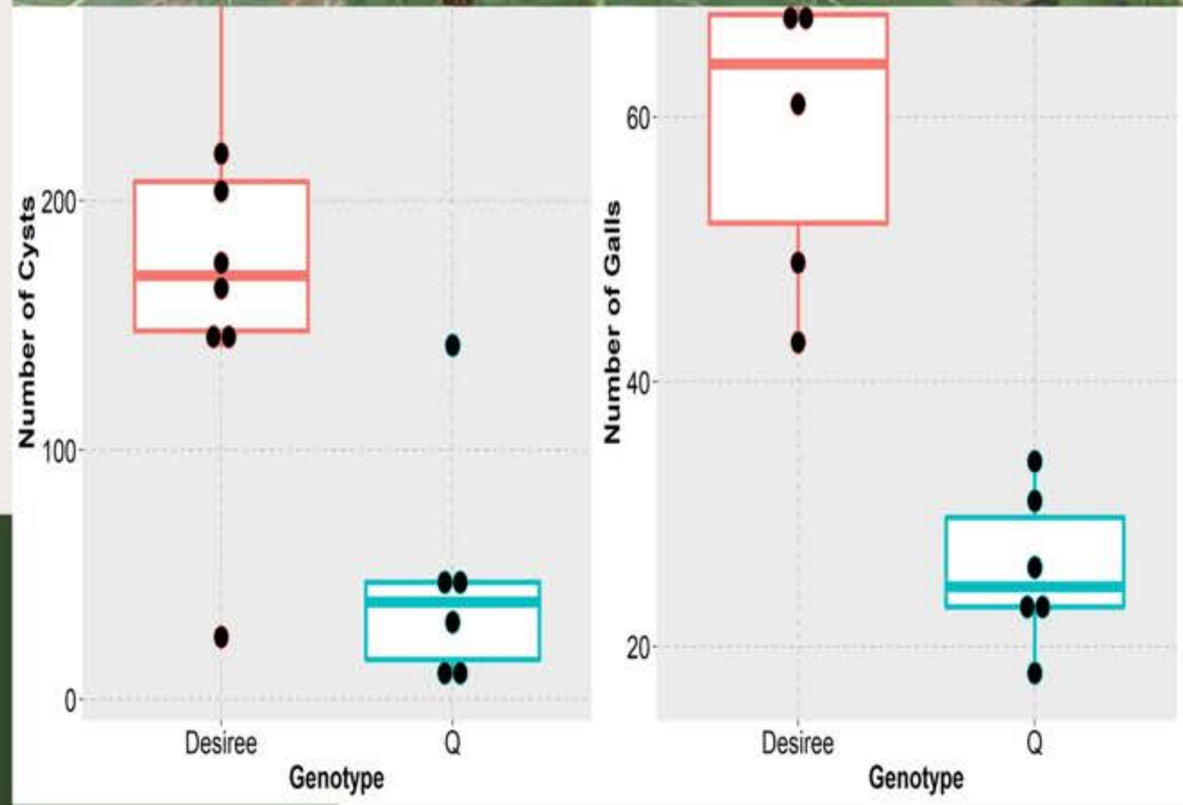

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Identifying novel bioactive compounds with nematicidal effects in litchi tomato

- Quantify the ability of fractionated extracts to disrupt nematode development
- Purify, identify, and optimize bioactive compounds

Industry Communication

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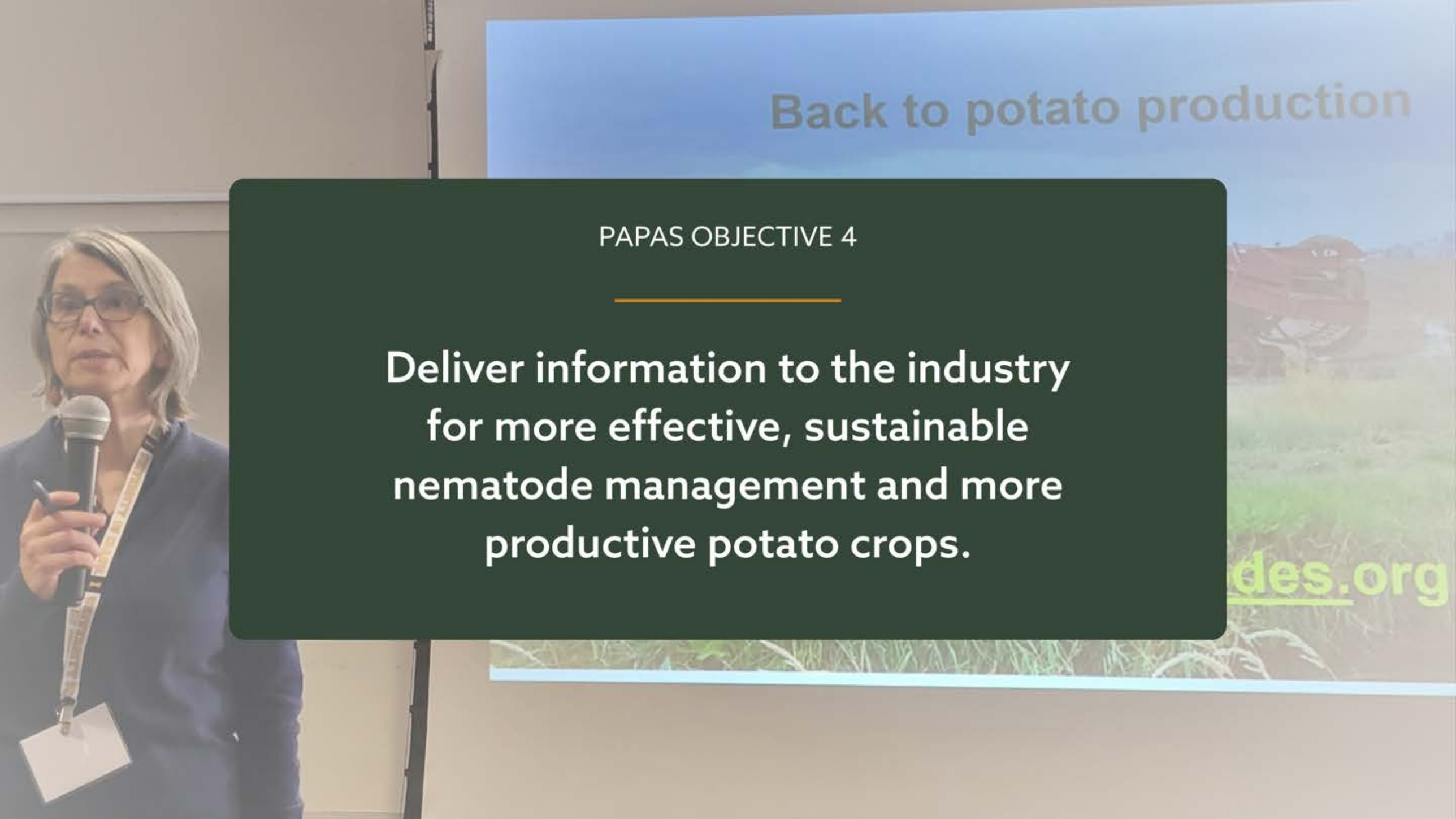
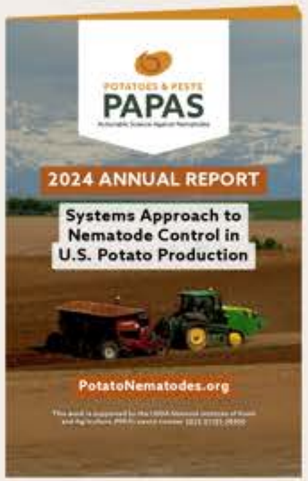


PAPAS OBJECTIVE 4

Deliver information to the industry for more effective, sustainable nematode management and more productive potato crops.

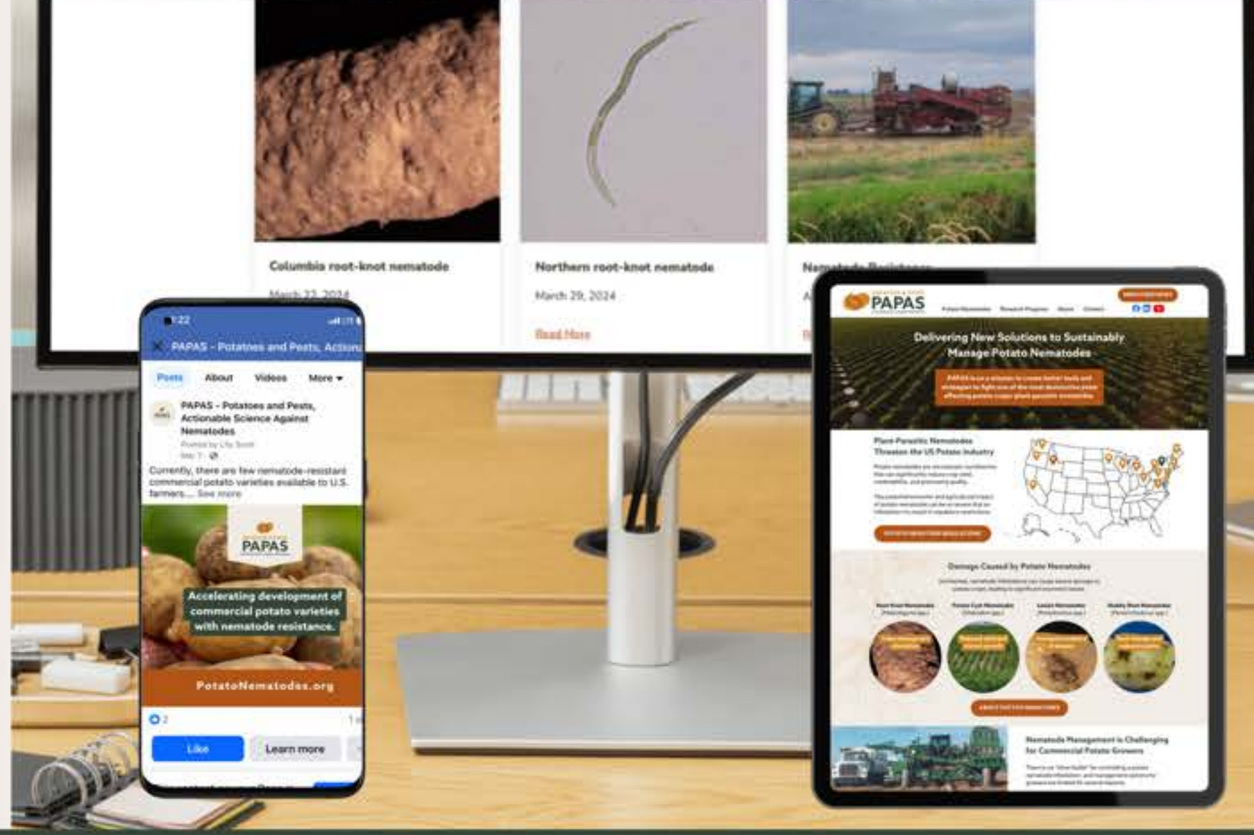
Potato Nematode News & Resources

@PAPAS — Potatoes and Pests, Actionable Science Against Nematodes



ANNUAL REPORT

EMAIL SIGNUP



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Potatoes USA

USDA

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Cornell University

Michigan State University

Oregon State University

Washington State University

Wisconsin – University of Wisconsin-Madison

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Addressing Industry Priorities

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The PAPAS advisory committee evaluates our progress and provides recommendations so that the milestones of the project are achieved.

Farmers, Agronomists, and Processors

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Northwest Potato Research Consortium

John Lundeen
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Chris Voigt
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Delivering New Solutions to Sustainably Manage Potato Nematodes

THANK YOU

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