Successful Control of *Globodera rostochiensis* (golden nematode) in New York State

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Potato Cyst Nematodes (PCN)

- Two species: golden nematode/GN and pale cyst nematode
- Hosts: potato, tomato, eggplant, and some weeds

G. rostochiensis (golden nematode/GN)

G. pallida
pale cyst nematode
Distribution of Potato Cyst Nematodes 
(*Globodera rostochiensis & G. pallida*) in North America

- **1. Idaho**
  - *New Detections* 
    - April 2006
    - August 2006
  - *G. rostochiensis*

- **2. Quebec**
  - *Both Globodera species*

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*New Detections*
1. April 2006
2. August 2006
Discovery of Golden Nematode in New York

- In late 1930’s, a grower on Long Island, NY noticed disease symptoms
- In 1941, the pathogen was identified as golden nematode
- Introduced by military equipment returning from Europe after WWI
- It took about 20 years before noticed
Successful Control of Golden Nematode in New York

Regulated areas:
Cayuga, Livingston, Nassau, Orleans, Seneca, Steuben, Suffolk and Wayne
Counties partially regulated

New York State regulated areas will mirror federal areas in early December 2014

Restrictions are imposed on the movement of regulated articles from a regulated area as follows: Red into or through white areas

Consult your State or Federal plant protection inspector or your county agent for assistance regarding exact areas under regulation and requirements for moving regulated articles.

For detailed information see 7 CFR 301.85-2a for quarantine and regulations.
Successful Control of Golden Nematode in New York

♦ A cooperative research program involving USDA/ARS and Cornell University
  - fundamental biology of PCN-potato interactions
  - resistant potato variety development and adoption
  - GN management strategies

♦ A regulatory program involving USDA/APHIS and NY State Department of Agriculture and Markets
  - soil surveys, sanitations, and regulatory and monitoring
A Longstanding Collaborative Effort
for developing and releasing nematode resistant potato varieties

50-200 crosses (Cornell Greenhouses)
20,000 seedlings in pots
Early generation selection in fields

Nematode resistance evaluations

Trials (research farm sites, grower farms)

Production of disease-free seed on Uihlein Farm

Walter De Jong
Plant Breeding, CU

USDA-ARS
Xiaohong Wang

Walter De Jong

Keith Perry
Plant Pathology, CU
Development of GN Resistant Potato Cultivars

Breeding Programs
Cornell University Plant Breeding
Cornell Horticulture
Frito-Lay Inc.
University of Maine
University of Michigan
University of Wisconsin
Texas A & M
USDA Potato Breeding project
Canada Potato Research Center
Oregon State University
USDA-ARS, Aberdeen, ID
PLSJ-Quebec

<table>
<thead>
<tr>
<th>Year</th>
<th>Cultivar</th>
<th>Source</th>
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<tbody>
<tr>
<td>1966</td>
<td>Peconic (CU)</td>
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<td>1967</td>
<td>Wauseon (USDA, MD)</td>
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<td>1972</td>
<td>Hudson (CU)</td>
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<td>1976</td>
<td>Atlantic (USDA, MD)</td>
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<tr>
<td>1977</td>
<td>Campbell 11 (CS)</td>
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<td>1978</td>
<td>Campbell 13 (CS)</td>
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<td>1979</td>
<td>Belchips (USDA, MD)</td>
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<td>1980</td>
<td>Highlat Russet (USDA, AK)</td>
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<td>1981</td>
<td>Rosa (CU)</td>
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<td>1982</td>
<td>Simcoe (AC)</td>
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<td>1984</td>
<td>Islander (ME)</td>
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<td>1985</td>
<td>Elba (CU)</td>
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<td>1986</td>
<td>Donna (AC)</td>
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<td>1989</td>
<td>Kanona (CU)</td>
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<td>1990</td>
<td>Allegany (CU)</td>
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<td>1991</td>
<td>Castile (CU &amp; USDA, MD)</td>
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<td>1992</td>
<td>Coastal Chip (USDA)</td>
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<td>1993</td>
<td>Genesee (NY78) (CU)</td>
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<td>1994</td>
<td>Belchips (USDA, MD)</td>
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<td>1995</td>
<td>Pike (CU)</td>
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<td>1996</td>
<td>Steuben (CU)</td>
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<td>1997</td>
<td>Salem (CU)</td>
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<td>1998</td>
<td>Reba (CU)</td>
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<td>1999</td>
<td>Keuka Gold (CU)</td>
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<td>2000</td>
<td>Eva (CU)</td>
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<td>2001</td>
<td>Amey (USDA, MD)</td>
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<td>2002</td>
<td>Marcy (CU)</td>
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<td>2003</td>
<td>Monticello (CU, Maine)</td>
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<td>2004</td>
<td>Lehigh (CU)</td>
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<td>2005</td>
<td>Red Maria (CU)</td>
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<td>2006</td>
<td>Waneta (CU)</td>
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<td>2007</td>
<td>Lamoka (CU)</td>
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<td>2008</td>
<td>Huckleberry Gold (USDA, ID)</td>
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<tr>
<td>2009</td>
<td>(22 CU / 44)</td>
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Ro1 Management Scheme

Infested field found

Grow resistant cultivar
Year 1

Grow resistant cultivar
Year 2, Survey

No viable cysts found

Enter rotation

Fixed rotation cycle

Resistant cultivar

Resistant cultivar

Susceptible cultivar

Non-host crop
/land rest
Ro2 management study (2008 – 2014)

5 years of NY140
(no emergence of virulent pathotype)

4 years of rotation cycle

Number of eggs/g of soil

Subplot 15-1
Subplot 15-2
Subplot 15-3
Subplot 15-4
Subplot 15-5
Subplot 15-6
Subplot 15-7
Subplot 15-8
Subplot 15-9
Subplot 15-10
Subplot 15-11
Subplot 15-12

2008/Pike
2009/Pike
2010/Pike
2011/Pike
2012/Pike
2013/Pike
2014/Pike

2009/NY140
2010/NY140
2011/NY140
2012/NY140/NY121
2013/NY140/NY121
2014/Nonhost/oat

Number of eggs/g of soil
Scientific & Technical Support
to Nematode Quarantine and Regulatory Activities

i. Cyst samples from surveyed fields--bioassay to determine nematode pathotypes (Ro1 or Ro2?)

ii. Cyst samples from fields determined for deregulation—bioassay to determine cyst viability

iii. Ro2 management
Fundamental Biology of PCN-Potato Interactions

Gheysen and Mitchum, COPB 2011
Manipulating of host CLE receptors resulted in increased resistance to PCN
Exploration of wild potato species for nematode resistance
Use nematode-secreted proteins to discovery new resistance genes

GFP control

GrSPRYSEC5

GrSPRYSEC8

Solanum hjertingii

HR

S. hjertingii 7dpi

Solanum brevicaule

GFP control

GrSPRYSEC19

GrSPRYSEC5
Conclusions:

1. Quarantine and the use of resistant potato varieties are essential for the successful confinement and control of PCN in New York.

2. Basic research is necessary for supporting nematode quarantine and regulatory activities and for developing novel nematode control and management strategies.

Acknowledgements:

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Cornell University
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