Stink Bug Management With Trap Cropping

Dr. Russell F. Mizell, III

Professor of Entomology

University of Florida

155 Research Rd, Quincy, FL 32351

rfmizell@ufl.edu

ufinsect.ifas.ufl.edu

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

4 Major Species of Stink & Leaffooted Bugs In Southeast

Euschistus servus

Nezara viridula

Chinavia hilaris (was Acrosternum hilare)

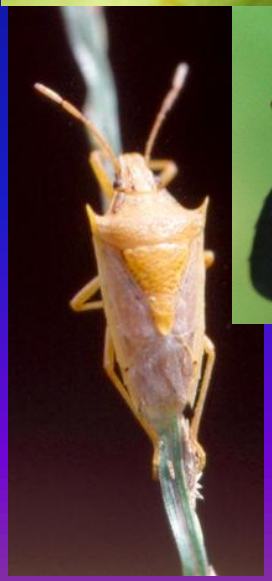
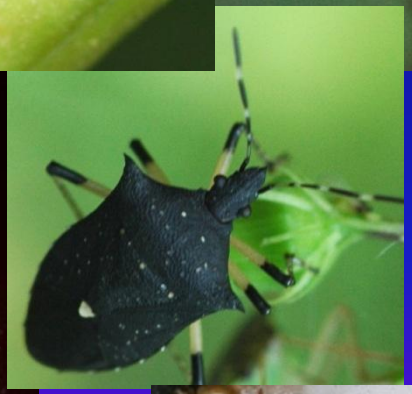
Leptoglossus phyllopus

Other Common Phytophagous Stink Bugs

Euschistus
Thyanta
Banasa
Oebelus
Proxys
Brochymena
**Piezodorus*
**Halyomorpha*
**Megacopta*

**New invasive species-bad*





Common Stink Bug Immature Life Stages

Stink Bug Morphology By Sex (*Euschistus servus*)

Other True Bugs

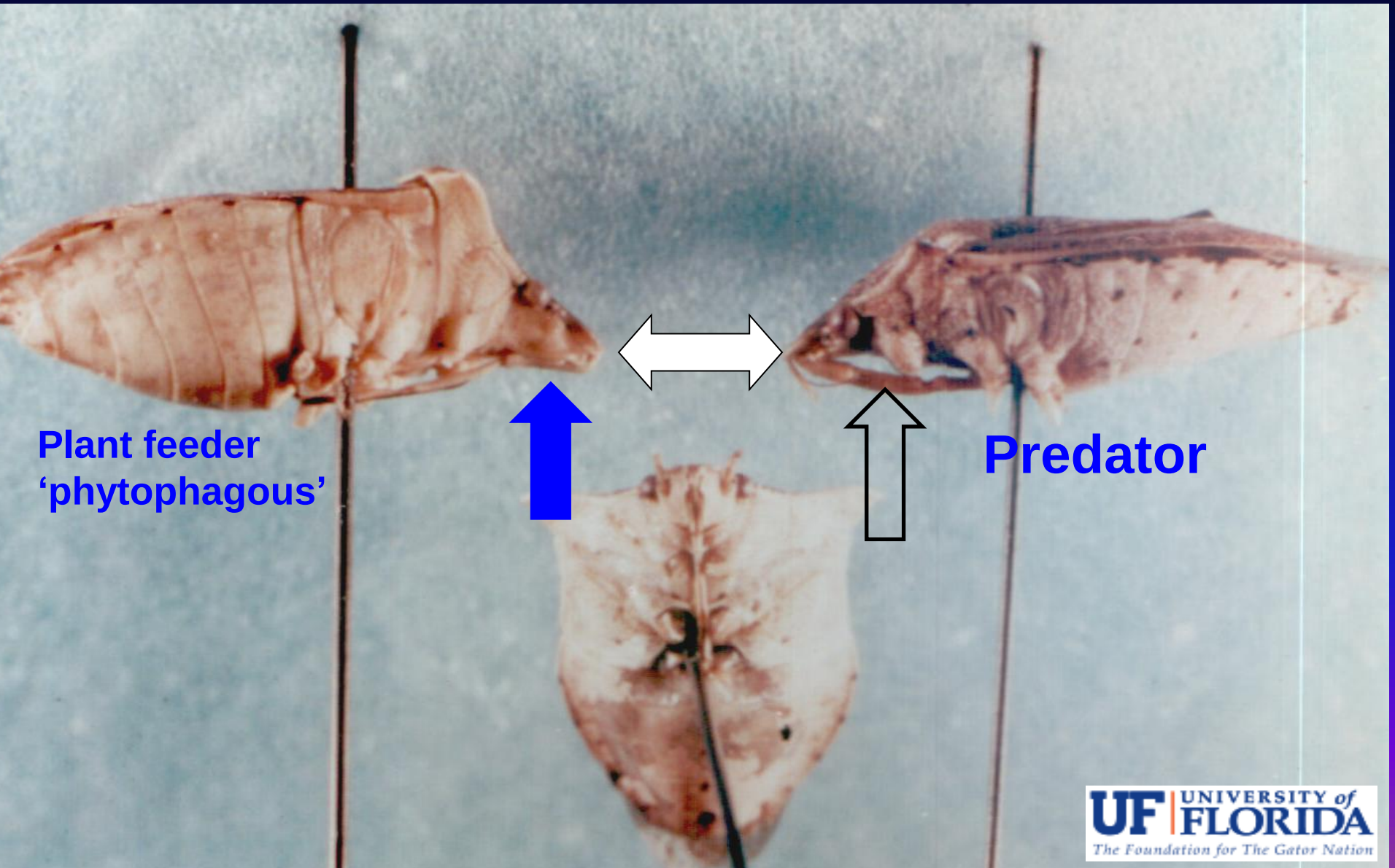
Acanthocephala femorata

Largus succinctus L.

Predacious Stink Bugs & Other Good Bugs

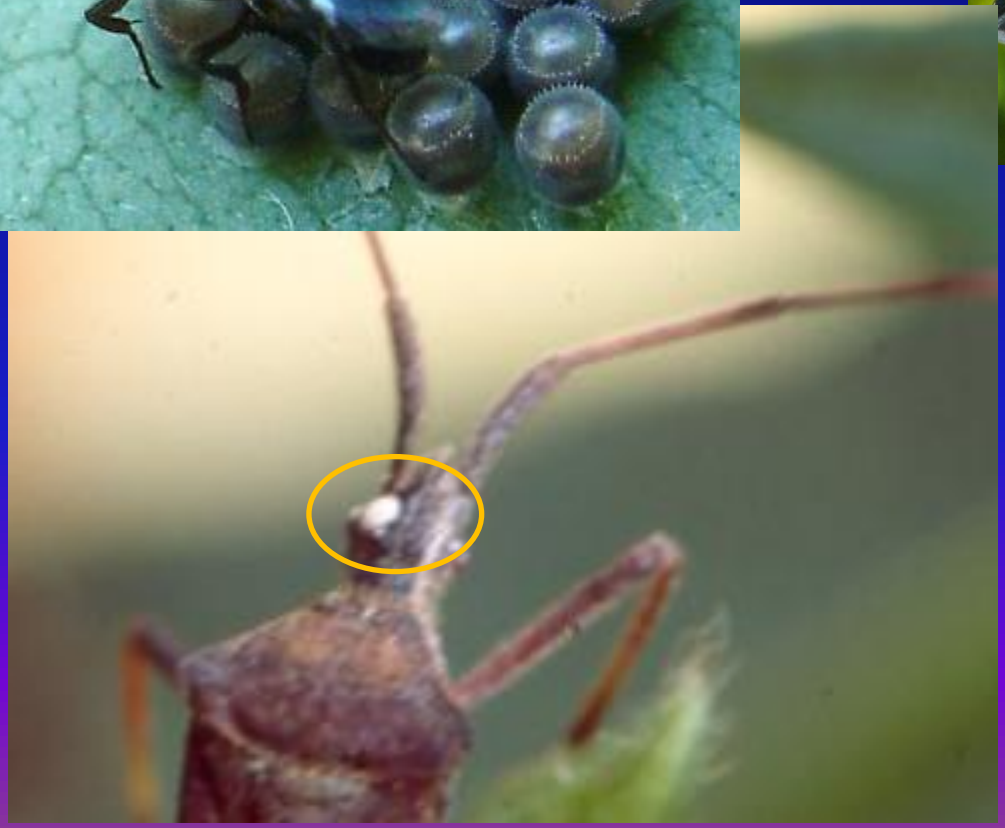
From lower left:
Alcaeorrhynchus grandis
Podisus maculiventris
Euthyrhychus floridanus
Apiomerus floridensis

Phytophagous vs Predacious



UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Stink Bug Natural Enemies
Wasp Egg Parasites & Tachinid Flies



UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Some Commonalities

- Overwinter as adults – most species
- Polyphagous – >1 host plant species
- Food suitability is ‘qualitative’
- Move through the landscape to find
- Respond to vegetation structure

Some Commonalities

- Have common natural enemies
- Highly tolerant to insecticides
- Relatively little knowledge for some spp.
- Other tools not available – big problem!
- Incremental approach required =IPM

Strategy: Manage Biodiversity via Vegetation-for Profit

- Cover crops
- Intercrops, polyculture
- Shelter belts, hedgerows
- Trap crops

- Outside orchard influences – crops, etc.
- Spatial configurations? Landscape!
  - crop and vegetation plantings

Biodiversity interactions are the engine.

Cover Crop Functions

- Erosion prevention and water holding (drought remediation)
- Nitrogen enhancement
- Soil organic “matter” increase
- Weed suppression
- Augmentation of beneficial arthropods

Cover Crop Side Effects

- **Pest increases**
  - Nematodes
  - Arthropods
- **Invasive weed outbreaks**
- **Competition for nutrients, water**
- **Increased costs - establishment**
- **More intensive mgmt – timing**
- **Unexpected consequences?**

Cover Crops – Peaches?

Exploiting Habitat Structure & Function, "Putting the Ecosystem to Work"

- **Site- row middles – avoid competition**
- **Cropping season - functions – side effects**
- **Fruit season – mowed sod + herbicide strip**
- **Post harvest - grasses, perennial peanut, flowers**
  - water, weed, nematode control
  - soil nitrogen- fall-winter-spring (tree age)
    - sun hemp, clovers, legumes, aeschynomene, stylo
  - pest targeting - biological control of borers, scale?
    - expt. – buckwheat, cowpea- flowers, cheap, easy

Trap Crops

Exploiting Habitat Structure & Function, "Putting the Ecosystem to Work"

- Stink bug biology, ecology and behavior
- Monitoring methods and results
  - temporal
  - spatial
- Trap cropping details
  - temporal
  - spatial
- Associated factors – multi-functions

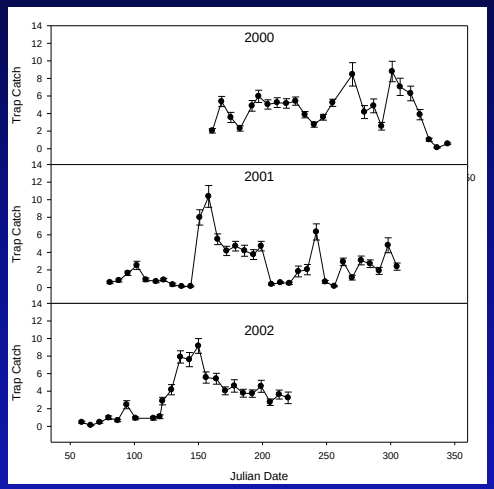
UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

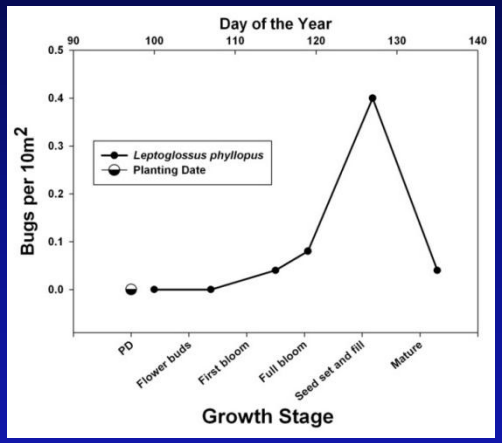
Outside orchard and other considerations

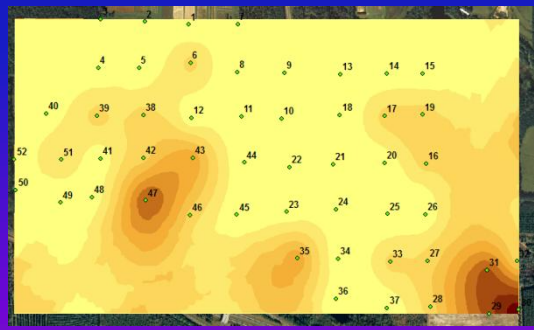
- Change in crop mosaic yr-yr, etc.
- Phenology change due to weather
- Crops planted near orchard
- Local benefits prob. higher in diversity poor landscapes
- Biodiversity conservation may be effective in rich environ., where species occur
- Food web interactions in time and space often unpredictable, counterprod.
- Functional scales need to be known

Understanding Bug Behavior & Dynamics

- Phenology
- Food quality
- Movement
- Landscape level processes
  - structures
  - corridors, barriers, matrices
  - ‘edge effect’ strong







UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Monitoring and Detection

- Must have!
- Efficiency – labor, costs
- Statistics – accuracy, precision

Florida Stink Bug Trap
Dr. Russell F. Mizell, III, Inventor

- Captures many Hemiptera species
  - Both phytophagous and predacious
- Visual attraction is primary
- Baits can be easy deployed
- Materials: 4 right triangles
  - 1/4” masonite, screen wire,
  - 1/4” x 4’ metal rod, twist ties
- “Triangle’s dimensions:
  - 4’ high, 11” base, 1” top
- Deploy in the open

Florida Stink Bug Trap:
Bare ground with open top.
Nothing touching trap.

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Commercial Traps Available

url:ufinsect.ifas.ufl.edu

[Stink Bug Trap - AgBio, Inc.](www.agbio-inc.com/stink-bug-trap.html)

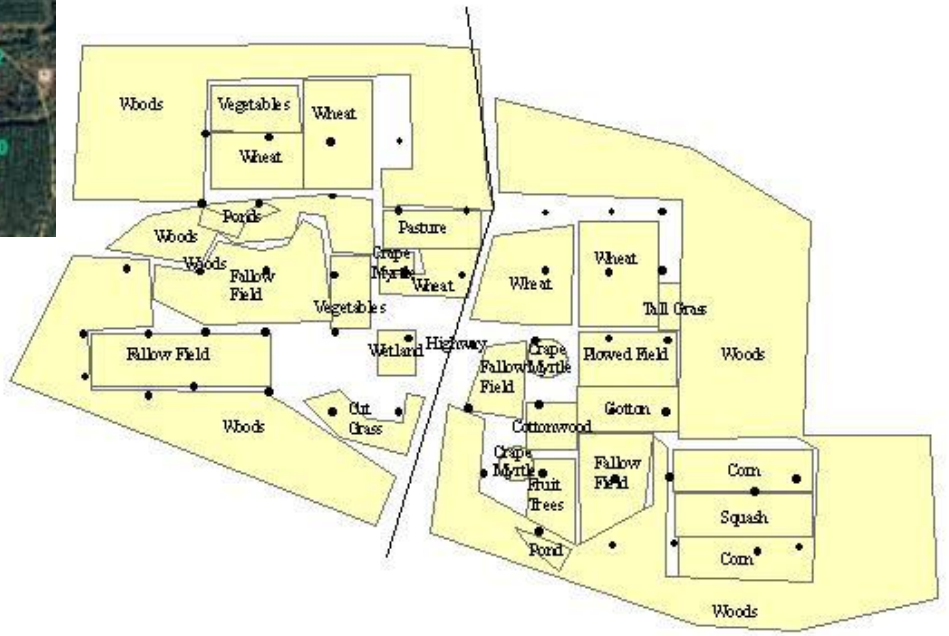
www.agbio-inc.com/stink-bug-trap.html

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

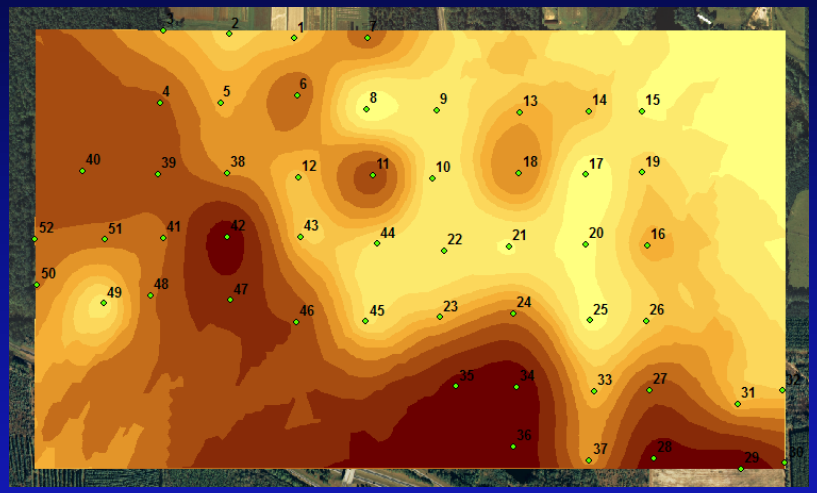
Temporal and Spatial Distributions

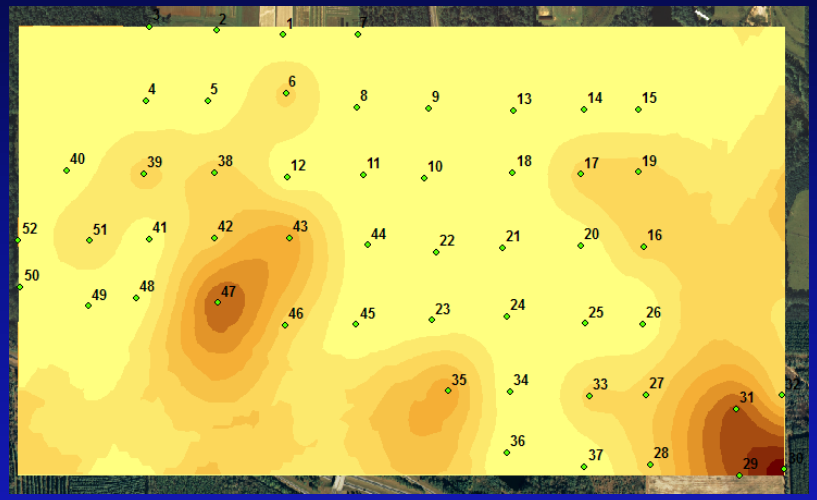
Where are the bugs in time and space?

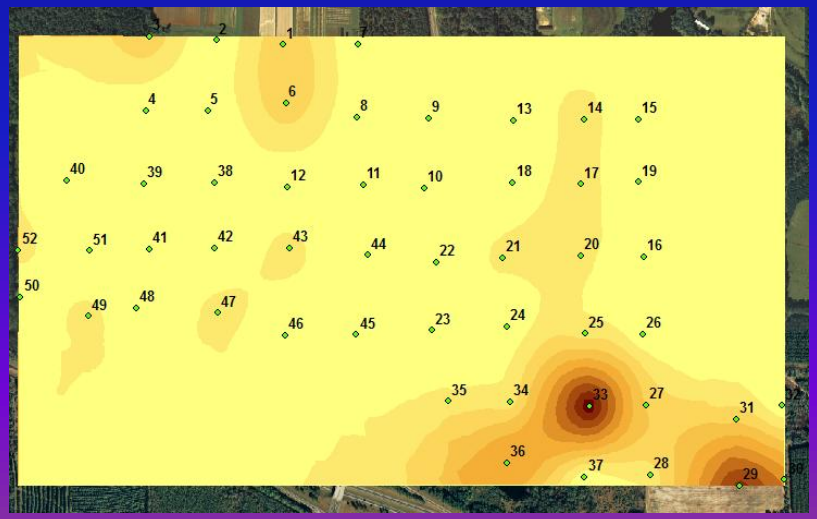
NFREC-Quincy Location

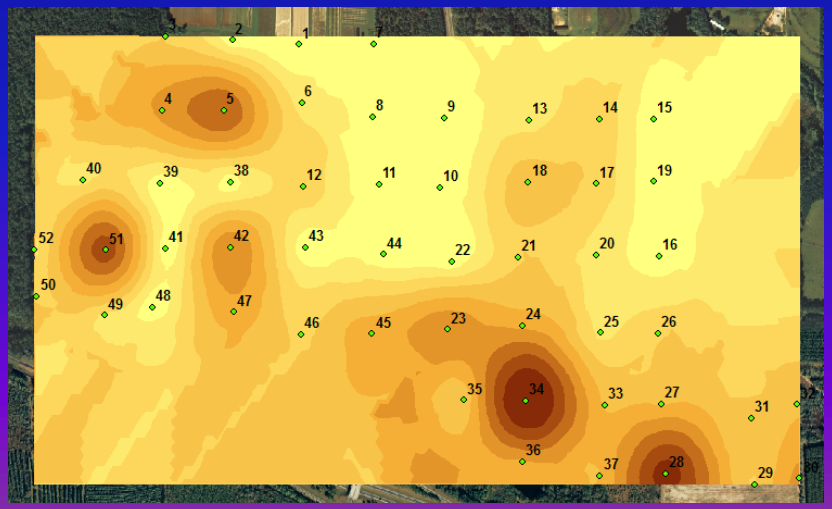


Locations with High Populations of *Euschistus servus* (scale neutral)

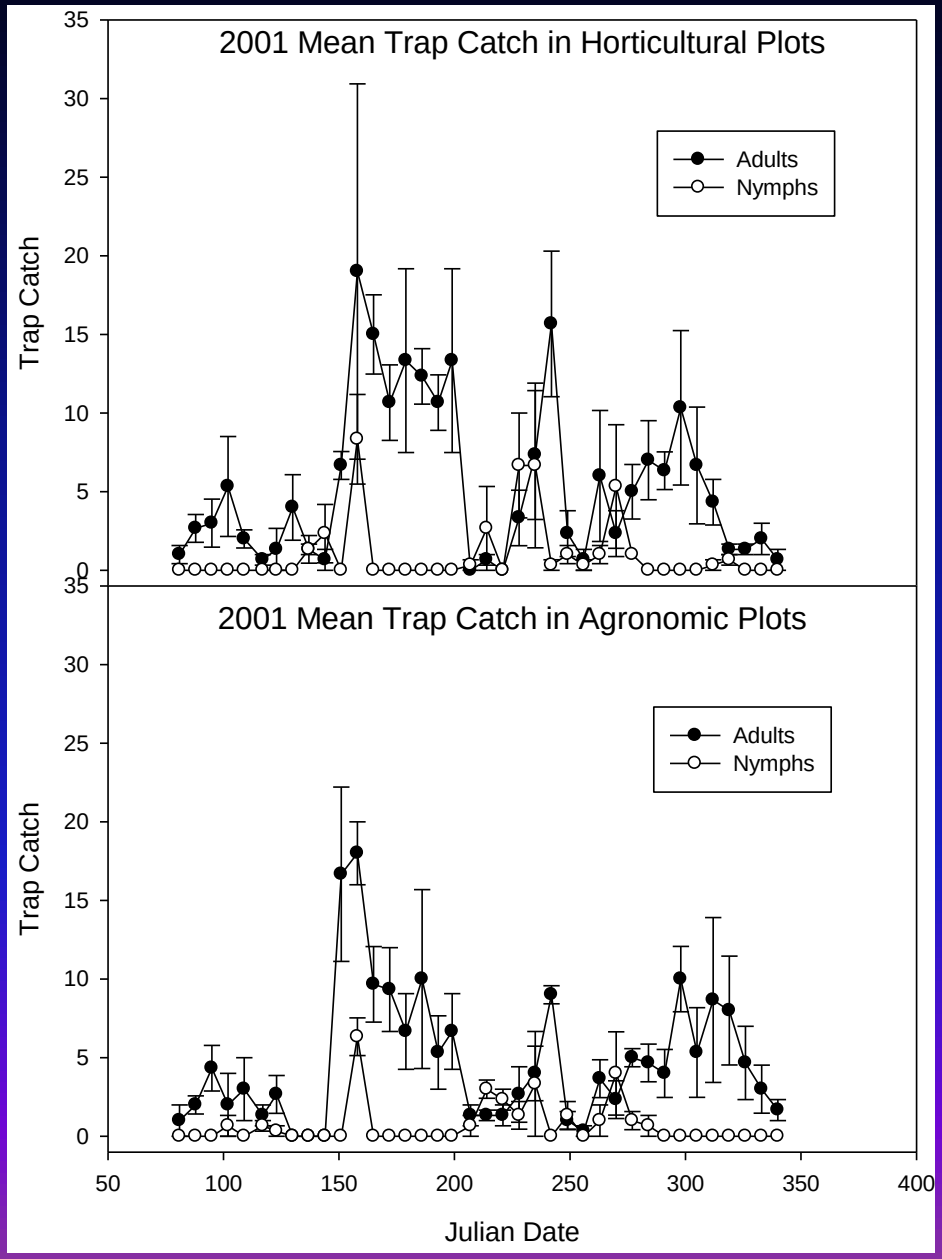








Combined Plot Means



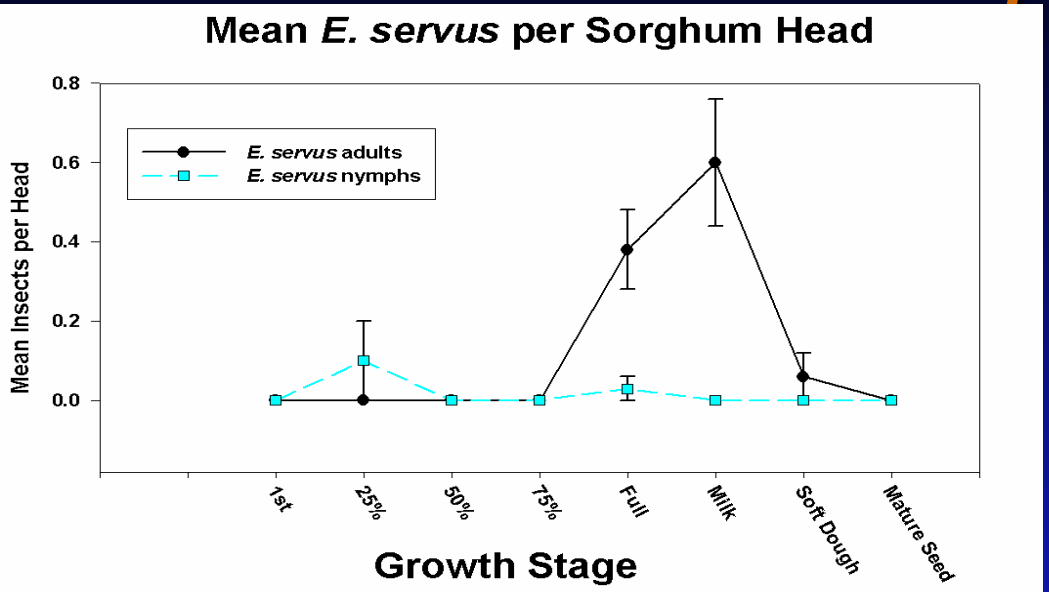
- **Temporal patterns are not significantly different, P = 0.909; Repeated Measures Analysis**
- **Note: Nymphs are late instars only**

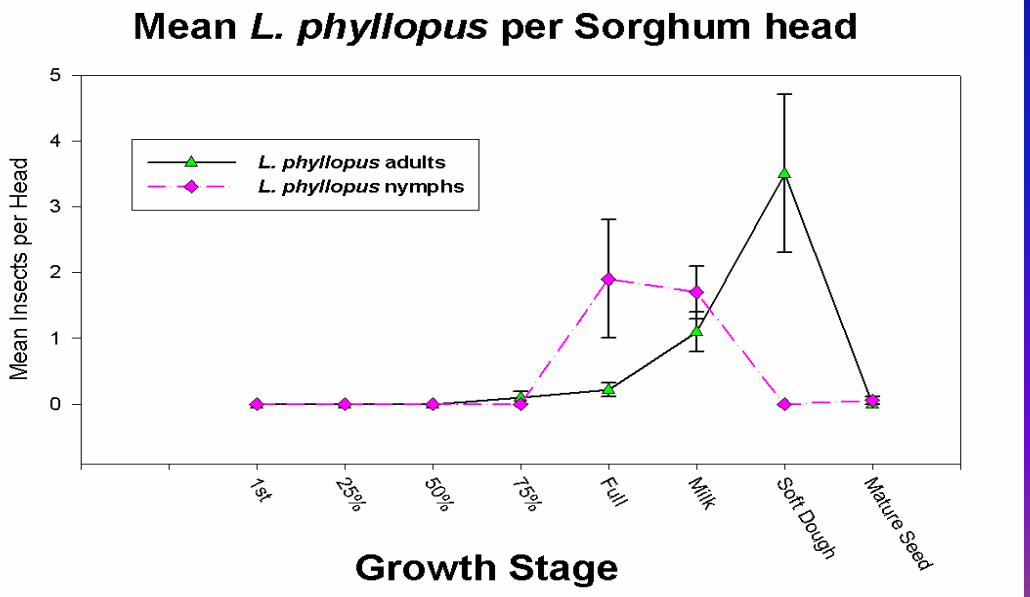
Movement Mechanisms?

What is driving the behavior ?

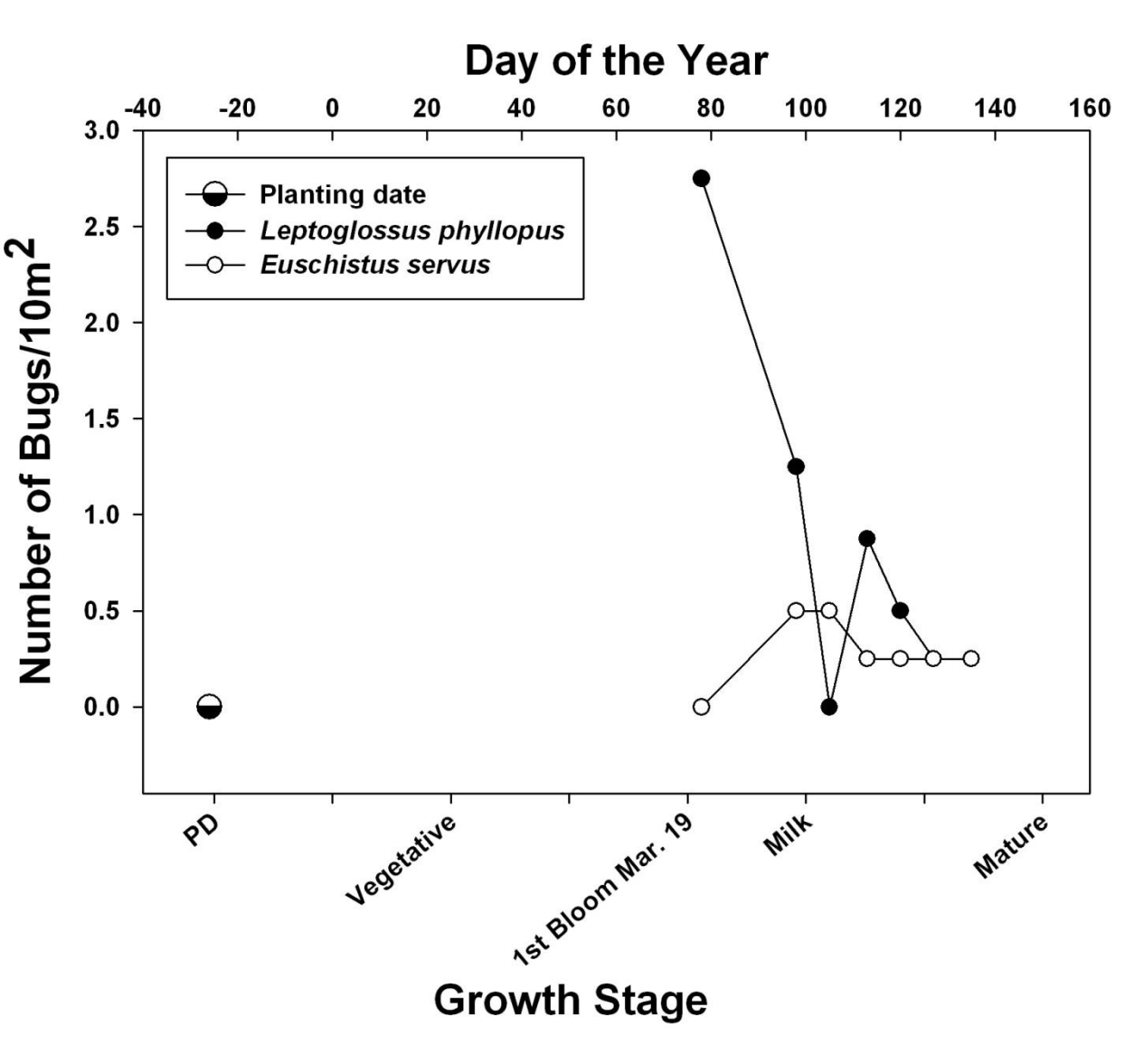
How can we exploit it?

Differential Use of Sorghum Growth Stages by *E. servus* and *L. phyllopus*



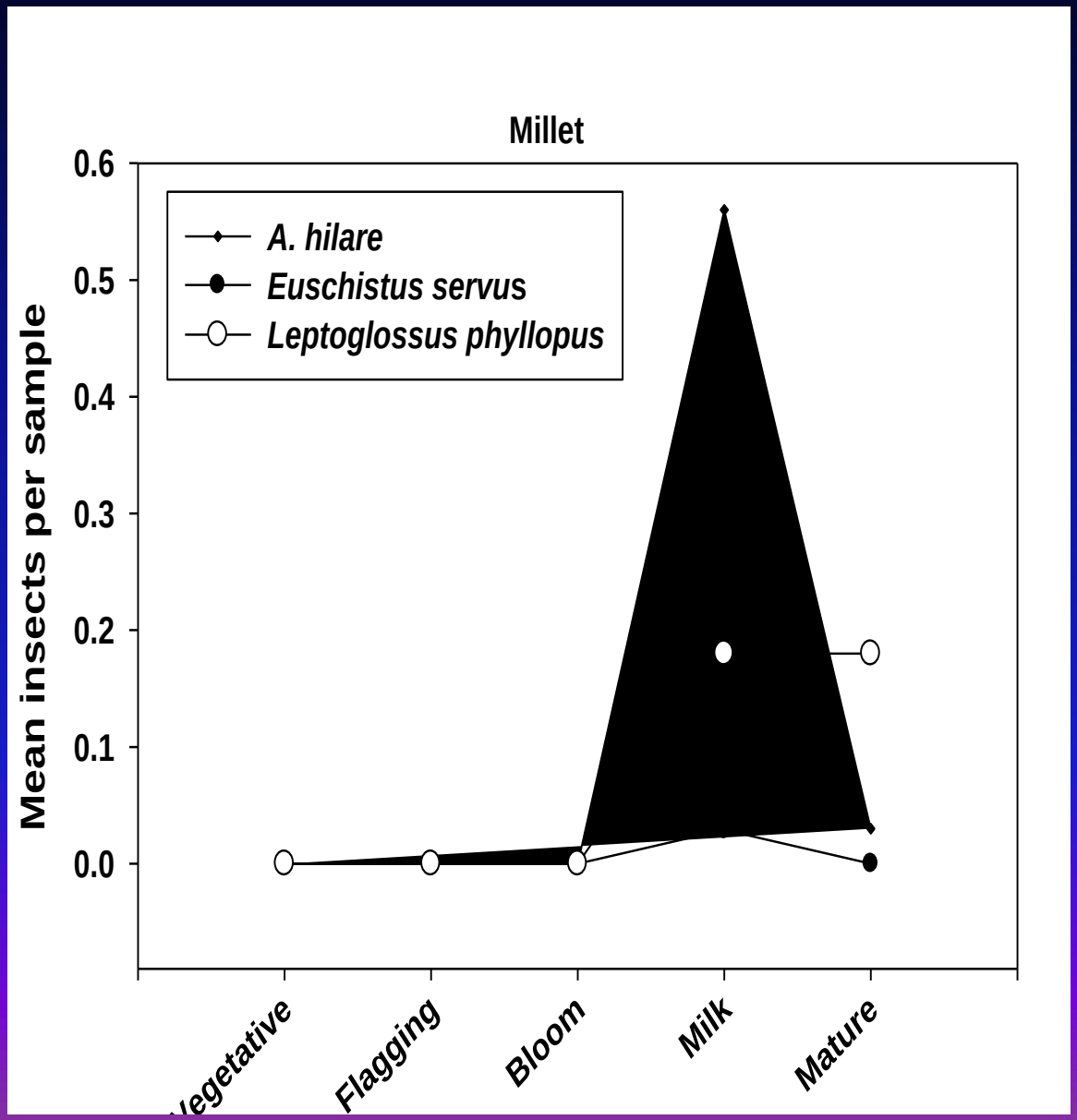


Differential Use of Triticale Growth Stages by *E. servus* and *L. phyllopus*



UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Differential Use of Millet Growth Stages by *E. servus, C. hilaris* (Es) and *L. phyllopus*



Mechanism

- Food quality very important!!!
  - not “preference”*, generalists
- Life stages and species differ somewhat – very close
- Phenology (timing) related statistic
- Driving variable!

- **Application – tools, trap crops**

Summary – So Far

- Behavior – understanding required
- Phenology – seasonal abundance
- Food quality change – mechanism
- Spatial distribution changes - time
- Structure is important – literature
  - affects movement "perceptual range"
  - **Edge effect** very strong
- Exploitation? Habitat manipulation using trap crops and other tools.

Trap Crop Approach

- Small area w/ highly competitive hosts
- Economical - $$$
- Strategic placement (GIS/GPS)
  - adjacent (?) to cash crops (Potting et al. 2005)
  - must intercept them!!!!!
- Minimize side effects & mgmt difficulties
- Combine with other tactics
- For all growing seasons

Cash Crop-Trap Crop Coincidence (phenology)

	Dec	Jan	Feb	Mar	Apr	May			
Cash Crop	++++	++++	++++	++++	++++	++++	++++	++++	
Trap crops	------	------						-----	------
		------	-----	------	------				
				-----	------	------	------		
			-----	-----	------	-----			
		------	-----	------					
				-----	------	------			

Characters: maturity date, longevity, ratooning, other

What Are the Ideal Features of Trap Crops?

- Attract required pests (multiple species)
- Seeds available (natives?)
- Economical -$$$
- Culture & management - seasons
- Minimal side effects (invasive, other pests)

Trap Crop Ideal Features, cont.

- Maturity time – length, cv range
- Good duration (ratooning)
- Height – barrier
- Multi-functions (beneficials, poll., wildlife)
- Special note*: native vs exotic plant use

<u>Must have something that works!</u>

Trap Crop Specifics

Central & South Florida?

Fall-Spring:

- Triticale (crimson clover, h or c vetch (F)- NE)
- Sunflower, buckwheat (Sp), barnyard grass
- Others – citrus related, winter crops

Spring-Fall

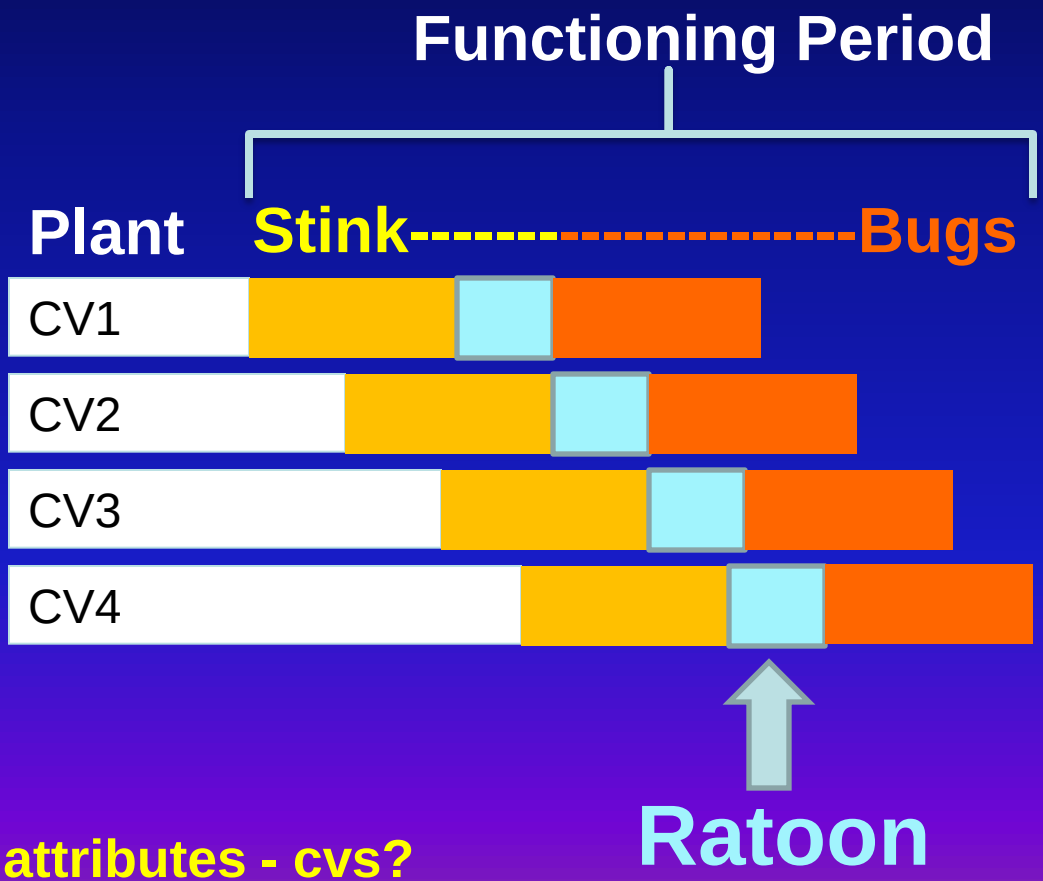
- Sorghum, millets, sunflower, buckwheat
  - barnyard grass, field peas, okra (pots?),
- Maturity times – multiple CVs
- Ratoon – after heading
- Use multiple tactics

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Trap Crop Novel Features

- Ratooning = **Mowing (like okra in Dade)**
  - At strategic time
  - All plant species NOT amenable
  - Saves plantings by extending efficacy
  - Saves $$ - less input time & costs
  - Negative: same location – double cropping

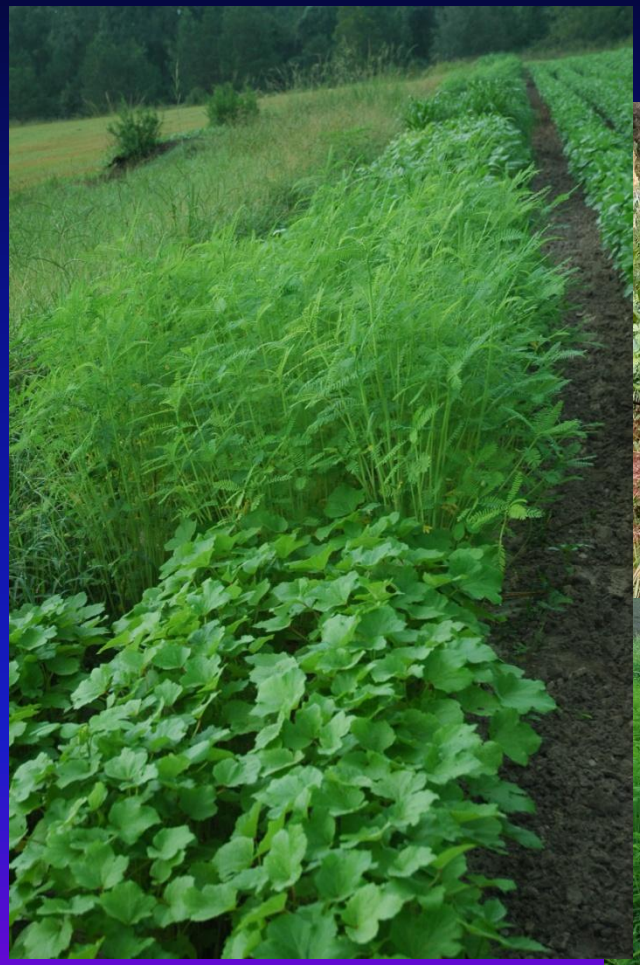
How to Exploit Sorghum Maturity Range & Ratooning



Physical attributes - cvs?
Height, color, etc.

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Trap Crops
Farm Scale and Philosophy Neutral



Where do you place them relative to the cash crop for interception?

Triticale for Spring

- Fall, early spring planting
- Range in hgt, phenology -cvs
- Beneficials
- All 4 bug species +
- Ratoons
- Hairy/common vetch + crimson clover = beneficials

**Beneficials= natural enemies, pollinators

Buckwheat

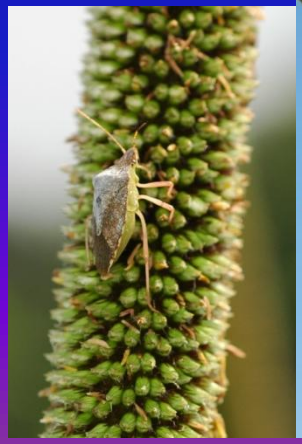
- Cheap, easy
- Fast maturing – 4-5 wks
- Ratoon, easy plant
- Soil temp, frost – good
- All 4 species +
- Organic crop
- “RELAY” crop
- Beneficials!!

Sorghum

- Maturity- 70-90 days
- Soil temp & frost -kills
- Ratoons well
- Germplasm – variable
- All 4 species +
- Beneficials
- Pots
- Organic

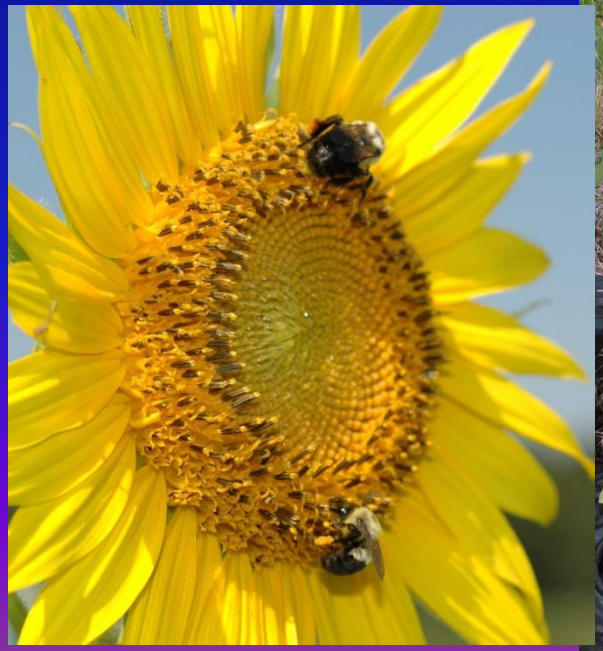
Pearl Millet

- Cheap, easy
- Low soil temp & frost - bad
- Ratoons
- 70-90 days to maturity
- Beneficials
- Pots
- Germplasm- variable
- Organic crop
- All 4 species +



Sunflower

- Cheap, easy
- Low soil temp & frost - good
- Beneficials!!!!!
- Containers
- Germplasm- variable
- Organic crop, biodiesel
- Ratoon- no



Japanese Millet: ’Barnyardgrass’

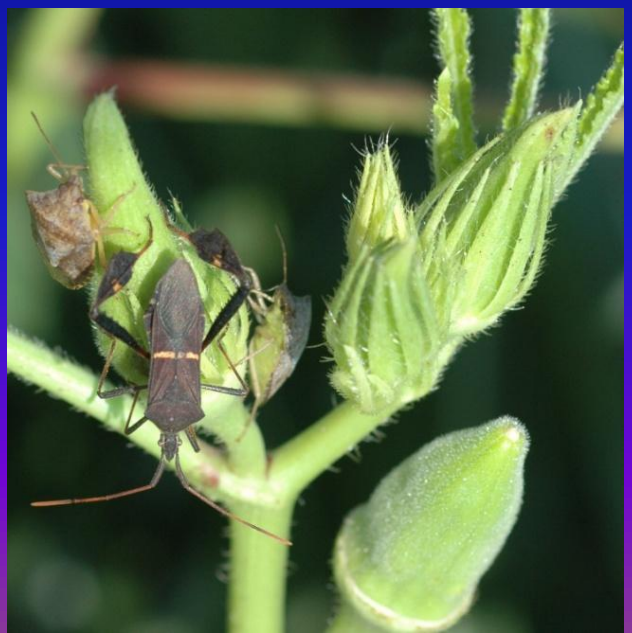
Echinochloa crus-galli

- Cheap, easy
- Maturity 6-7 weeks
- Beneficials
- Containers
- Germplasm
- All 4 species +
- Short attraction time
- 3-4’ in height
- *Can be invasive - aquatic*

Other Species w/Potential? Field Peas & Okra

Field Peas
- Cheap - easy
- Extrafloral nectaries
- Previous work+
- Height-short; trellis?
- Cultivars

Okra: (containers)
- Cheap, must manage!
- Beneficials, EFN
- Rootknot nematodes neg.
- Ratoons



Other Species w/Potential? Hemp Sesbania (Y/N?), Hairy Indigo, *Crotolaria* – (N)

Hemp Sesbania: ??
- Height – tall - barrier
- Not all SB species
- *Oebalus* spp.
- Invasive

Hairy indigo – weedy, nematode suppressor+

Showy Crotalaria- poisonous to cattle

Other Species w/Potential? Browntop Millet – No; Wildlife

- Cheap, easy
- Doesn't last long
- 5-6 weeks
- Height - short
- Attracts beneficials, pollinators
- +*Oebalus* spp.
- Weedy - invasive

Containers for Portability, Visual/chemical Cues Enhance

Yellow trap –Attraction - 4X increase in *H. axyridis*

Trap Crop Summary

Fall-Spring:

- Triticale (crimson clover, hairy vetch) (F)
- Sunflower, buckwheat (Sp), field peas, okra

Spring-Fall

- Sorghum, millet, sunflower, buckwheat
  - okra, field peas, others
- Multiple species and cultivars
- Ratoon – after heading
- Portable containers, greenhouse starts
- Remove pests: by hand, vacuum or spray
- Add in other tools: traps, pheromones, BC, etc.

Some Other Ideas

Physical properties, barriers:

- Height ⬆ -trap crop via cultivar selection
- Configuration of plants
  - short to tall toward cash crop
  - density of trap crop plants
- Trellis of vines like field peas - ⬆ height
- Exploit visual components
  - Use of visual repellent – UV mulch
  - Use best colored cultivar
- Artificial materials – netting, etc.

Brown Marmarated Stink Bug

- Invasive pest, like few others!
- Double whammy – plants and buildings
- Major research efforts underway in conventional and organic
- Trap crops: are being developed and tested. Look to have promise.
- Various cucurbits and others? TBD

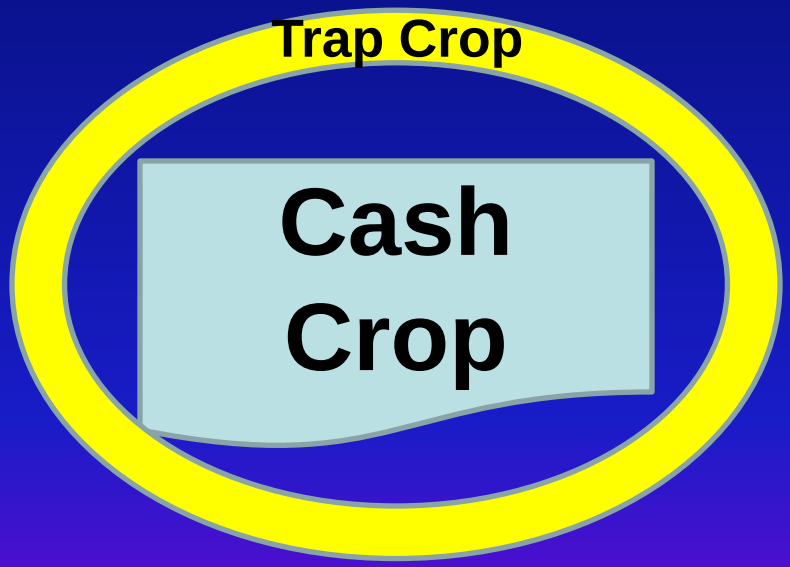
Trap Crop Spatial Orientation
Interplanting- NO!!!
Edge Interception – Yes!

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Spatial Configurations
Aerial Plats

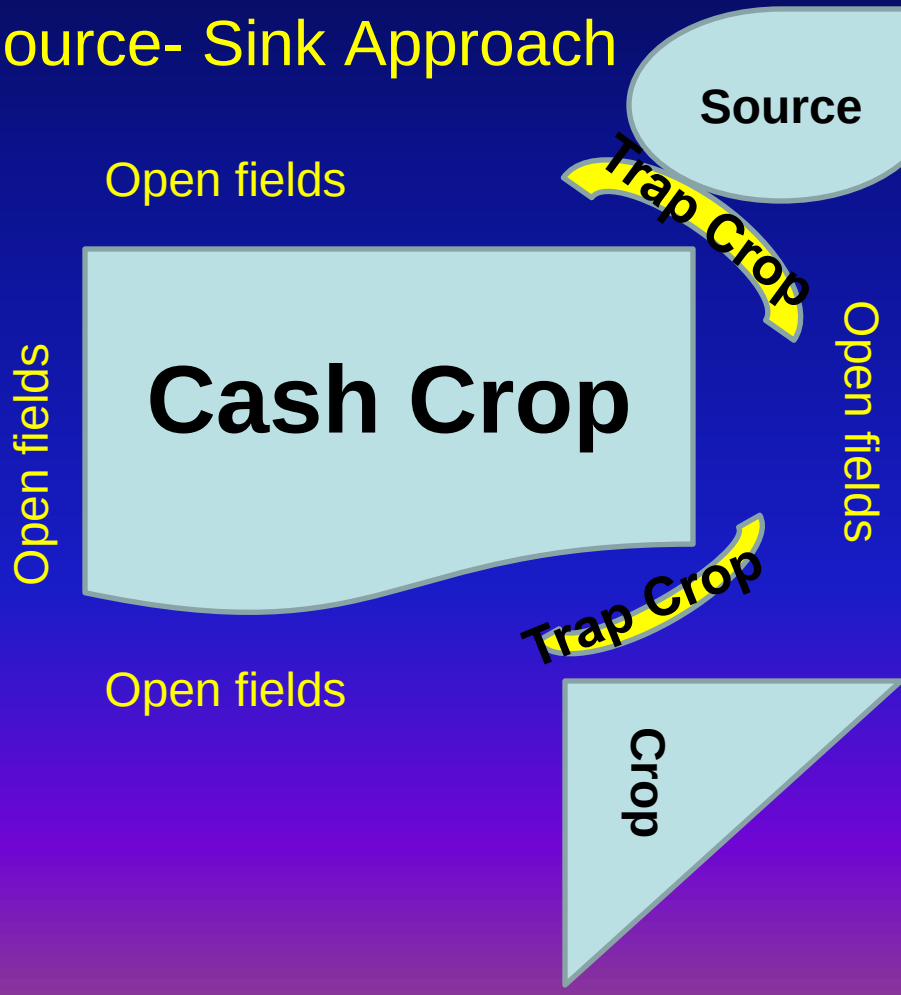
Unknowns

Default – Ring It



With Knowledge:

Source- Sink Approach

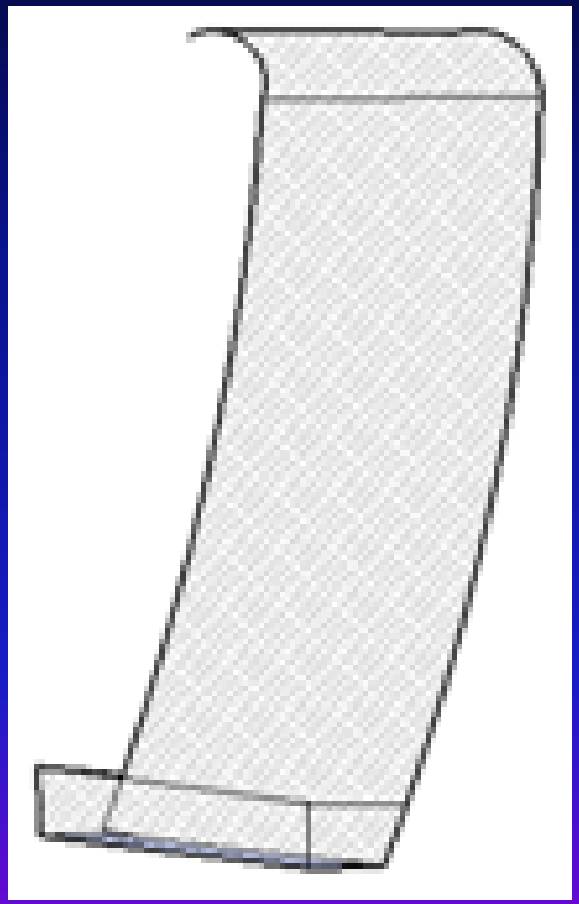


Plot size: one tractor implement width

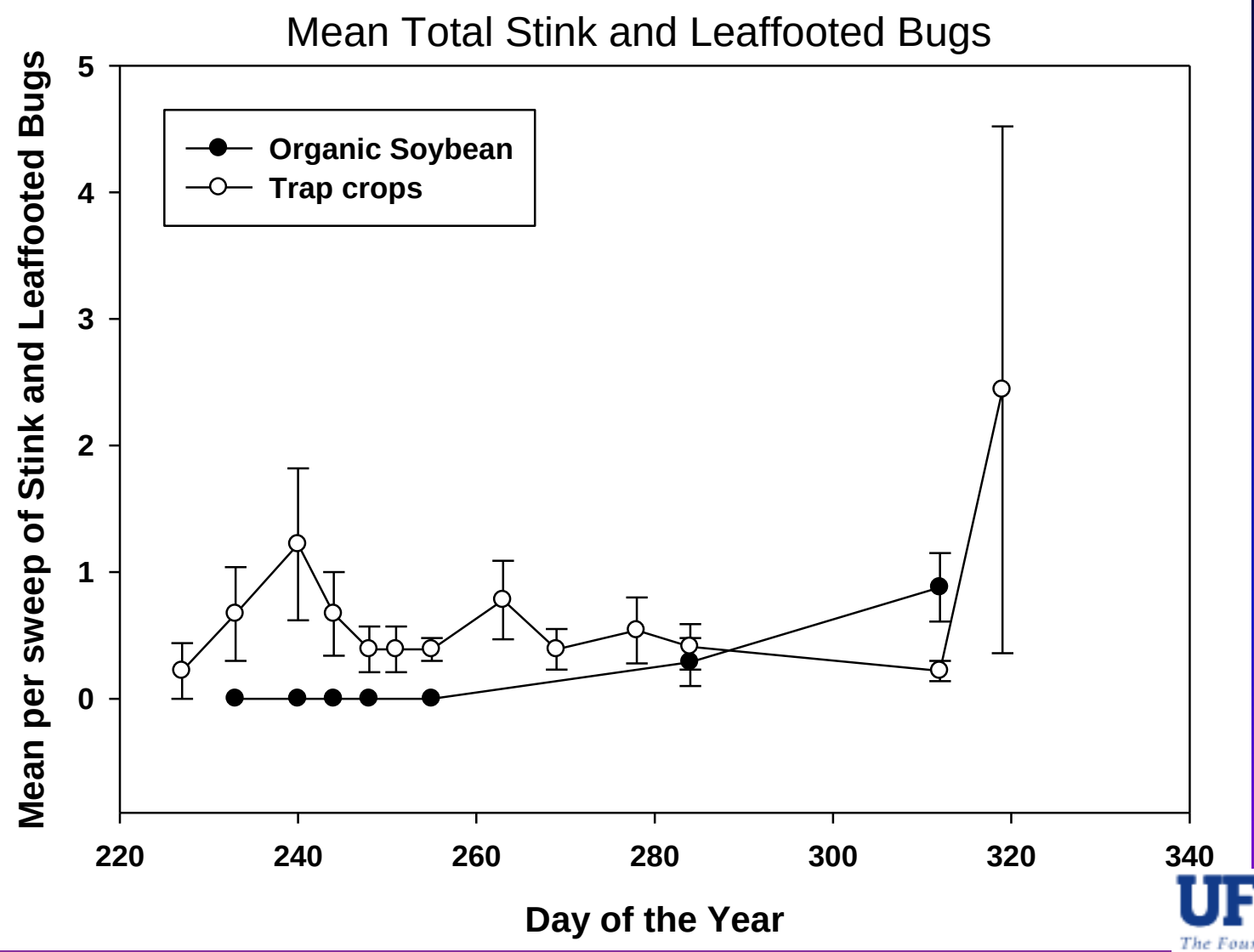
Management in the Trap Crop

- **Insecticides ?**
- **Mechanical**
  - by hand
  - sweep net
- **Vacuum device**
- **Blower – catcher**

4’ x 7’ PVC frame with netting + blower



Trap Crop Efficacy, Edge of Organic Soybean



UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Research: Multifunctional Plots Augment Ecological Services

Plant Species	Common Name	Season of Service	Ecological Service				
			Flowers, Nectar[1], Pollen, Fruit and Seeds for:				Trapping
			Pollinators	Beneficial Insects[2]	Butterflies	Wildlife	Stink and Leaffooted Bugs
Trees							
Callistemon viminalis	Weeping bottlebrush	Wi-Sp	X	X	X	X	
Cercis canadensis	Redbud	Sp-Su	X			X	
Cornus florida	Dogwood	Sp				X	
Ilex opaca	American holly	Su-Fa	X	X		X	
Lagerstroemia indica/faurei	Crapemyrtle	Su-Fa	X	X	X		
Malus angustifolia	Crabapple	Su-Fa	X	X		X	
Osmanthus fragrans	Tea olive	Wi-Sp	X				
Prunus persica	Peach[1]	Sp	X	X	X	X	
Prunus sp.	Wild Plum, plum[1]	Sp-Su	X	X		X	
Shrubs							
Abelia sp.	Glossy abelia	Su-Fa	X		X		
Camellia spp.	Camellia	Wi-Sp	X	X			
Cliftonia monophylla	Buckwheat tree[3]	Sp	X			X	
Fatsia japonica	Japanese aralia	Fa-Wi	X	X	X		
Lonicera fragrantissima[c]	Win. honeysuckle	Wi-Sp	X			X	

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

The End

Thank You!

Questions

ufinsect.ifas.ufl.edu
rfmizell@ufl.edu

UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation