



# Root Knot Nematode Management Strategies in Processing Vegetables

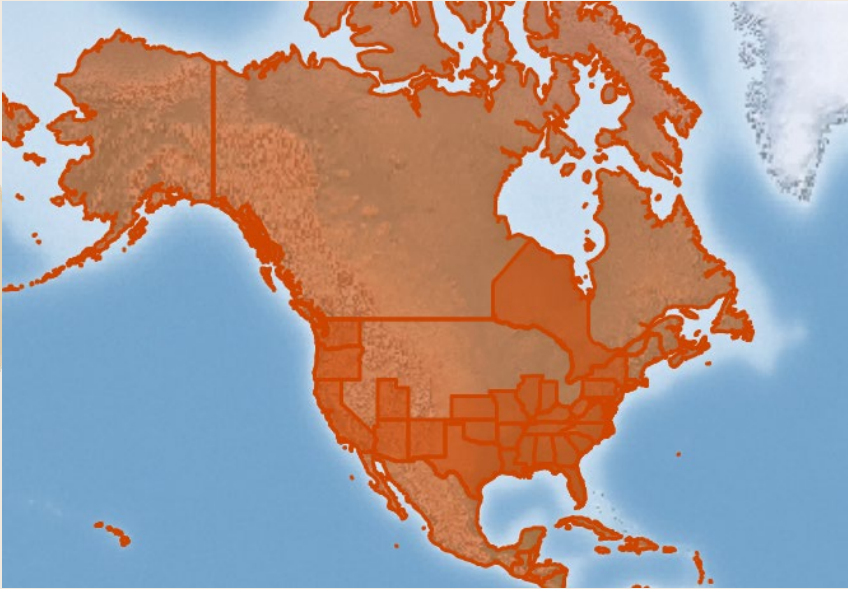
Eboni Traverso | Emmalea Ernest | Alyssa Koehler

# Root Knot Nematodes

- Microscopic roundworms
- *Meloidogyne* genus
- >100 species
- >3000 host species



# Root Knot Nematode in the Mid-Atlantic



- Most common species: Southern RKN (*M. incognita*)
- Sandy/loamy soil allows for high mobility

CABI, 2022. *Meloidogyne incognita*. In: Invasive Species Compendium. Wallingford, UK: CAB International. <https://www.cabi.org/isc>

# Diagnosing Root Knot Nematode

## Above Ground Symptoms

- Stunting
- Wilting
- Chlorosis, or yellowing of the leaves
- Decreased plant vigor
- Uneven growth throughout the field

**Check roots for galls and collect soil samples for testing**



# Crop Rotation and Cover Cropping

This can be difficult to do due to RKN's large host range, which includes common weeds.

## Crop Rotation Options

- Small Grains
- Sorghum
- Alfalfa



# Other Cultural Control Options

## Tilling



Leege, 2019

## Solarization



Hagan, Smith, & Sikora, 2021

Care should be taken to reduce plastic waste after treatment

## Fallow Periods



**These methods have limited effects and can be costly**

# Chemical Control: Nematicides

Fumigants: Gas

Nonfumigants: Liquid

Nematicide use has  
environmental consequences  
and high financial burden



Teleos Ag

Trade Names	Formulation	Active Ingredient	Manufacturer
Telone II	Fumigant	1,3 dichloropropene (1,3-D)	Corteva Agriscience™
Chlor-O-Pic	Fumigant	96.5-99% chloropicrin	Corteva Agriscience™
Vydate	Nonfumigant	1,3 dichloropropene (1,3-D)	Corteva Agriscience™
Velum Prime	Nonfumigant	96.5-99% chloropicrin	Bayer CropScience

# Genetic Resistance

## Plant Breeding

Examples of desirable phenotypes

- Corn – larger cob
- Lima bean – lanceolate leaf shape



**We also breed for  
disease resistance traits!**

## Characteristics

- Reduced Feeding (Galling)
- Reduced Reproduction (Eggs)
- Ideal – Reduction in both



# Genetic Resistance to RKN in Lima Beans (2021-2022)

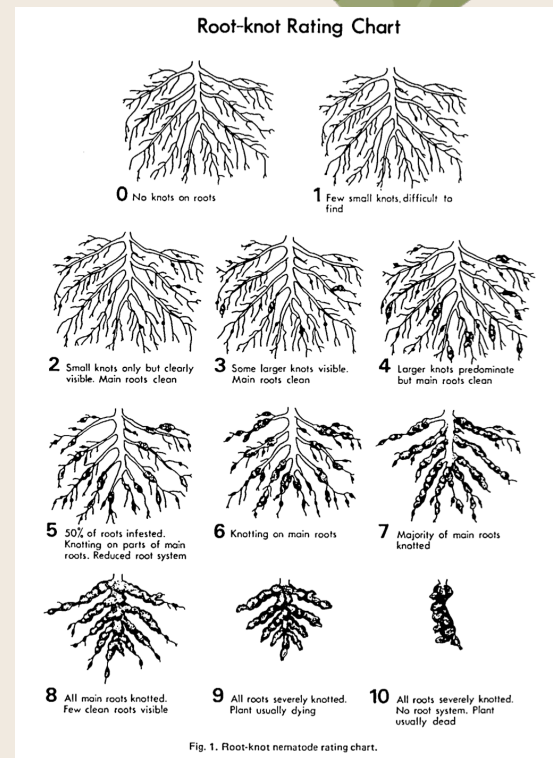
## Comparing:

- 3 resistant accessions from the UD Lima Bean Breeding Program (Dr. Emmalea Ernest)
- Commercial standards – 'Cypress' and 'C-elite Select'

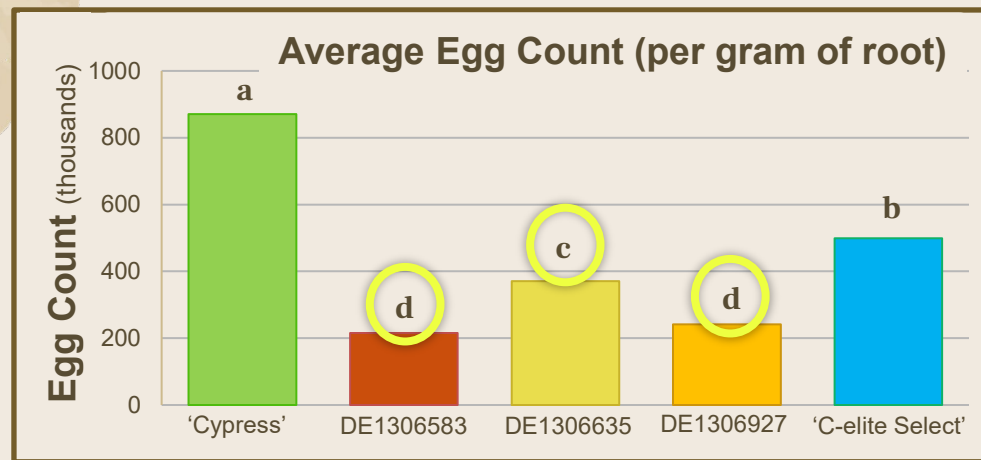
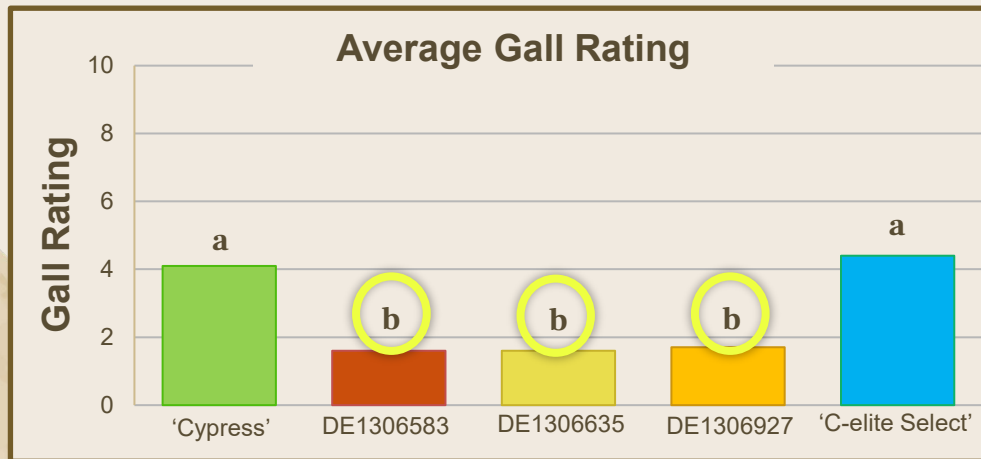


## Resistance Traits

- **Galling:** Qualitative rating of root appearance
- **Reproduction:** Number of eggs within the root system



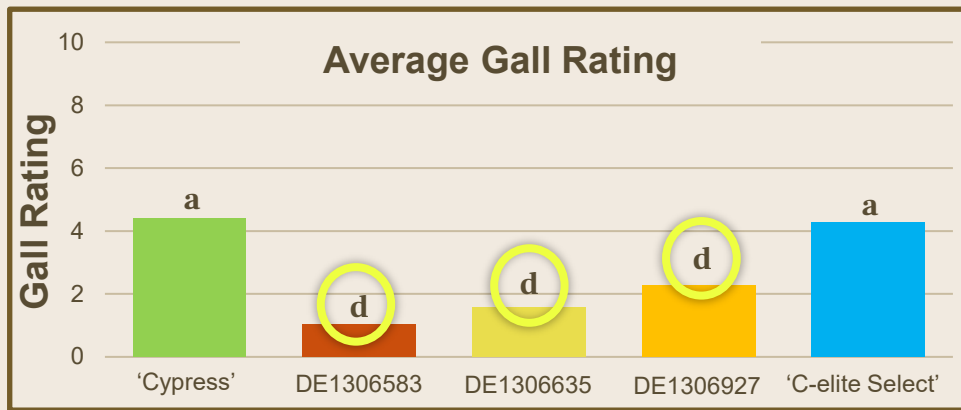
# Genetic Resistance – Year 1



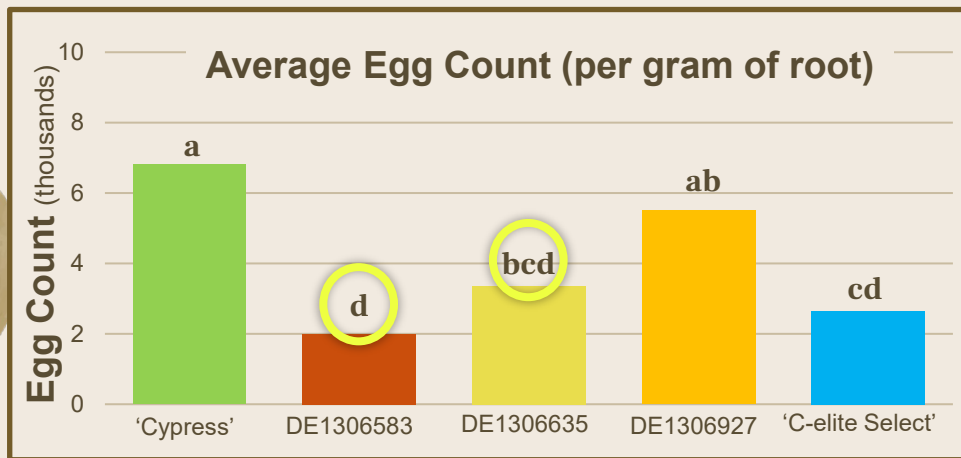
Varieties from the UD Lima Bean Breeding Program had significantly less nematode feeding (galls) and reproduction (eggs) than the commercial standards

*Treatments followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD;  $\alpha = 0.05$ )*

# Genetic Resistance – Year 2



Significantly less nematode feeding (galls) in UD bred varieties compared to the commercial standards

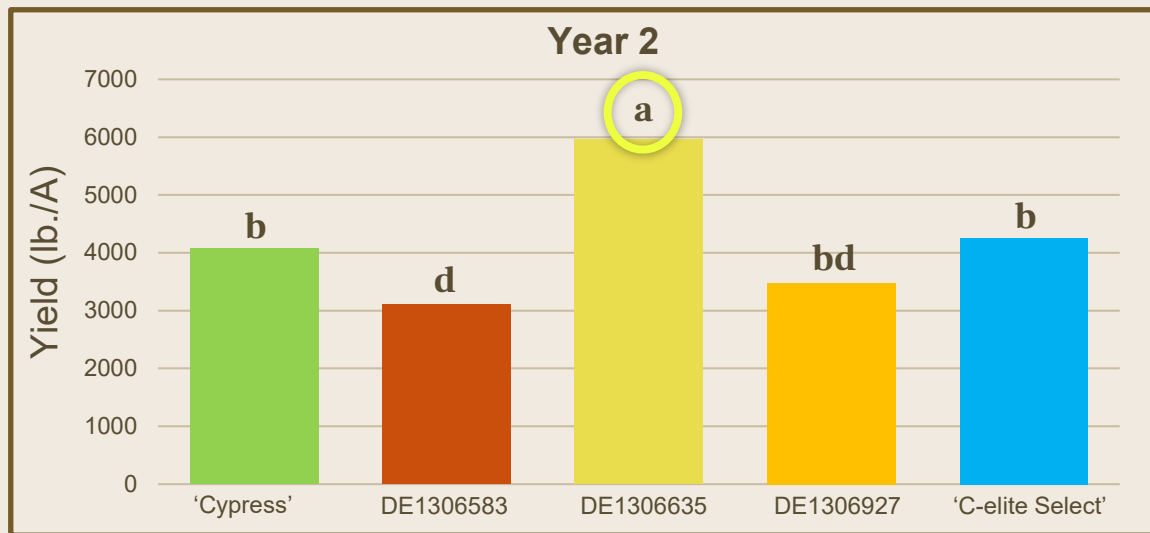
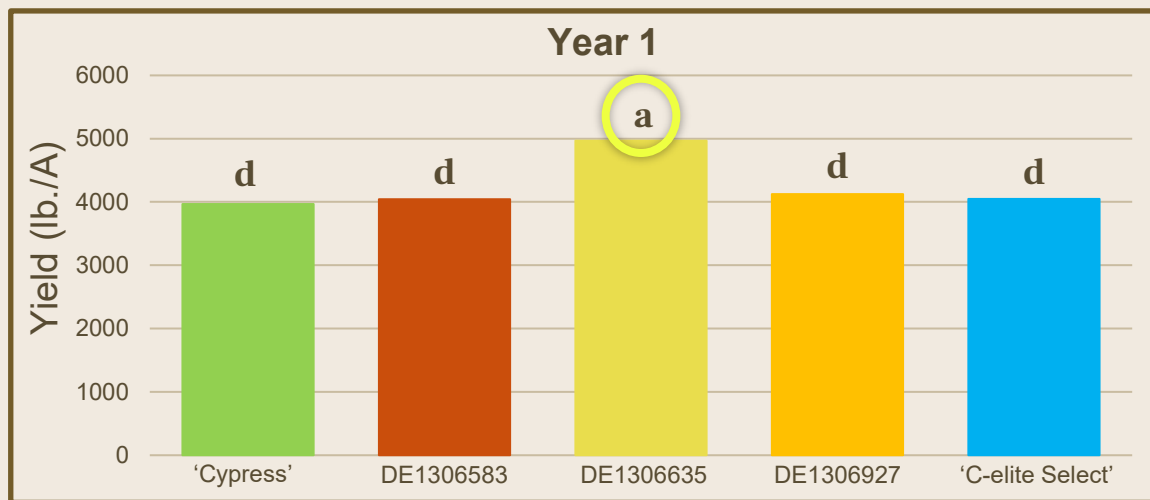


Some of the UD bred lines had significantly less reproduction (eggs) than the commercial standards

*Treatments followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD;  $\alpha = 0.05$ )*

# Yield Results

Both years, DE1306635 had significantly higher yield than any other varieties, including 'Cypress' and 'C-elite Select'.



*Treatments followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD;  $\alpha = 0.05$ )*

# Biological Control

## What is it?

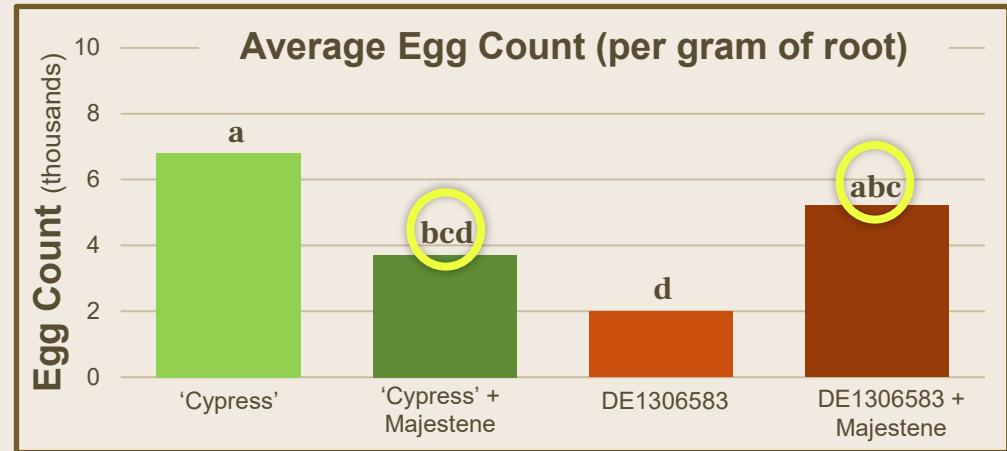
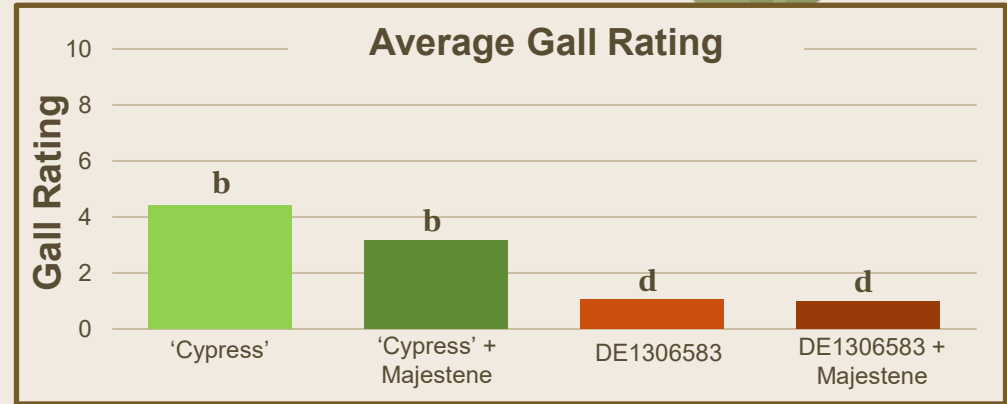
- Antagonism
- Living or nonliving biological organisms, or derivatives

## Objectives

- Are there additive effects from bio-control on resistant lines?
- Majestene: Heat-killed *Burkholderia*
  - Marrone Bio Innovations

## Results

- No apparent benefit from biological control



Treatments followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD;  $\alpha = 0.05$ )

# Conclusions

**An integrated management strategy is most effective**

**When available, genetic resistance is one of the most powerful tools**

## Management Options Include:

- Physical control methods like crop rotation and solarization
- Chemical fumigant and nonfumigant nematicides
- Biological nematicides
- Genetic resistance



## Promising Accessions

- DE1306635 shows great promise for commercial distribution
- We are working on connecting with seed production companies

# Acknowledgements

## Committee Members:

- Dr. Alyssa Koehler
- Dr. Emmalea Ernest
- Dr. Nicole Donofrio

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# Questions?



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