



## Erosion of potato resistance to *Globodera pallida*

By Zahra Bitra Amiri, University of Idaho

### *Globodera pallida*

- A regulated pest, the pale cyst nematode, PCN, was found in Idaho in 2006
- Three pathotypes of PCN are known to occur in Europe: Pa1, Pa2, and Pa3. The pathotype of the Idaho population is Pa2/3.



**ZERO TOLERANCE  
in the US**

### Eradication effort in U.S.

#### Soil fumigation:

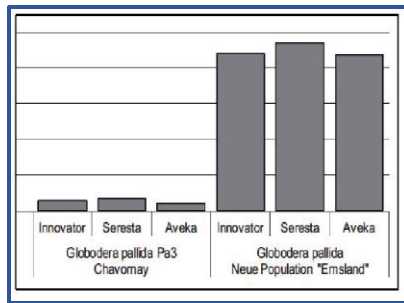
- 1,3-dichloropropene

#### Resistance:

- No resistance to PCN is found in russet type potatoes but breeders are developing resistance for US growers

### Resistance breeding challenges

- PCN is highly heterogeneous. Thus, multiple resistance sources need to be incorporated into breeding germplasm.
- Continuous use of resistant varieties imposes a strong selection pressure which increases the frequency of **resistance breaking populations.**

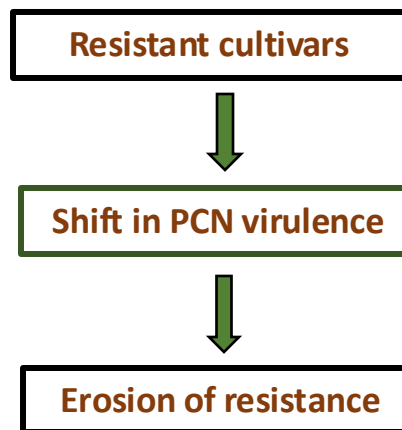
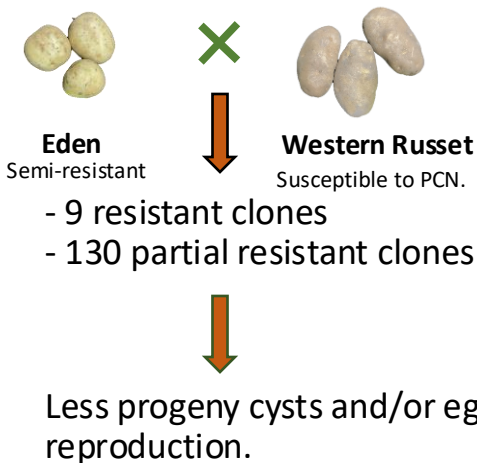


Niere et al., 2014

### Resistant breaking populations

- PCN reproduction on resistant potato varieties due to multiple croppings with resistant varieties containing the same resistance source has been observed in Europe
- This caused genetic selection for stronger and/or more virulent PCN populations.

### Resistant breeding in Idaho



### Biology of progeny cysts from resistant potatoes

- There is a significant change in the behavior of PCN from these resistant clones, including:
  - **Less hatch**
  - **Larger cysts**
  - **Longer larvae**

Beniers, J. E., Nöllen, Y., van Eck, H. J., & Schouten, H. J. (2019). Increased virulence of *Globodera pallida* during repeated rearing on different resistant potato cultivars explained by a simple model. *Plant Pathology*, 68(3), 445-453.

Dandurand, L. M., Zasada, I. A., Wang, X., Mimeo, B., De Jong, W., Novy, R., ... & Kuhl, J. C. (2019). Current status of potato cyst nematodes in North America. *Annual review of phytopathology*, 57, 117-133.

Fournet, S., Kerlan, M. C., Renault, L., Dantec, J. P., Rouaux, C., & Montarry, J. (2013). Selection of nematodes by resistant plants has implications for local adaptation and cross-virulence. *Plant pathology*, 62(1), 184-193.

Fournet, S., Eoche-Bosy, D., Renault, L., Hamelin, F. M., & Montarry, J. (2016). Adaptation to resistant hosts increases fitness on susceptible hosts in the plant parasitic nematode *Globodera pallida*. *Ecology and evolution*, 6(8), 2559-2568.

Jones, J. (2017). The Fascinating Biology of Potato Cyst Nematodes. *Globodera Alliance Newsletter*.

Kort, J., Ross, H., Rumpfenhorst, H. J., & Stone, A. R. (1977). An international scheme for identifying and classifying pathotypes of potato cyst-nematodes *Globodera rostochiensis* and *G. pallida*. *Nematologica*, 23(3), 333-339.

Mwangi, J. M., Niere, B., Finckh, M. R., Krüssel, S., & Kiewnick, S. (2019). *Reproduction and life history traits of a resistance breaking Globodera pallida population*. Society of Nematologists (via Exeley Incorporated).

Turner, S. J., Stone, A. R., & Perry, J. N. (1983). Selection of potato cyst-nematodes on resistant *Solanum vernei* hybrids. *Euphytica*, 32(3), 911-917.

Turner, S. J. (1990). The identification and fitness of virulent potato cyst-nematode populations (*Globodera pallida*) selected on resistant *Solanum vernei* hybrids for up to eleven generations. *Annals of applied Biology*, 117(2), 385-397.