Soil-chemical interactions affecting the effectiveness of reduced rates of insecticide for the control of the wireworm, *Melanotus communis*, in Florida sugarcane

By

Nicholas A. Larsen

Biographical Information

- Bachelor’s degree in Spanish from UF
- Recruited to sugarcane industry in 2005
- Currently live in Pahokee, Florida
- Married to Kiley
- Currenty work at EREC on sugarcane and vegetable entomology

Why does a Spanish major study agronomy?

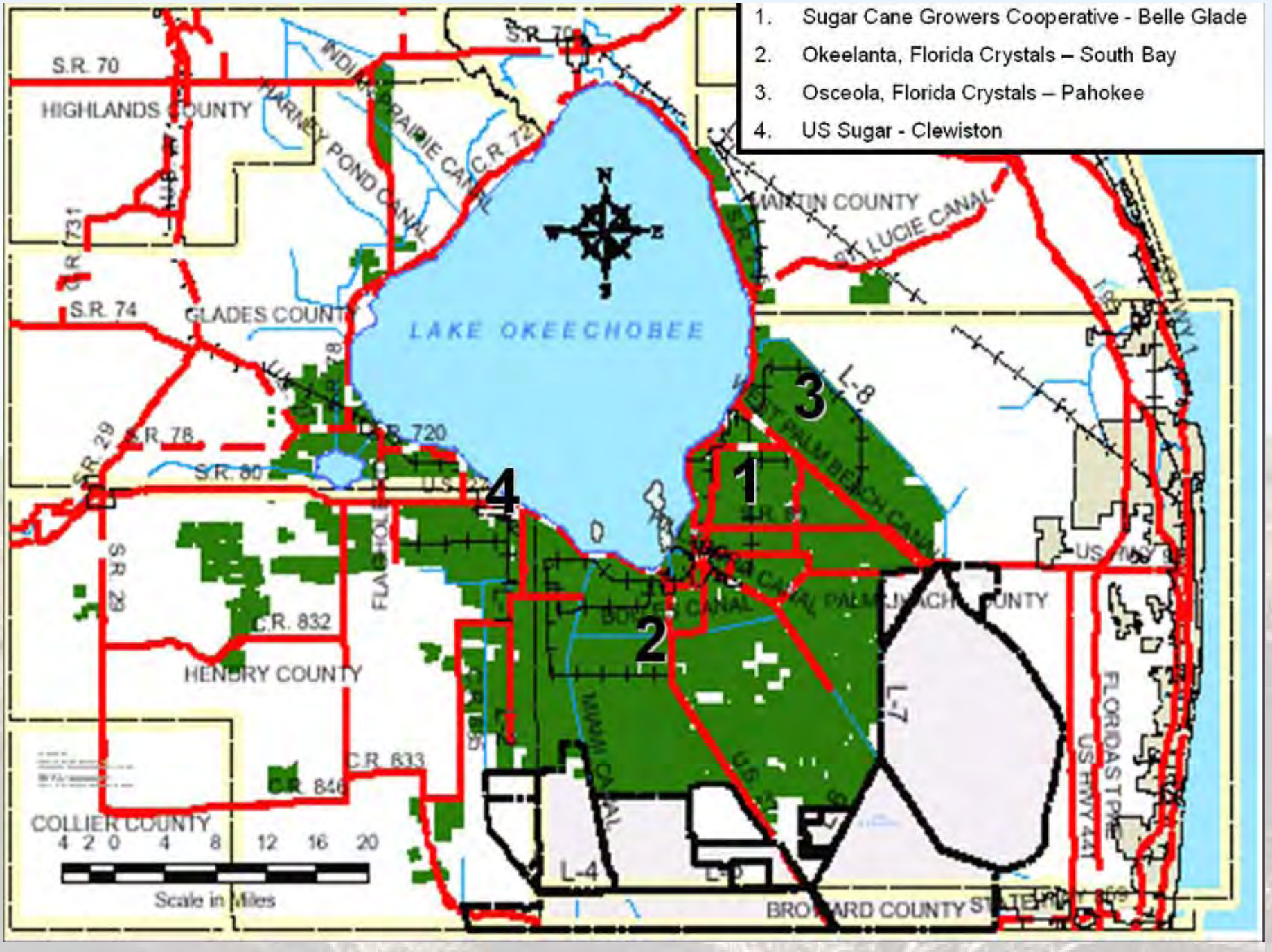
- VA benefits only allow one change of major
- I like to garden
  - I took an agronomy class to improve my skills
- I liked my crop physiology course
- Started working with Dr. Sinclair
- Decided that I would continue my education in Agronomy

Sugarcane in Florida

- Brought over with the Spanish
- Many small plantations before 1900
- Drainage expanded acreage
- Large acreage increases after Cuban Embargo
- Currently ≈ 400,000 acres

Florida Sugarcane Industry (prior to 1930)

1. Turnbull Plantation –New Smyrna
2. Dunlawton Plantation – Port Orange
3. Spring Garden Plantation – DeLeon Springs
4. Gamble Plantation – Bradenton
5. Yulee Sugar Mill – Homosassa
6. St. Cloud Plantation – St. Cloud
7. Pennsuco Sugar Mill – Hialeah
8. Fellsmere Sugar Company - Fellsmere


1. Sugar Cane Growers Cooperative - Belle Glade
2. Okeelanta, Florida Crystals – South Bay
3. Osceola, Florida Crystals – Pahokee
4. US Sugar - Clewiston
S.R. 70
HIGHLANDS COUNTY
HARNEY POND CANAL
INDIAN PRAIRIE CANAL
C.R. 72
MARTIN COUNTY
ST LUCIE CANAL
C.R. 731
S.R. 74
GLADES COUNTY
LAKE OKEECHOBEE
L-8
WEST PALM BEACH CANAL
S.R. 78
C.R. 720
S.R. 80
S.R. 29
FLAGHOLE
C.R. 832
HENDRY COUNTY
BOLES CANAL
PALM BEACH COUNTY
L-7
FLORIDA TPKE
US HWY 441
C.R. 833
C.R. 846
COLLIER COUNTY
4 2 0 4 8 12 16 20
Scale in Miles
L-4
BROWARD COUNTY
1
2
3
4

Sugarcane Cultivation

- Heavy land preparation
- Mostly hand planted in 6” furrows
- Many passes with mechanical cultivation
- Pre-post tank mixes for chemical control
- 12-18 months to harvest
- Crops are ratooned twice or more
- Usually only one succesive planting

Sugarcane Cycle

Stage	Start	End	Notes
Regular plant cane	Sep-Oct 2008	Feb-March 2010	
1st ratoon	Feb-Mar 2010	Dec-Jan 2010/2011	
2nd ratoon	Dec-Jan 2010/2011	Oct-Nov 2011	More ratoons possible
Successive plant cane	Nov-Dec 2011	Feb-Mar 2013	Soil insecticide applied
1st ratoon	Feb-Mar 2013	Dec-Jan 2013/2014	
2nd ratoon	Dec-Jan 2013/2014	Oct-Nov 2014	
Rotation winter	Dec-Jan 2014/2015	Feb-Apr 2015	Vegetables
Rotation summer	Mar-Apr 2015	June-Oct 2015	Silage/Rice
Regular plant cane	Sep-Oct 2015	Feb-Mar 2017	Cycle restarts

Wireworms

- Several species
  - *Melanotus communis*
  - *Conoderus spp.*
  - *Ischtodontus sp.*
  - *Glyphonix bimarginatus*
- Long life cycle
  - 2 to 10 years
  - Oviposit in summer
  - Emerge in spring
- Polyphagous
  - Sugarcane
  - Corn
  - Potatoes
- Habitat
  - Grassy fields in sandy and muck soils

Wireworm IPM

- Wireworms are more of a problem in successive plantings
- Clean fallowing
- Flooding
- Fast germinating, high tillering varieties
- Early planting
- Chemical control
  - Phorate
  - Ethoprop

Control Options

- Thimet (phorate) 14.6-19.5 lbs/acre
- Mocap (ethoprop) 10 – 20 lbs/acre
- Both labels advise higher rate for heavy infestation
- Cheap insurance
- Most economical rate undetermined

Soil-Chemical Interaction

Chemical Characteristics

- Sorption coefficient, Koc
- Half Life
- Solubility
- Toxicity
- Degradation products
- Volatility

Soil Chemical Interaction

Soil Characteristics

- Soil pH
- Soil Organic Matter
- Soil Moisture
- Temperature
- Porosity/structure
- Texture
- Microbial populations

Previous Studies

- Cherry and Hall (1985)-Topical Application
- Coale and Sosa (1991)- Field Trial
- Cherry and Raid (1999)-Efficacy
- Hall (2003) - Efficacy
- Hall and Simms (2004) - Efficacy

Objectives

- Determine if new method of evaluating soil insecticides against wireworms is effective
- Determine if lower rates are still effective against wireworms
- Determine if different rates should be used on sandy soils and muck soils

Experimental Design

- Place 10 wireworms in a 5 gallon bucket and plant 8 sugarcane eyes per bucket
  - Variety CP89-2143
- Compare two soil types
  - Dania muck
  - Immokalee fine sand
- Compare two chemical treatments
  - Phorate
  - Ethoprop

Experimental Design

Experimental Design

Evaluation procedures

- Stand count
  - Count number of healthy and damaged shoots and dead hearts.
- Mortality and Seed piece assesment
  - Empty the bucket and count number of live *Melanotus communis* remaining and then look for damage on the seed piece shoots and tillers.

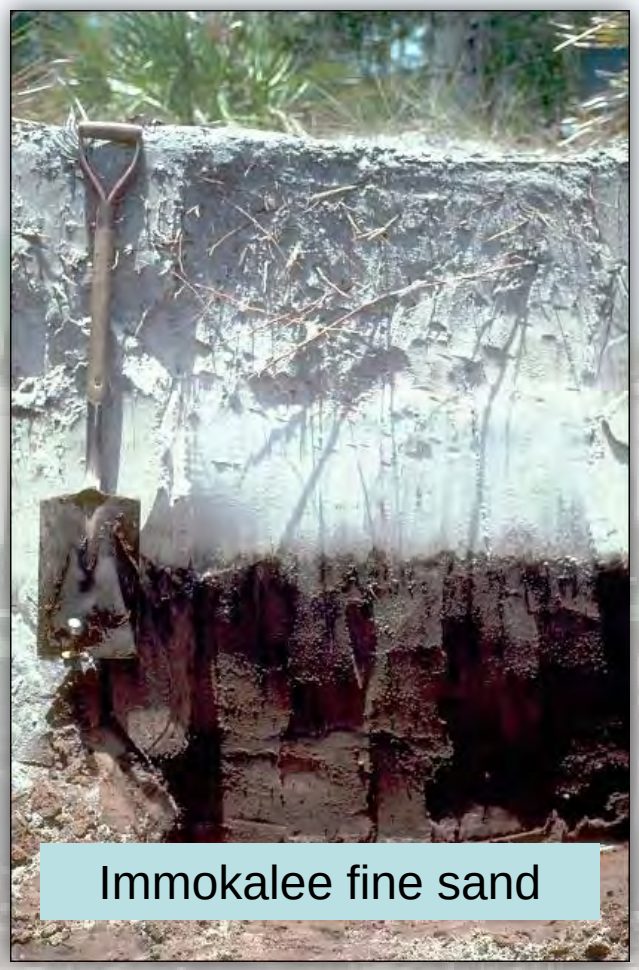
Evaluations

Chemical - soil type interaction

- Dania muck
  - Histosol
    - 65% organic matter
  - pH
    - 7.4
  - Bulk density
    - 0.5 g/cm³
- Immokalee fine sand
  - Spodosol
    - 2% organic matter
  - pH
    - 7.8
  - Bulk density
    - 1.4 g/cm³

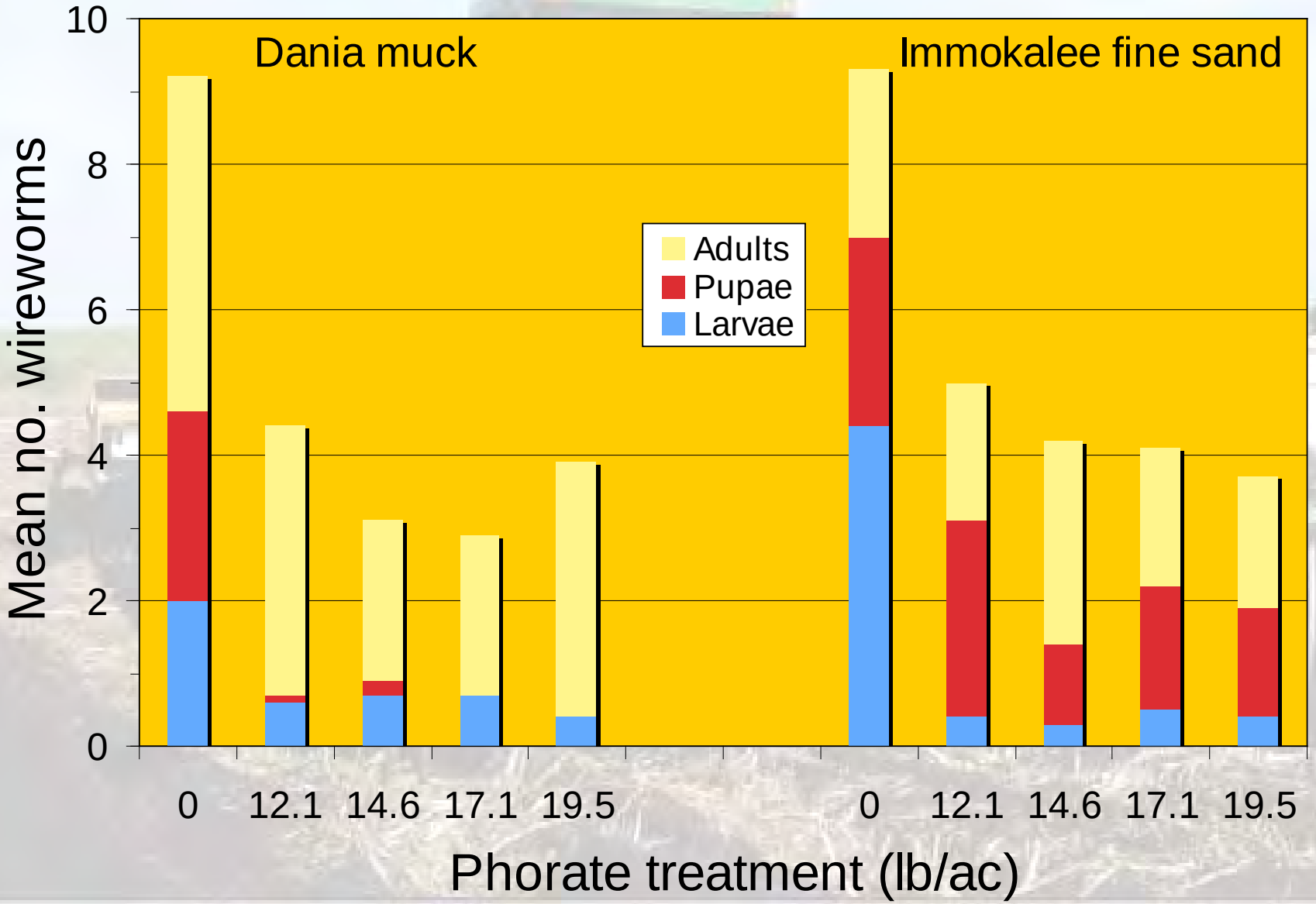
Soil – chemical interactions

Lauderhill muck

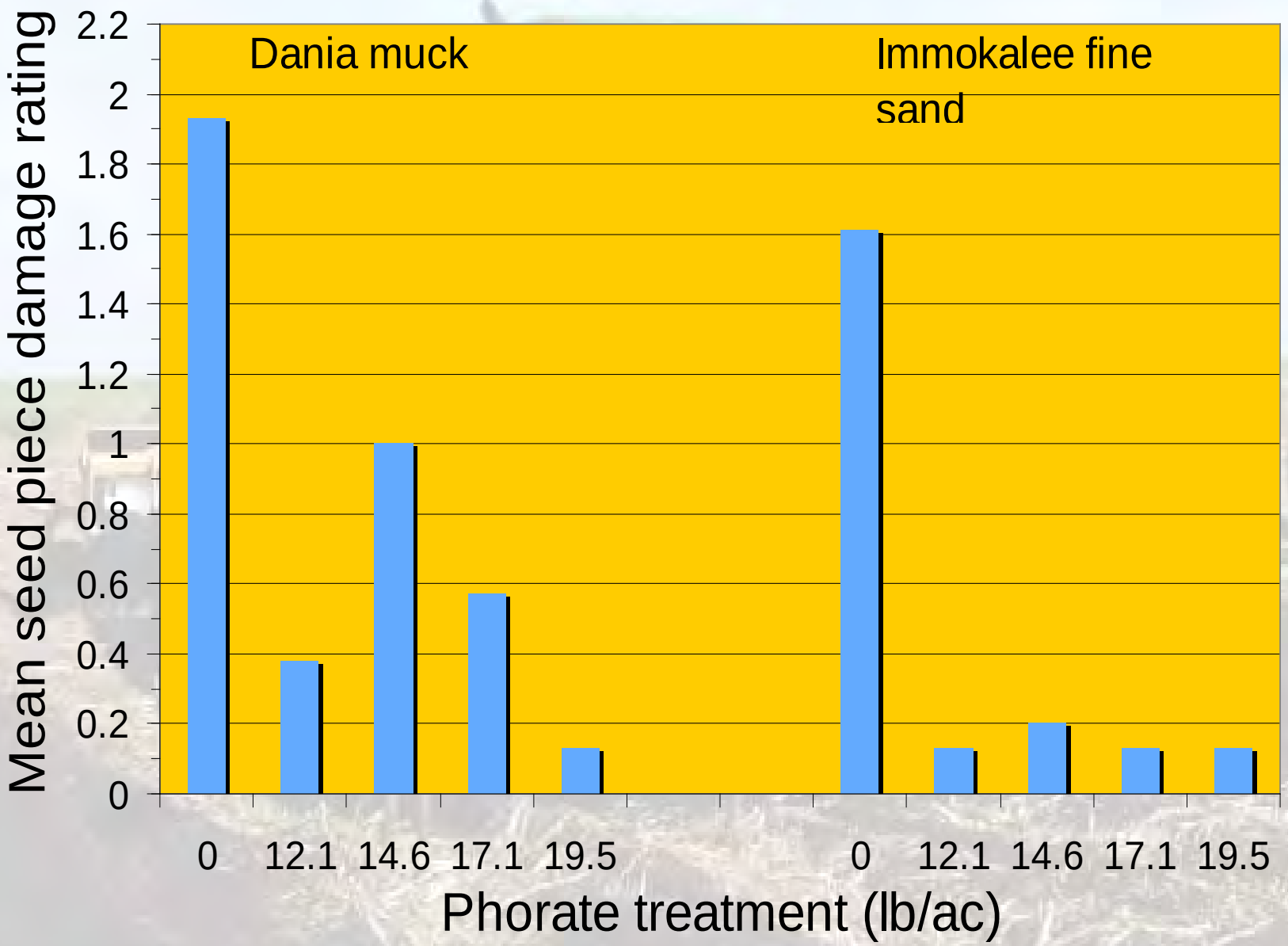


Immokalee fine sand

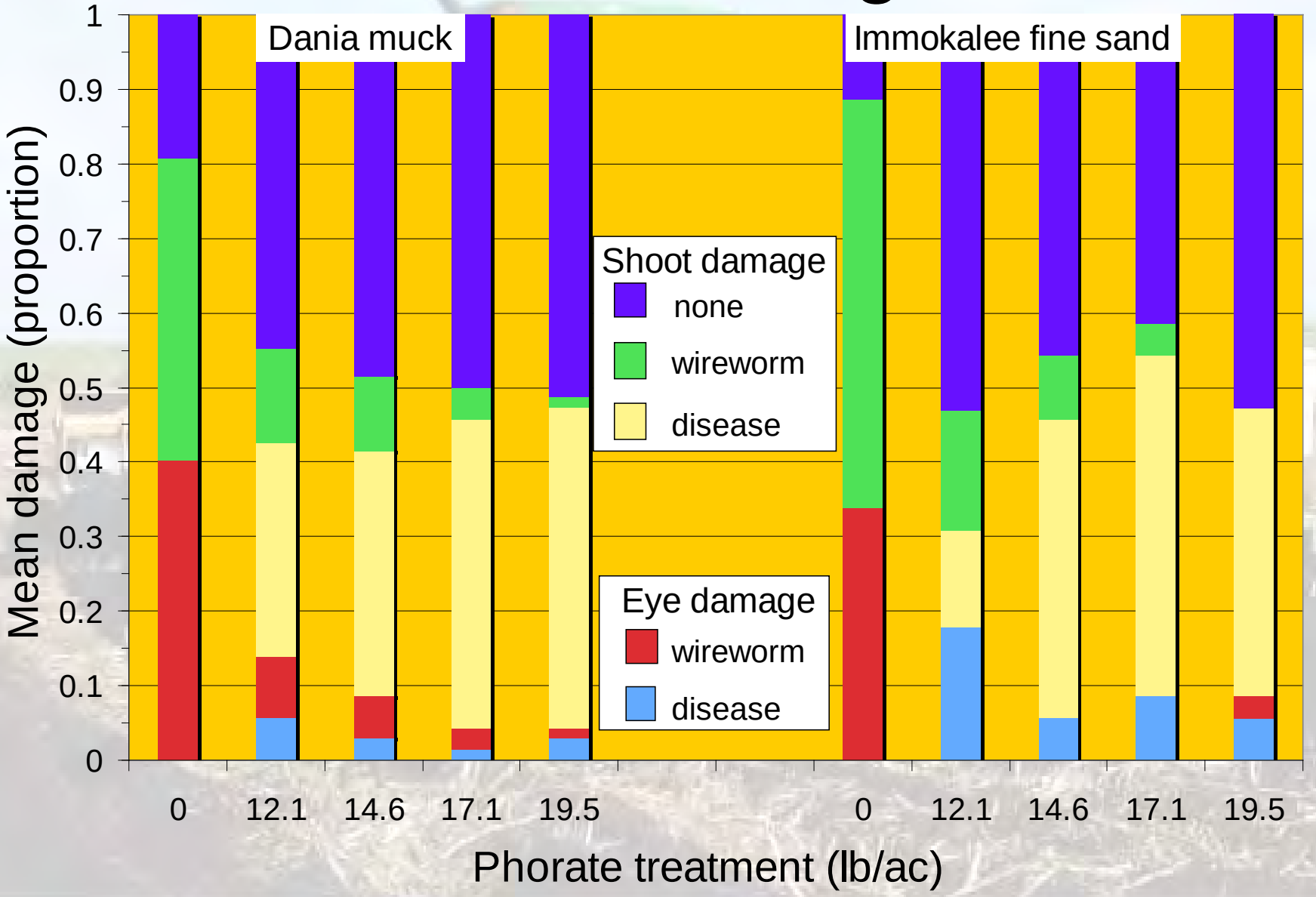
Total *Melanotus communis*



Seed piece damage



Plant Damage



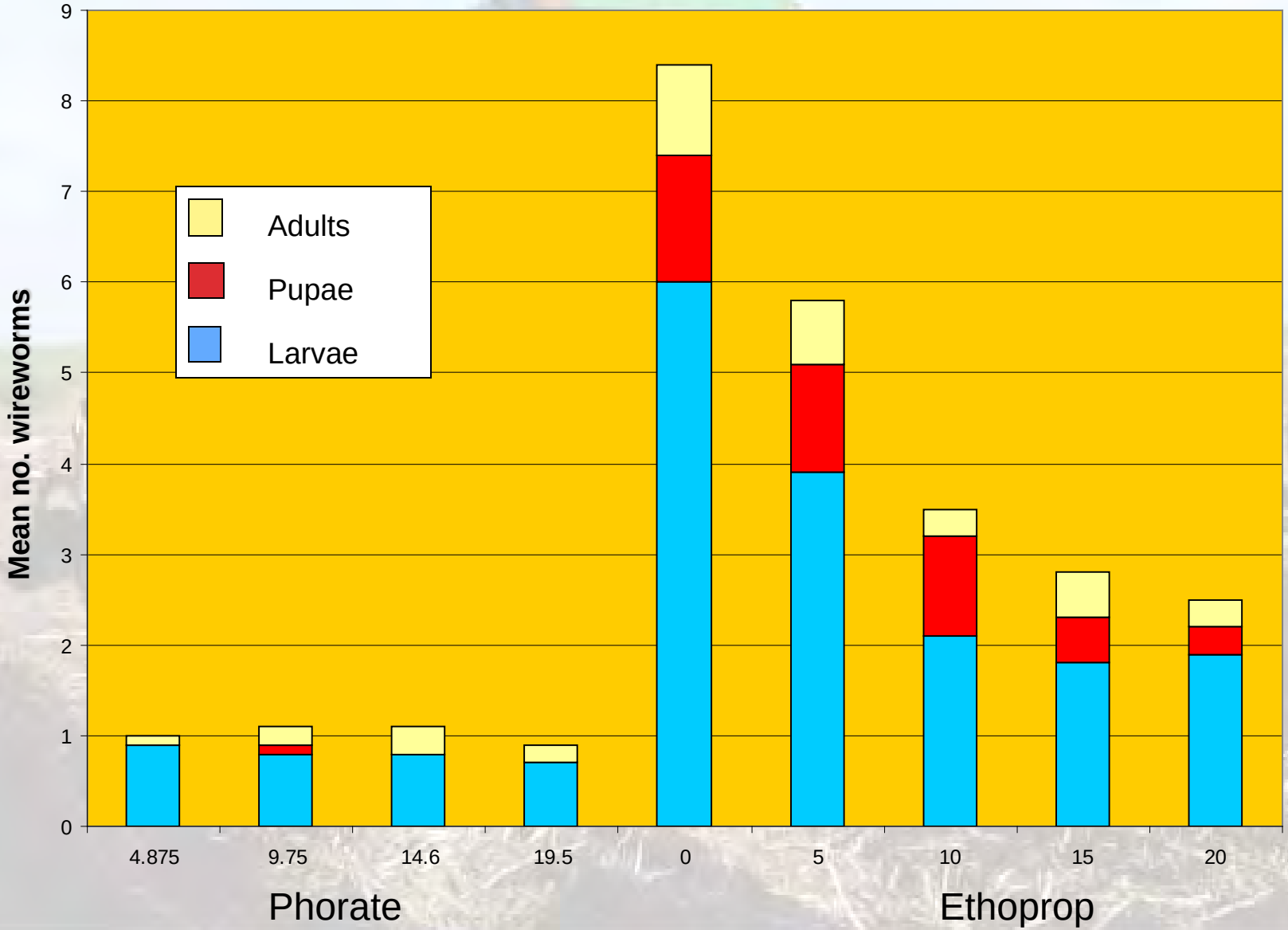
Soil Variable Conclusions

- Phorate highly effective in both soils
- Difference did not meet expectations
- There appeared to be a muted rate response, but it was not significant enough

Chemical differences

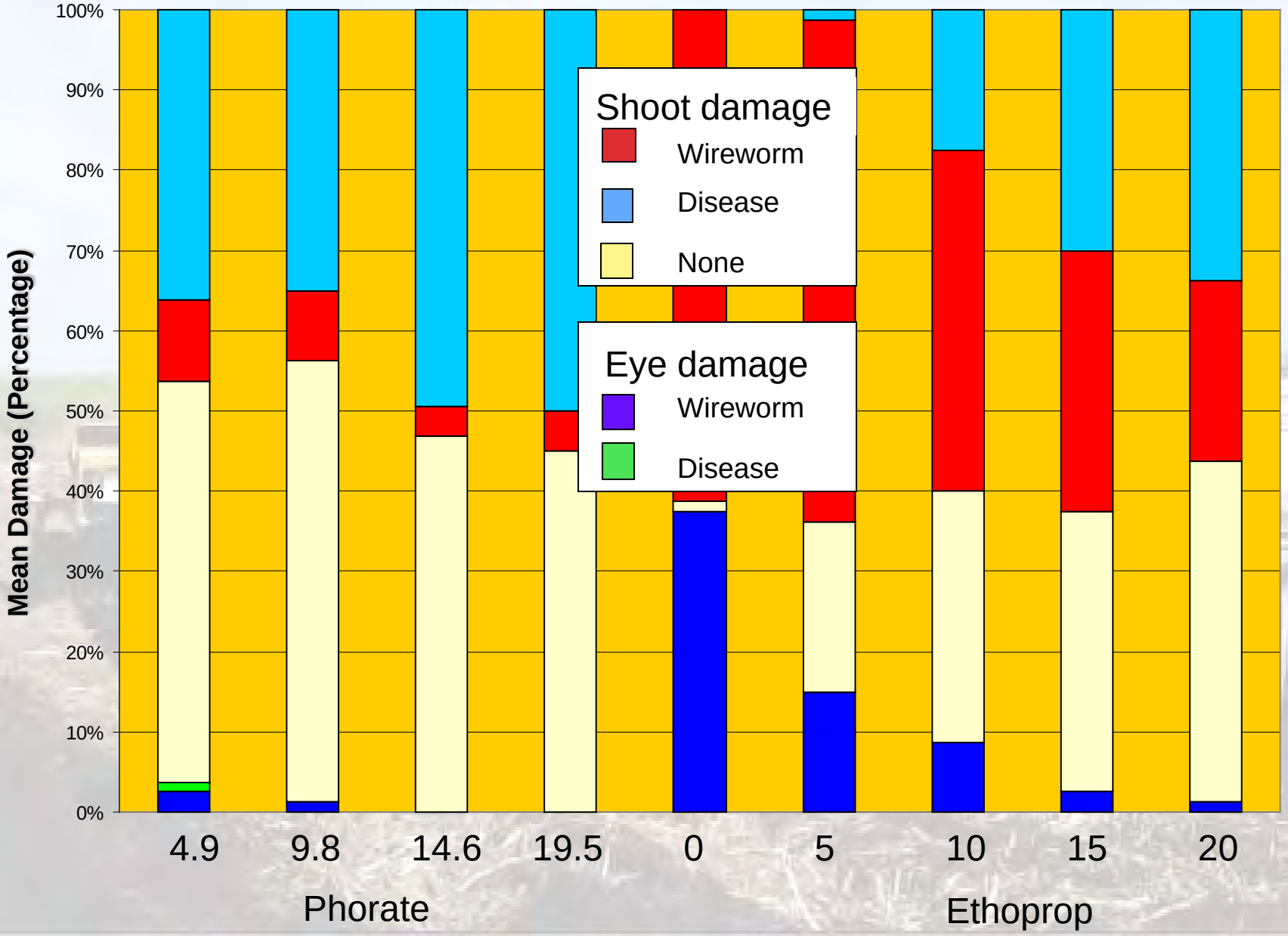
- Phorate
  - KOC = 1000
  - Half Life = 60 days
  - Solubility = 22 PPM
  - Toxicity = 0.64 – 1.03
- Ethoprop
  - KOC = 70
  - Half Life = 25 days
  - Solubility = 750 PPM
  - Toxicity = 0.44 – 2.00

Total *Melanotus communis*



Seed Piece Damage

Plant Damage



Chemical Variable Conclusions

- Phorate more effective than ethoprop
- Phorate very effective across all rates tested
- Ethoprop rate sensitive

Related experiments

- Zeta-cypermethrin
  - Impregnated fertilizer
  - Spray
  - Spray + impregnated fertilizer
- Imidacloprid
  - Soak
  - Spray
  - Spray + adjuvant
- Field trial – wireworm seeding
  - Ethoprop
  - Phorate
- Sweet Corn
  - Seed treatments
  - Granular products

Lessons learned

- Plant earlier and use smaller wireworms
- Soak the seed pieces in propiconozole
- 10 wireworms is an excellent number
- Container trials more accurate and easier to evaluate than field trials

Acknowledgements

- AMVAC
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